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Mismeasurement of the CPI

Kenn Ariga and Kenji Matsui

As the Japanese economy continues to experience negative or near-zero growth under weak demand, many economists and policy makers are increasingly concerned over the accuracy of many key economic statistics. In particular, the accuracy of the consumer price index (CPI) has become a central issue.

The annual CPI registered declines in 1998 through 2001. In early 2002, the data indicate the possibility that deflation might be somewhat accelerating. While the economy seems to be floating at the edge of a deflationary spiral, many suspect and are worried that prices are falling faster than CPI statistics suggest. Supporting these concerns are such things as Seiyu, a large supermarket chain, publishing an index showing how its own prices had fallen much faster than the official CPI.

If CPI data contain significant measurement errors, such that the downward trend is not measured with accuracy, the cost of such bias can be substantial. Consider, for example, potential ramifications on the heated debate over monetary policy, especially inflation targeting. The very idea of

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inflation targeting hinges critically on timely and accurate measurement of the inflation rate. Because retail price data collected by Sōmusho (Ministry of Public Management, Home Affairs, Posts, and Telecommunications) for the CPI are also used for the national income statistics, mismeasurements in the CPI can lead to serious errors in gross domestic product (GDP) statistics as well.

In general, the potential cost of incorrect or absent measurements in official statistics can be substantial and are not limited to affecting policy making. Many economists in the financial sector and consulting firms have voiced concern over the noise and inconsistency in the quarterly GDP estimates. The discrepancy between preliminary and final GDP figures is suspected to originate in the inconsistency in several dimensions of the methodologies employed in the two estimates.[1]

Given the critical role of key economic indicators such as GDP and CPI, it is not surprising that large and frequent swings in official statistics can create visible commotions in financial markets and other sectors of the economy. The potential costs due to problems in the official statistics are widespread and far reaching. For example, a key part of the structural reform advanced by the Koizumi government is job creation in services and information technologies (IT). However, there are no official statistics to guide such policy, as none of the published data report job creation by start-ups or job destruction from closing of establishments.

To be fair, there are many good, even wonderful, things to say about economic statistics in Japan. There is extensive and comprehensive coverage on a wide spectrum of topics, especially those collected on an establishment basis. Some are quite exotic and probably not available anywhere else in the world; many are collected by nongovernment institutions. Moreover, data are comprehensive, geographically and otherwise. Although the country consists of many small islands, most government statistics cover virtually the entire population.

There are problems, of course, some rather serious in nature and quantitatively important. In this paper, we point out several underlying factors responsible for the problems in official statistics in Japan. In doing this, however, the focus is on the CPI. Most of the problems raised by the Boskin Commission for the U.S. CPI are found in Japan's CPI. In many areas, the potential ramifications seem even more important in Japan.

The CPI is an important and popular statistic and is used for many different purposes. The CPI inflation rate is one of the key indicators for cyclical fluctuations of the economy. The CPI also is used as the bench-

1. For example, in the preliminary GDP figures, private fixed investment growth for the year 2000 initially was reported as 4.6 percent, this became 9.3 percent in the final figure. For a brief review of the quality-of-statistics issue and a response by the Economic and Social Research Institute, Cabinet Office, see the website http://www5.cao.go.jp/2000/g/0602g-gdpcoments.html.

mark in many wage-setting negotiations and public pensions are linked to it. (Although, for political reasons, the pensions have not been adjusted downward to reflect the sizable decline in the CPI.) Recent macroeconomic developments in Japan also add to the significance of studying potential mismeasurements in CPI in that the stagnant economy has been experiencing zero or negative inflation rates for prolonged periods, an experience that is rather unique and which might shed new light on issues of measurement biases in CPI.

The choice of the CPI is partly because of the authors' background: In past research we have used disaggregated price data as well as price indices such as CPI or wholesale price index (WPI) and therefore we are concerned about their accuracy. More important is the depth of the analysis that can be achieved. Although GDP is by far the most popular and important statistic, it is a secondary one based on a large variety of primary statistics. That means the potential sources of biases and other problems are simply too great to be thoroughly analyzed in a single paper.[2]

Moreover, the CPI shares with other major official statistics the underlying causes of the problems in the Japanese official statistics system. We hope this investigation of the CPI helps elucidate the nature of the problems commonly found in many important official economic statistics of Japan.

The paper is organized as follows: First we offer an overview of official statistics in Japan, point out several important deficiencies, and then review key issues in the CPI. Using this background, we investigate potential problems in several major aspects of the CPI. These include data collection procedures (including how discounted prices are handled), services, quality change and new products, and aggregation issues (substitution across time, brands, and stores). We then look at a discrepancy between CPI and WPI that probably relates to differences in how quality adjustments are made and some hitherto neglected aspects of the measurement problem, relating to shopping and storage behaviors. From this analysis we offer a tentative assessment of the magnitude of the CPI inflation rate bias and draw some suggestions for improving the statistics in general and the CPI in particular.

A cautionary note on the distinction between potential measurement errors in general and bias in the inflation rate: Measurement errors contaminate the CPI, but they do not imply systematic bias in the measured inflation rate, or changes in the cost-of-living index. For example, consider medical and health care services. Although we believe there are serious

2. For the revised System of National Account (SNA) in Japan, see the website http://www.esri.cao.go.jp/en/sna/020612/outline.pdf. Ando (2002) explains in great detail the problems he encountered in SNA data as he investigated the cause of the long stagnation of the Japanese economy. For those not familiar with Japanese economic statistics, Matsuoka and Rose (1994) provide a gateway into major economic statistics in Japan.

measurement errors and under-representation problems, it is unclear if and in which direction they affect the measured inflation rate. Indeed, several indices shown in Iwamoto (2000) indicate higher, and others, lower, inflation in medical expenditure than does the CPI.

4.1 Overview of Official Statistics

Japanese official statistics fall into three broad groups based on how they are created. Primary statistics collected for specific purposes (*chōsa-tōkei*), primary statistics collected as part of the regular tasks of governmental offices (*gyōmu-tōkei*), and processed statistics derived from primary data. Primary data on exports and imports (Custom Clearance Statistics) compiled by the Ministry of Finance (MOF) is an important example of the second group. The National Accounts are by the far the most well known of the last group.

A more important distinction among *chōsa-tōkei* is based on legal status. The core series of official statistics are called designated statistics (*shitei-tōkei*). There also are approved statistics, so named because they are approved by the Minister of Sōmusho.

Designated and approved statistics have special status in the law. Specifically, the law stipulates clearly that government bodies collecting these statistics are endowed with authority to request and enforce proper cooperation from the public chosen to be surveyed. At the same time, the law sets rather rigid restrictions on the use and dissemination of information so obtained. This allows the data collection agency to conduct surveys and census in a way that private bodies without such authorization cannot hope to accomplish. In short, compared to other official statistics, these two types of statistics are given priority in data collection and a more stringent set of rules governs their use and dissemination. Table 4.1 lists the number of designated and approved statistics by the ministry responsible for collecting them along with that ministry's staff and budget for statistics.

4.1.1 Staffing and Collecting

Officially, the Statistics Bureau of Sōmusho is responsible for coordinating the activities of the statistics sections of all ministries. It is apparent, however, that the system is highly decentralized and each ministry seems to act on its own in creating, collecting, abandoning, and publishing data. Which ministry is responsible for a series often is a historical accident, but ministries seem unwilling to reshuffle assignments. For example, Sōmusho conducts the Survey of Research and Development, the National Tax Agency collects data on salaries in the private sector, and the Bank of Japan (technically not even a part of the government) compiles the WPI and corporate service price index (CSPI).

Table 4.2 displays data for the U.S. federal government comparable to

Table 4.1 Major Official Statistical Series, 2000

Ministry	Designated[a]	Approved[b]	1999 Budget (¥ millions)[c]	Staff
Agriculture	8	119	13,032	5,979[d]
Education	4	50	256	102
Finance	2	8	144	86
Health and labor	8	102	5,758	465
Land and transport	7	68	4,169	124
Public management (Sōmusho)	14	59	14,494	1,617
Trade and industry	17	47	5,867	381
Others	0	27	1,360	50
Total	62	480	45,080	8,804[e]

Source: Sōmusho (1999, 2000b).

[a]We include only those designated statistical series that are currently collected on a periodic basis, thus excluding those for which new data collection has been stopped. In effect, the latter series are no longer used, primarily because of the lack of interest (they retain the special status only because the use of the original data is still tightly controlled by law).

[b]The number of approved series collected in each year at each ministry varies widely, but the total number has been stable between 400 and 500 since the mid-1990s. Unlike the designated series, many of these statistics are collected once and only.

[c]In ¥ millions for fiscal 1999, which ended 31 March 2000. This is roughly 0.06 percent of the central government budget. The budget has been in a ¥40–50 billion range since the early 1990s, except when there is a population census (years ending in 0 and 5). Thus, the total fiscal 2000 budget was ¥98.6 billion, with ¥75.9 billion allocated to Sōmusho, which conducts the census.

[d]This is 68 percent of the total. Most of them are at regional offices of the ministry.

[e]The total given is 2.2 percent of total central government administrative staff, 398,000.

Table 4.2 U.S. Statistical Staff and Budget

		Permanent Staff	
	2002 Budget ($ millions)[a]	Total	Statisticians
Agriculture	366.6	1,595	33
Commerce, except census	143.1	4,154	1,403
Census Bureau	563.4	3,708	1,398
Education	198.0	127	78
Health, "Homeland Security"	1,260.6	606	212
Justice	57.4	67	42
Labor	655.4	2,792	179
Transportation	122.3	162	54
Other	686.3	374	55
Total	4,110.5	9,877	2,056
Total[b]	3,906.3	6,169	658

Source: U.S. Executive Office of the President, Office of Management and Budget (2002).

[a]Estimate for fiscal year ending 30 September 2003.

[b]Excludes the 2000 census, entities spending less than $0.5 million, and statistics collection in conjunction with other major activities.

table 4.1. Its budget in 2002 was roughly ten times that of Japan in absolute terms and over three times in share terms. Although total staff is similar, this is only because of the large number employed at Japan's Ministry of Agriculture, Forestry, and Fishery.

Composition of staff in Japan is problematic. As far as is known, only a very few workers actually have advanced degrees in statistics, and virtually no one does in economics. Based upon information from Sōmusho, Statistics Bureau, perhaps 10 (out of 384 full time staff) have an M.S. in statistics, and no one had an M.A. or Ph.D. in economics.[3] In contrast, the U.S. federal government employs more than 2,000 professional statisticians on a full-time permanent basis. It is not clear, however, how many of them have advanced degrees in statistics or economics. In any case, we are certain that U.S. government professional staff with advanced degrees far outnumbers the Japanese counterpart.

4.2 General Data Problems

Japanese statistics have several broad problems in addition to the absence of statistical professionals among the staff mentioned above. These include long lead times, coordination among agencies, appropriateness of the data collected, access to raw data, and information on how data are processed.

4.2.1 Long Delays in Adjustments

Titles of the designated statistics indicate that their coverage is far from being well balanced. Although each series differs in scope and size, table 4.1 is at least suggestive of the imbalance between the coverage of official statistics and the relative importance of subjects covered. This reflects slowness in changing the data collected to reflect changes in the economy. The imbalance is particularly noticeable in agriculture and fishery. In 1999, the Ministry of Agriculture, Forestry, and Fisheries spent 29 percent of the total budget and employed 68 percent of staff devoted to statistics collection and compilation, but all primary industries combined provide less than 2 percent of GDP.

For example, domestic production and usage of coal is a designated series even though only 1.9 percent of total coal consumption is produced domestically and only 12 percent of total energy consumptions is coal. There are three designated statistics on shipping and sailors, although Japanese commercial ships long ago replaced Japanese crew with foreigners. Even though the industry was all but extinct years earlier, production of silk and silk worms was a designated statistic until the end of fiscal 2002.

On the other hand, surprisingly few resources are allocated for data on

3. We are grateful to Mr. Masato Aida at Sōmusho for this information.

tertiary industries, especially services. There is only one designated series that covers the service industry on an annual basis, offering basic data on production, employment, firm size, and so forth. Even this statistic rotates among subsectors on a three-year cycle so that the data for each subsector is available only every third year. There is only one other designated series that covers the service industry, but this survey is conducted every five years and it covers only those not covered in the first survey.

As we see more closely later, the weights attached to items in the CPI are based on the FIES (Family Income and Expenditure Survey), and it is fixed for a five-year period, even though the FIES is conducted monthly. Japan is not unique in this, other countries also have similar delays in adjusting coverage and weights. In the U.S. CPI, 1982–1984 weights were used until 1996, finally being replaced by 1993–1995 weights.

Especially for GDP statistics, long lead times are a problem. Preliminary figures are not announced until three months after the end of a quarter. These are revised three months later. The final figure is made available in December of the next year. Moreover, the inconsistency between quarterly estimates and the final figures reflects underlying differences in the estimation procedure. The inconsistency and long lead times in GDP statistics have been known for quite some time, but there seems little hope that any fundamental measures will be taken to rectify the situation. In the United States, preliminary quarterly GDP data are announced in eight weeks, and the final figure is available in about thirteen weeks. In other words, by the time the preliminary Japanese figures are announced, the final U.S. figure has already been announced. The release of the latest CPI figures is far more timely. The most recent month's figure is released on the Friday of the last week of each month, whereas in the second ten days of the current month the CPI for metropolitan Tokyo area is released on the same day.

4.2.2 Lack of Proper Coordination

There is a lack of proper coordination among different bodies of government and coordination with nongovernmental institutions is uncommon. As a result, different bodies collect similar, if not duplicate, sets of data. At the same time, in many important areas there is a lack of proper official statistics, due mainly to the fact that the area falls under more than one ministry's responsibility. This is especially true in the areas of information and communication: Subsets of these are covered rather independently by sections of Sōmusho and the Ministry of Economy, Trade, and Industry (formerly, the Ministry of Trade and Industry [MITI]).

Inadequate coordination creates difficulties in combining sets of statistics. For example, many statistics on private enterprises and establishments cover essentially the same universe of firms, yet each series employs its own coding method, sample selection methodology, and so forth, with the result that none of these statistics can be integrated to form a unified series.

In other cases, the series employ unique geographical grids, strata, or categories, which means cross-referencing is often difficult and may lead to erroneous conclusions. The best known example is the apparent inconsistency in personal savings rates in the National Accounts and the *Household Saving and Expenditure Survey*.

Lack of coordination places a heavy burden on sample respondents, especially the large firms that are included in most enterprise-based statistics. In 1993, more than 25 percent of polled firms listed on the Tokyo Stock Exchange said they had to reply to more than 100 different central and local government surveys each year.[4]

Rectifying the situation is straightforward in some cases. For example, many establishment-based surveys cover 100 percent of firms (their establishments) with more than ¥1 billion paid capital. It would be easy to use the same identification code for these firms to facilitate cross-referencing of a large variety of statistics.

4.2.3 Inadequate Disclosure

Inadequate disclosure of information is especially troublesome in two ways. First, many published statistics are processed using one or more primary statistical series, but details of the procedure generally are not available. The disclosure problem is extremely severe for most of the National Accounts data, as they incorporate so many different statistics. (See Ando 2002 for the problems he faced in his exploration of the measurement errors in savings rate.)

In GDP statistics, the corporate sector includes not only privately incorporated enterprises, but also the portion of central and regional governmental activities conducted by specific agencies (such as the postal system). There is no precise and reliable information on how to identify which part of the government activities are included. The problem is not limited to secondary statistics. The CPI is based on surveys of prices at sample retail stores, but original results are not available. For example, it is consequently not known how adjustment is made for quality change and by how much. The same problems exist for the WPI.

For economists, an equally, if not more, important problem is government unwillingness to make original microdata available to outside researchers. The law explicitly and categorically prohibits use of official statistics for purposes other than the ones specified in the law establishing each statistical series or the corresponding ministerial orders. Thus, to obtain original data for designated statistics, one must file a petition for special exclusion. This is a complicated, time-consuming process with no

4. The preceding results cited are taken from the following survey: *Tokeichōsa Hōkoku To no Kinyūni Kansuru Jittai Chōsa* (*Survey on the Burden of Respondents in Official Surveys and Statistics*, by Sōmucho (1994; to become Sōmusho in 2001), summary available at http://www.stat.go.jp/info/seido/6-1-2.htm.

guarantee that permission will be granted (see Matsuda, Hamasura, and Mori 2000 for details).

The difficulty in obtaining original data places severe constraints on outside observers, making it difficult even to point out with any reasonable accuracy where problems may be. Concern over the accuracy of CPI arose partly because many retail firms started publishing their own price data to argue that the CPI contains sizable upward bias (see, e.g., Sezon Research Institute [SRI] 2000). The resulting debate ultimately was unproductive in part because Sōmusho would not disclose data comparable to those covered by the retailers.

4.3 CPI Statistics

Japan's CPI is collected and published by Sōmusho Tōkeikyoku (Statistics Bureau and Center, Ministry of Public Management, Home Affairs, Posts and Telecommunications). Japan's CPI is by and large typical of CPIs collected in most countries. It is essentially a fixed-weight Laspeyres index with weights taken from FIES, which also is conducted by Sōmusho. The weights are revised every five years, incorporating the latest FIES.

Especially since the late 1990s when deflationary pressure became apparent, the CPI index has been criticized for its apparent failure to register the impact of rapidly declining retail prices as reported in the media and by some of the largest national general merchandise stores (GMSs).[5]

Compared to the CPI in the United States, there are several notable differences in data-collection procedures and lower-level aggregations. The Japanese CPI includes a larger number of individual items (roughly 600 compared to about 200 in the United States). For each item, Japan uses a single brand and a single retail outlet within each designated area to survey prices. Both the outlets and items used are rotated in the United States.

Surveys are prices on specific days of each month rather than averages over period or brands, as in the United States. Arithmetic means are used in every stage of aggregation, rather than geometric means. (The United States converted to geometric for lower-level aggregation in January 1999, as recommended by the 1996 Boskin Commission Report.)

4.3.1 Alternative Inflation Measures

If the CPI inflation rate is so problematic, why not use some other measures such as the GDP deflator or WPI? In fact, all of these are used to measure inflation, and many view the GDP deflator as a better indicator than the CPI. However, the same primary price survey data are used to estimate

5. The most comprehensive study is Shiratsuka (1997). Shiratsuka (1999) offers a review of his 1997 monograph and other major studies in English. Sōmusho posts various documents prepared by the Ministry on this issue at http://www.stat.go.jp/data/cpi/8.html.

Table 4.3 Annual Inflation Rates, 1900–2000 (%)

Period	CPI	WPI[a]	GDP[b]
1990–2000	1.64	–0.55	0.49
1995–2000	0.30	–0.76	–0.32

[a]For final consumption goods.

[b]Deflator for household final consumption. This is a Paasche index using current weights from FIES. Both factors tend to generate a lower inflation rate than the CPI.

GDP deflators as to estimate CPI and WPI. So, if CPI and WPI data contain measurement errors, they will also appear in other processed statistics such as the GDP deflator.

Moreover, the CPI is a more appropriate measure of overall changes in the cost of living. In contrast, changes in the GDP deflator reflect overall changes in the prices of goods and services produced in the country, not necessarily those consumed. The difference can be large and important when events, such as large increases in crude oil, give rise to major swings in the final price.

Table 4.3 shows the CPI, WPI for final consumption demand, and the GDP deflator for household final consumption. The CPI and WPI are both Laspeyres indexes with weights fixed for five-year periods, whereas the GDP deflator is a Paasche index with weights given by current-year expenditure shares. By construction, inflation in the GDP deflator has a downward bias, as opposed to an upward bias in CPI and WPI.

4.3.2 The CPI as the Cost of Living Index, the CPI as the Cost of Goods Index

From the viewpoint of standard microeconomic theory, the principal objective of a CPI is to provide a benchmark for the cost of living index (COLI). However, as is the official view in most other countries, the Statistics Bureau of Sōmusho clearly states that the CPI should be viewed as the index of the specific basket of goods it contains—that is, the cost of goods index (COGI). It does not subscribe to the view that the CPI should be the best estimate of the COLI. (See Schultz and Mackie, forthcoming, for a discussion of this incorporating the Boskin report.) Box 4.1 discusses the CPI as a COLI.

Even though we concur with the majority view among economists that CPI should serve as a measure of COLI, we also think that COGI, as it is constructed as an index representing a fixed basket of consumption goods, has its own merits. Especially as a macroeconomic indicator, the inflation rate measured in terms of changes in COGI is important, given the crucial role played by the private and social costs of changing nominal prices. Unlike COGI, a properly defined COLI can change without any accompanying change in nominal prices (for example, due to changes in quality). This

Box 4.1 CPI as a COLI

Under certain strict conditions, we can derive a group of price indexes called superlative price indexes (see Diewart [1976] and Caves, Christensen, and Diewert [1982]) that approximate the true COLI up to the second order. One index among the group is the Tornqvist price index (TR) and it is given by

$$\log P_{0t}^{\mathrm{TR}} = \sum_{i=1}^{n} \frac{1}{2}(\omega_0^i + \omega_t^i)(\log p_t^i - \log p_0^i)$$

where 0 denotes the reference period, i is the index for the goods and services, ω is the expenditure share, P is the price index, and p is individual prices. The Laspeyres index, on the other hand, is given by

$$P_{0t}^{L} = \sum_{i=1}^{n} \omega_0^i \frac{p_t^i}{p_0^i}.$$

The major advantage of a superlative price index, including the Tornqvist, is that the index properly incorporates substitutions among goods and services in response to changes in relative prices, among other things. Neither Laspeyres (reference-period fixed weights), nor Paasche indices (current-period fixed weights) incorporate substitutions. The most serious problem with Laspeyres as an approximation of a COLI is that the index tends to overrepresent prices that have risen from the reference period, thus overstating the impact of price increases. By the same token, the index underrepresents the impact of price declines. The magnitude of the bias depends crucially on two factors: relative prices and the degree of substitution across goods and services.

The practical difficulty in using Tornqvist or Fischer (geometric mean of Laspeyres and Paasche) indexes is that they require current data on expenditure shares. If expenditure shares are continuously available, one can construct corresponding chained indexes.

$$\log P_{0t}^{\mathrm{TRC}} = \prod_{s=0}^{t-1} \sum_{i=1}^{n} \frac{1}{2}(\omega_s^i + \omega_{s+1}^i)(\log p_{s+1}^i - \log p_s^i)$$

$$P_{0t}^{\mathrm{LC}} = \prod_{s=0}^{t-1} \sum_{i=1}^{n} \omega_s^i \frac{p_{s+1}^i}{p_s^i}$$

The important drawback of chained indexes is path dependence. That is, the same magnitude of total price changes results in different price index values, depending on the sequence in which the changes take place. The problem is quantitatively important in high-frequency data (See Feenstra and Shapiro 2001 on such bias).

can be misleading, especially when quality unadjusted indexes are not available.

In relation to other price indices, such as WPI, CSPI, and various wage indices, the COGI is also important in monitoring the dynamics of vertical price formation. Thus, we agree that the CPI should continue to serve as a COGI, providing an aggregate measure of nominal price changes.

Even as a COGI, however, the CPI should perform better by incorporating lower-level substitution more explicitly. Accordingly, there is strong evidence that consumers substitute brands, shop around, and continue to shift toward mass retailers with lower prices. Moreover, unless one subscribes to an extremely narrow and rigid definition of a fixed basket (i.e., fixed brand purchased at fixed set of retailers), CPI should move in the direction of COLI at least in these dimensions.

We believe the CPI should serve both COLI and COGI purposes. Whenever an important difference arises between the purposes, separate COLI and COGI series can be compiled. There is no practical or theoretical difficulty in this. As a matter of fact, the additional cost of preparing a separate COLI for different groups of households is relatively small, and the current CPI does include such series. We suspect, however, that the relevant COLIs for different groups differ substantially, once proper attention is paid to shopping behavior. To incorporate shopping behavior into the COLI, it is essential that information be collected at the household level.

Whether the CPI is viewed as strictly a COGI or also serves as a COLI, it is crucial to disclose details of the compilation processes, such as quality adjustments and brand and sample-store replacements. Without full and timely disclosure of these details and the original survey results, the extent to which external monitoring can check potential problems is limited.

4.4 Major Sources of CPI Bias

There are several fairly well-known, if not well-established, sources of problems in the Japanese CPI, and all are considered sources of upward bias. One set relates to aggregation procedures and the second to lower-level data collection procedures (including how discounted prices are handled). Collection procedures, services, quality change, and new products are covered in this section. Aggregation issues are taken up in later sections.

4.4.1 Lower-Level Data Collection Procedures

Under current procedures, prices for each item are collected first by specifying the most representative brand for each item, then by selecting the most representative sample store (usually the one with the largest sales volume of the item) within each precinct.

The brand selection procedure is problematic. Setting aside the problem of changes in the leading brand over time, fixing a particular brand in itself creates upward bias because many people are largely indifferent among brands and thus will substitute among brands, especially when one is temporarily discounted. Fixing a particular brand gives unbiased COLI data if and only if all consumers are completely brand loyal or retail prices of different brands all move together. Sōmusho does not release data on how many or how often brand replacements occur, but states that it checks the selection of specific brands every half year and replaces brands whenever appropriate.

In the United States, CPI does not fix any particular brand and different brands rotate in each price survey. The U.S. procedure is superior because the procedure avoids the inherent bias associated with fixing particular brands. On the other hand, Shapiro and Wilcox (1996) contend that brand turnover is closely related to CPI inflation in the United States because the bulk of the inflation rate is attributable to the imputed price increase registered for newly surveyed brands and entry-level (new) items when the sample is changed. That is, if brand A is substituted for brand B in the sample, the price difference between the two will be recorded as a price change affecting the CPI whether or not there is an actual change in the price of either brand between sample periods.

Selection of a single store within each sample precinct also is problematic because consumers substitute among shopping outlets. Neglecting store substitution also tends to introduce upward bias.

Discount prices or specials are another issue. Each month the survey collects prices on the Wednesday, Thursday, or Friday of the week that includes the 12th of the month. If the price is a discount price, the sample is void unless the price has been quoted for at least eight days at the time of the survey. It is not clear how regular and discount prices are defined. In most cases, the highest selling price seems to be the one defined as the regular price. It is unclear if the regular price ever changes at each store and, if so, how often—even though actual prices change quite frequently.

The current procedure thus tends to ignore almost all discount prices of short duration. However, the bulk of sales of many products, especially ones easily stored, are concentrated in short periods when prices are discounted.

The extent to which discount sales are used differs systematically across items, brands, and types of retail outlets. Discounts are widespread and routinely used by national brands, whereas most generic commodities without strong brand recognition are rarely discounted. Discounts are far more common at large supermarkets and specialty stores, but very infrequent at small general stores and almost nonexistent in convenience store chains.

Although there is no a priori reason to believe these measurement errors inherently generate systematic bias in the measured inflation rate, the recent macroeconomic setting and secular changes in the retail industry do give reasons to suspect that they create systematic upward bias. The share of retail sales in Japan has been shifting away from traditional small stores toward large supermarkets and discount stores in suburbs and toward inner-city convenience store chains. This may introduce systematic upward bias to the extent that current CPI procedures subsume some of the pure price differences across different types of stores as reflecting differences in service.

Biases created at lower levels can be quantitatively large precisely because they occur as a result of substitutions over very close substitutes: over time of the same brand, among different brands of the same good, and among neighborhood stores.

4.4.2 Services

After the 2000 revision, services comprise 48.4 percent of the CPI. There are no natural measures for the quantity of most services purchased, implying that expenditure data, such as FIES, are ill suited as the alternative data source for prices. Objective measurement of the quality of services is even more difficult. For these reasons, we have little to offer on biases from services.

Compared to commodity prices, there are reasons to believe raw price data are more accurate for some services in the CPI. For example, most utility rates and public transportation service prices are uniform and well documented. For these, there is little or none of the discounting so common for food and clothing. This applies also for price data on medical services. The bulk of payments are covered by public health insurance, and readily available and highly comprehensive price lists exist for individual treatments, various fees, and prescription drugs.

Setting aside quality issues, the biggest problem in service categories is underrepresentation of medical and health care in the CPI, as the weight is based on consumer out-of-pocket expenditure in the FIES and totally neglects payments for medical insurance. According to the *Survey on Medical Expenditure* (Ministry of Health, Labor, and Welfare, various years) in 1999, ¥30.9 trillion (8.1 percent of national income) was spent on medical care. Out-of-pocket expenses covered by FIES were only 14.6 percent of that. In the current CPI, the weight for medical care is 2.4 percent and for health care is 1.4 percent, a total of 3.8 percent.

The medical- and health-related items in the CPI are limited to those not covered by typical health insurance. Thus, nonprescription drugs, physical check-ups, and the basic hospitalization fee for normal delivery of a baby are included, but most other medical services are excluded. Not surprisingly, data indicate systematic differences in price indexes, depending on who directly pays the cost: the consumer, insurance, public institutions, and so forth (See Iwamoto 2000 for representative medical price indexes).

It also should be noted that the CPI contains several conceptual flaws in some other service prices. Especially noteworthy is imputed rent for home owners. The actual rent data collected are those for rented dwellings; it is well known, however, that rented and owner-occupied homes differ greatly in capacity and quality. Measured rent is likely to include sizable upward bias to the extent that the recent improvements in the quality of owner-occupied homes are not properly incorporated. Bear in mind, however, that given the sheer magnitude of the diversity of dwellings across regions, types, and vintage, it is a formidable task even to estimate the size of the bias, let alone correct it.

4.4.3 Quality Change and New Products

Although quality changes and new goods are potentially the most important source of bias in the CPI, we do not investigate the problems in any depth here. Instead, we argue two points: First, in principle, the CPI would benefit enormously from careful and systematic improvements in incorporation of the effects of quality change and introduction of new products. Second, there is an important inconsistency between CPI and WPI regarding certain groups of items. We suspect the inconsistency stems at least partially from differences in quality adjustments in the two indexes. This is dealt with in a later section.

Some argue that, ultimately, measurement of quality should be aimed at measurement of contribution to the quality of life. For example, some say the measurement of medical services should be reformulated to measure the cost of cure, rather than the cost of treatment as is now the case (See Schultze and Mackie [forthcoming]). We do not engage in this debate here except to the extent that it is an aspect of the issue of the role of the CPI as a COLI, as we noted earlier.

In the current CPI, essentially nothing is done to address the effect on living costs from introduction of the new products. This is understandable, given that no established procedure to do so exists. On the other hand, the long delay in incorporating changes in the consumption basket by itself introduces large and rectifiable biases if price declines primarily occur soon after a product appears and before it is included in the CPI. That seems to be the regular pattern for many consumer durables, but it is conceivable that for other types of products, prices rise during the early stage.

It is only in the 2000 revision that the CPI included items such as personal computers and service charges for mobile telephones. The CPI still does not include fax machines, printers and other computer peripherals, or internet service provider charges!

As for quality change, in the current procedure, whenever a sample item or brand is considered different in quality from the previous item, an overlap method is used to take account of quality changes. In 2000, the CPI for the first time started using hedonic methods to estimate quality changes in personal computers, but, as of now, this is the only item utilizing the method.

Few empirical studies in Japan measure quality changes and assess the impact of changes on the CPI. Shiratuska (1997, 1999) are the only published results we are aware of that estimate the impact of quality change on CPI bias. He estimates that underestimates of quality changes result in an annual upward bias of 0.3 percent to 0.9 percent, with 0.7 percent the point estimate. However, he notes the estimate is based only on studies of a few consumer electronics and passenger cars.[6]

Most of Shiratuska's work uses data from the first half of the 1990s, so it is not clear if the same estimates apply to later periods. As will be shown, in the late 1990s, the consumer electronics component of the CPI registers a lower (actually, larger negative values) inflation rate than the comparable WPI rate.

For the U.S. CPI, Hausman (1999) estimates annual upward bias of 0.8 percent to 1.9 percent for telecom services as a result of not including cellular phone services in CPI until 1998. The potential bias can be substantially larger in Japan because the use of mobile phone increased so fast and the price declined so dramatically. In 2001, the number of cellular users surpassed the number of fixed telephone lines in Japan.

Sōmusho (2000) has conducted preliminary estimation of a hedonic price index for personal computers. They estimate a price decline from the 1995 average, set at 100, to 12.8 by mid-1999. This is a 36.7 percent annual decline. Thus, if the personal computer had been included in the CPI in 1995, that alone would have reduced the inflation rate by 0.2 percentage points each year during 1995–1999. (The personal computer weight in the current CPI is 0.54 percent). One can expect similar dramatic price decline for other items that now command sizable expenditure shares: fax machines (not included), printers (not included), mobile phones (0.74 percent), internet service providers (not included), and so forth.

More often than not, the same goods and services appear on lists related to both proper adjustments in quality and timely inclusion of new goods. This is because the most important quality changes typically take place when items are relatively new. In this sense, timing is crucial. If an item is included only after it has become a part of the standard consumption basket, much of the impact of quality change and consumer surplus associated with quality-adjusted price declines is missed.

4.5 Aggregation Biases

Aggregation procedures are a problem. The Japanese CPI is a fixed-weight Laspeyres index. The biases created by using fixed weights and tak-

6. Shiratsuka (1997) and his associates estimated hedonic price indexes for personal computers, camcorders, automobiles, and apparel. They found quality-adjusted personal computer prices declined 25 percent a year from 1990 to 1994, while unadjusted prices fell 3 percent. For camcorders, the annual quality-adjusted decline was 11 percent, but only 6 percent unadjusted. For automobiles, adjusted prices declined 0.4 percent, but increased 4 percent unadjusted.

ing arithmetic means are well known. Aggregation bias arises at every stage in the Japanese CPI.

At the bottom level, one representative brand of each item is chosen for data collection. This assumes away interbrand substitution and thus tends to create sizable upward bias. Fixed-weighting problems also appear in the selection of sample stores. As discussed later, this became serious in the 1990s as sales shifted away from small independent stores to larger chain-store discount outlets (see table 4.8).

The FIES has a significant sampling problem because it does not include single-person households. Given the large portion of the population living alone and the substantial deviation of consumption patterns of single-person households from others, the bias implicit in this procedure is potentially important. Starting in late 2002, FIES is being expanded to cover single-member households.

In an earlier step to improve data quality in October 2001, Sōmusho started a new consumption survey covering 20,000 households and focusing on items the basic FIES is ill suited to cover, such as high-priced products purchased infrequently and services. The new survey includes appliances, personal computers, other consumer electronics, mobile phones, and internet service providers, as well as some services already covered in FIES. The survey is conducted by a semiprivate research organization and includes single-member households. Zero or negative inflation in recent years probably has lessened the size of aggregation bias in comparison with economies with a mild but positive inflation rate.

4.5.1 Higher-Level Aggregation Bias

At higher-level aggregation, it is well known that the current fixed-weight Laspeyres index using arithmetic means tends to produce some upward bias in the CPI. This is the case because whenever relative price changes, people do tend to buy more of the goods and services whose relative price declined and buy less of those which have become more expensive. In short, people change the consumption shares with their response to changes in relative prices. The assumption of fixed weights neglect this substitution and hence tends to overstate/understate the impact of price increase/decrease. This problem of using fixed weights is not unique to the Japanese CPI. The procedure to measure the bias is simple and straightforward: Annual expenditure weights from FIES for the eighty-five lowest-level categories are used to compute chained Fischer and Tornqvist indexes that are compared to the CPI, which uses the same price data but with fixed 1995 weights. Table 4.4 summarizes Shiratsuka's (1997) calculations and extends them to 1995–2000.

The bias is not large for years since 1995, except for 1999. Relatively large bias in the CPI inflation rate for 1999 (i.e., the change in CPI from 1998 to 1999) probably reflects relatively large changes in consumption weights after the increase in consumption tax from 3 to 5 percent in April 1998.

Table 4.4 **Aggregation Bias (annual percentage rates except as noted)**

	Fixed Weights				Chained			
	Laspeyres		Tornqvist		Tornqvist		Fischer	
	CPI Index	Inflation	Inflation	Difference[a]	Inflation	Difference[a]	Inflation	Difference[a]
1996	100.180	0.180	0.154	0.026	0.154	0.026	0.154	0.026
1997	101.869	1.689	1.651	0.038	1.657	0.032	1.649	0.032
1998	102.613	0.744	0.713	0.031	0.716	0.028	0.703	0.028
1999	102.242	–0.371	–0.498	0.127	–0.440	0.069	–0.429	0.058
2000	101.415	–0.827	–0.877	0.050	–0.864	0.037	–0.870	0.043
1995–2000	n.a.	0.283	0.229	0.054	0.245	0.038	0.241	0.042
1970–1995	n.a.	4.438	n.a.	n.a.	4.313	0.125	4.216	0.222
1990–1995	n.a.	1.153	n.a.	n.a.	1.152	0.001	1.272	–0.119

Source: 1970–1995 and 1990–1995 are from Shiratsuka (1997).

Note: n.a. = not available

[a]Difference between the CPI inflation rate in column (2) and the inflation rate in column to the left. As discussed in the text, this is an indicator of upward bias in the CPI inflation rate.

Compared to chained Tornqvist or Fischer indices, the fixed-weight Laspeyres generates roughly 0.04 percent upward bias per year in the five years through 2000. There is larger bias in earlier periods—on the order of 0.1 percent.

Although the magnitude is not large, aggregation bias is serious because it always exists and accumulates forever. Thus, it can have a quantitatively large impact when tracing living standards for generations. Aggregation bias arises due to the underrepresentation of the scope of substitution whenever the relative prices of goods and services change over time. The results indicate that the bias is smaller in the more recent years primarily because of smaller variations in relative prices.

Notice that a low or negative inflation rate per se does not reduce aggregation bias. What matters is changes in relative prices. These results only confirm that relative price variability at higher-level aggregation is positively correlated with the inflation rate.

4.5.2 Discounts and Intertemporal Substitution

Biases created within each item, an aspect of lower-level aggregation, is now considered. There are two issues: selection of a particular brand of an item and how price observations are collected. In a sense, bias at this level is the easiest to deal with because, in principle, there is not much room for disagreement. The extent to which different brands of an item are substitutable is an empirical question that can be answered with reasonable accuracy if sufficient data are collected. Substitutions across brands within each item is addressed later.

Here the issue is substitution over time of the same brand—that is, the extent to which consumers can exploit periodic discounts. This appears to be quantitatively important, and how much substitution occurs depends primarily on consumer knowledge and the ability to hold inventory at home. Feenstra and Shapiro (2001) is an early attempt to incorporate home storage and shopping patterns into CPI measurements (also see Ariga, Matsui, and Watanabe 2000).

In principle, the upward bias due to the survey procedure described earlier applies only to the level, not necessarily to changes, in the index. The problem is essentially that the procedure systematically truncates the low price observations. This truncation may or may not generate upward bias in the inflation rate. Circumstantial evidence indicates, however, that it does indeed produce sizable upward bias in the measured inflation rate, as retailers reduce average sales price by further lowering the discounted price or increasing the frequency of discounts.

The easiest way to demonstrate the inflation bias created by intertemporal, intrabrand substitution is to compare the actual average purchase price to hypothetical price data, which the CPI would collect following the data collection procedure described earlier. For this exercise, we use point of

Table 4.5 Bias Due to CPI Data Collection Procedure (% per year)

	Mean Inflation			Standard Deviation[a]	
	Weighted Average	CPI Procedure	Upward Bias	Weighted Average	CPI Procedure
Mayonnaise	–1.36	–0.38	0.98	.0148	.0208
Ketchup	–3.12	–0.41	2.71	.0195	.0305
Soy sauce	–2.25	0.00	2.25	.0343	.0434
Liquid soup base	–2.94	–0.30	2.64	.0238	.0429
Laundry detergent	–2.73	–0.10	2.83	.0298	.0149
Instant coffee	–5.44	–1.45	3.99	.0378	.0957

[a]Annual log differences.

sale data prepared by the Distribution Economics Institute (POS-DEI). (See appendix A for details regarding the data sets).

Table 4.5 covers six selected items sold at sample large-scale retail stores during the twenty-four months starting April 1995. The results are consistent across all of the items: The current CPI procedure consistently overestimates the inflation rate because most special-sales prices are dropped from the survey. Notice that the results indicate that the decline in the average purchase price occurred primarily as a result of lowering the discount price or increasing the frequency of the discounts. Moreover, as Shiratsuka (1997) pointed out, the current procedure substantially increases noise, as it only sporadically picks up sales discounts. Table 4.5 shows that standard deviations in the inflation rate under the current survey procedure are substantially higher than those of average purchase prices for most items.

Unfortunately, there is no unambiguous way to estimate the extent to which the bias due to survey procedures applies to other items in the CPI. It is known that periodic price discounts (specials and sales) are quite widespread in most medium- to large-scale retail stores. Discounts typically apply to processed food, toiletries, cosmetics, household appliances, and some clothing. In other words, for most items sold at large-scale retail stores, one expects periodic discounts. Table 4.5 indicates that the current CPI creates systematic upward biases for these items mostly in the order of 3 percent per year.

4.5.3 Substitution Across Brands

The CPI chooses a single brand to represent the price movement of each item. In general, ignoring substitutions across brands results in an upward bias in the level of the cost of living, but it is not certain if it results in any bias in the inflation rate. If the relative price of different brands is stable over time, the bias may well be negligible in computing the CPI.

Figure 4.1 shows three price indexes compiled from point of sale data prepared by the Sezon Research Institute (POS-SRI) for liquid condiment,

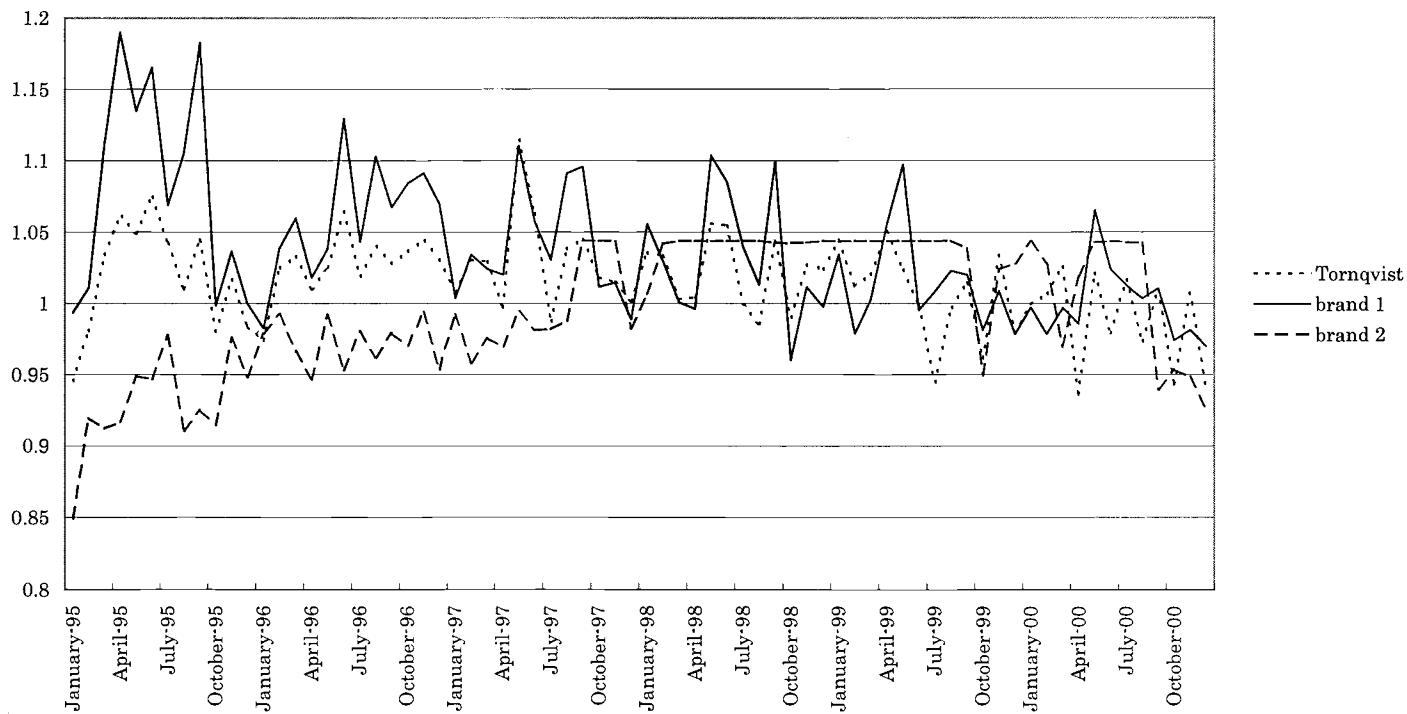

Fig. 4.1 Brand specific price indexes for liquid condiments

Table 4.6 Mean Inflation Rates and Within-Item Variances

	Mean Inflation Rate (%)	Variance[a]
Instant coffee	0.4477	.016
Facial tissue	0.1006	.0062
Mayonnaise	–0.2258	.0041
Yogurt	–0.1324	$.94 \bullet 10^{-5}$
Liquid condiments	0.0781	.0080
Fruit juice	0.2465	.092
Fresh milk	–1.4649	.019
Sugar	–11.8878	.038
Wheat flour	0.2117	.0061
Soy sauce	–0.1937	.0043
Cooking oil	0.2850	.0070
Sanitary napkins	0.9755	.052
Laundry detergent	–0.0627	.060
Kitchen detergent	–0.0738	.0078

[a]Monthly average for indexes of brand-specific inflation normalized to set the annual average for 2,000 equal to 1. The variance of mean inflation rate across different brands within each item is shown in the second column.

one of the fourteen items included in the 1997 *National Survey of Prices, Special Volume on Bargain Prices*. Along with the Tornqvist index for the item, the figure shows indexes for the brands that registered the lowest and the highest inflation rate from 1995 to 2000. Variations across brands are very large indeed.

Table 4.6 shows the intraitem sample variances for the fourteen items and the monthly inflation rate for the corresponding item-level Tornqvist index. A simple panel regression of monthly item-level price variances on inflation rate (ifr) for fourteen items yields

$$(1) \qquad \text{var}_t^i = \sum_{k=1}^{14} \text{constant}^k - .0363 ifr_t^i (.023)$$

$$R^2 = .0874$$

The result (standard errors in the parenthesis) indicates that deflation ($-ifr$) coincides with increase in price variations across brands. These findings thus indicate that, at least for these fourteen items, consumers have ample opportunities to substitute among brands.

In Ariga, Matsui, and Watanabe (2000), we used daily POS data for two rival brands of curry paste sold at selected supermarket stores. Table 4.7 shows the impact of price discounts on sales volume.

If brand B also is at a discount price, average sales volume of brand A at a discount price is 57.4, which is 19 percent smaller than the average sales volume (70.7) at a discount price if brand B is sold at regular price. The impact of brand A's discounted sales on brand B at discount price is even

Table 4.7 **Substitution across Brands: Curry Pastes**

Sales Volume	Brand A's Price: Regular	Discounted
Brand A		
Brand B's price is regular	5.4	70.7
Brand B's price is discounted	5.0	57.4
Brand B		
Brand B's price is regular	3.1	2.9
Brand B's price is discounted	42.3	29.2

Note: Unit of measure is the average number of sales units per day.

larger, more than 30 percent (compare 29.2 against 42.4). On the other hand, pricing has a much smaller impact on volume at regular price, around 6 percent to 8 percent (5.0 versus 5.4 for brand A and 2.9 versus 3.1 for brand B).

Given the large impact of periodic price discount on sales, these figures suggest the presence of heterogenous consumers, as well as sizable interbrand substitutions in response to changes in relative prices. Although these findings strongly indicate that price data of any particular brand can be a highly misleading indicator for overall changes in prices of different brands of each item, it is not possible to provide estimates of the magnitude of the inflation rate bias created by brand substitutions per se. Given the analysis on intertemporal substitution, it is probably not very productive to try to estimate the effects alone, as substitution in this aspect is closely related to intertemporal substitution and periodic price discounts.

There also are difficulties from the extremely high rate of new brand introductions and retirement of old brands, particularly among items in the food, household appliances, toiletry, and clothing groups. Shifts in sales shares from one brand to another not only are highly frequent but also unpredictable. This makes it practically impossible to obtain reliable estimates of substitution elasticities for the wide range of goods in the CPI. Again, these observations indicate the problem inherent in choosing a single specific brand to represent the spectrum of brands of each item. It is far more satisfactory and actually easier to use price averages across brands.

4.5.4 Substitution Across Stores

According to the current CPI procedure, the survey selects the most representative store within each survey precinct for each item. Nationwide, the survey has roughly 700 precincts. Usually the store with the largest sales volume is chosen for the item.

Table 4.8 shows the changes in shopping points in the *National Survey of Family Income and Expenditure*. As expected, regular stores lost shares

Table 4.8 Share of Expenditures on Selected Items, by Type of Retail Outlet, 1984–1994 (%)

	Regular Small-Scale	Supermarkets	Department Stores	Convenience Stores	Cooperatives	Discount[a]
Total						
1984	50.8	28.9	10.0	0.0	4.6	0.0
1994	40.5	30.3	9.3	1.1	6.3	4.0
1999	34.0	35.3	9.1	1.7	5.9	5.4
Food						
1984	40.6	44.9	3.5	0.0	7.0	0.0
1994	25.2	49.2	4.1	1.9	10.4	2.3
1999	16.7	57.5	4.5	2.6	9.8	2.7
Appliances						
1984	46.3	24.1	15.1	0.0	4.3	0.0
1994	37.1	22.7	10.8	3.1	5.8	12.5
1999	32.3	26.6	9.4	3.0	5.3	16.7
Clothing						
1984	36.9	18.1	37.6	0.0	1.8	0.0
1994	33.7	17.7	34.0	1.3	2.1	11.2
1999	28.7	20.5	36.5	1.4	2.3	10.6

Source: Sōmusho (various years).
Note: Row totals do not add to 100 percent because not all store types are included.
[a]Mass-marketing specialty discount stores.

across the board in the fifteen years from 1984 to 1999. The decline is especially large in food.

Sōmusho (2000) explains the selection procedure for precincts and sample stores. It is not entirely clear, however, to what extent the delay or failure in changing sample retail stores contributes to selection bias in the CPI. According to Sōmusho (2000a, 75), "the latest store selection is fairly close to the 1999 distribution," which is shown in table 4.8.

Shiratsuka points out that "the shift from department stores and small general stores to discount outlets has largely subsided," so that price differentials have "settled down to a level consistent with the difference in service quality" (1999, 90). However, table 4.8 suggests the shift is still very much an ongoing process.

The current CPI revises sample store selections in two ways. Every five years the most representative store is chosen for each commodity group in each precinct. This reflects changes in market shares across different types of retail shops in each precinct and commodity group. In principle, the CPI uses the overlap method to correct for underlying differences in retail services between sample stores before and after the changes. Sample stores also are replaced on an ad hoc basis. This is necessary when stores are closed or stop selling the sample product. In such cases, price data are directly connected and no adjustments are made in prices. In the case of services, the overlap method is used.

To sum up, the current procedure uses direct comparison methods only

Table 4.9 **Average Across-Store Price Differentials for Fourteen Items**

	Small Stores	Supermarkets	Mass Discount	Co-ops
Regular price	100	95.4	95.0	94.4
Discount price	78.7	64.9 (17.5%)	68.9 (12.5%)	68.7 (12.7%)
Case 1[a]	89.4	74.0 (16.7%)	76.8 (14.1%)	81.6 (8.7%)
Case 2[b]	95.7	74.0 (22.7%)	76.8 (19.8%)	89.3 (6.7%)

Source: Sōmusho (1998).

Note: Small-store regular price = 100. Percentages in parentheses are the discount from the small store's price for each of the cases.

[a]In determining the average price for Small Stores category, 50 percent of volume is assumed to be sold at a discount.

[b]In determining the average price for Small Stores category, 20 percent of volume is assumed to be sold at a discount.

for ad hoc sample-store replacements for commodities. One expects that in the case of an ad hoc replacement, the replacing store is selected in a way that retains the characteristics of the previous sample store. It is not clear to what extent overall the overlap and direct comparison methods are used. As a result, it is not known how much of the price differentials across stores are subsumed and assumed away using the overlap method. We suspect that whenever major changes in the characteristics of sample stores occur, the overlap method is used so that the CPI attributes the price differentials across old and new sample stores to differences in the quality of retail services. In short, even if the CPI has been correctly adjusting the sample store distribution to changing shopping patterns, most within-brand price differentials across different types of stores are assumed away.

In principle, we agree that some price differentials reflect differences in service quality. On the other hand, given the long history of restrictions on entry of large-scale retail stores and the fact that consumers do shift purchases from general small-scale stores to supermarkets and mass-marketing specialty stores whenever such stores are opened in the neighborhood, it seems clear that some of the price differentials are indeed pure price differentials, reflecting the local monopoly power element of retail pricing. Tables 4.9 and 4.10 offer some evidence, using cross-sectional data on retail prices of fourteen items at a variety of retail stores at many locations collected by the *1997 National Survey of Prices*.

Table 4.9 shows the difference in actual retail prices of the items across different types of stores. Ariga, Matsui, and Watanabe (2000) found that for two brands of curry pastes sold at sample supermarkets 31 percent of daily observations were of discounted price, but 72 percent of volume was sold at discount prices. More generally, for a sample of eighteen supermarkets, we found that share of sales at discount prices was 70 percent. Small general stores and co-ops offer price discounts much less frequently.

We used the survey data to run simple cross-sectional regressions on av-

Table 4.10 Impact of a Nearby Rival Store on Retail Prices

	log (Regular Price)	log (Discount Price)
Large Store	–.0401	–.0426
	(6.16)	(4.50)
Supermarkets	–.0579	–.243
	(2.84)	(8.18)
Mass-discount	–.170	–.315
	(4.24)	(5.42)
Co-op	–.116	–.180
	(2.63)	(2.79)
RS	–.082	–.155
	(4.48)	(5.82)
RS × supermarkets	.0659	.122
	(3.14)	(3.98)
RS × mass-discount	.0898	.139
	(2.17)	(2.31)
RS × co-op	.120	.123
	(2.62)	(1.86)
Adjusted R^2	.995	.978

Source: Sōmusho (1998).

Notes: Results of OLS cross-sectional regressions. Numbers in parentheses are *t*-statistics. RS = rival store.

erage regular and discount prices over a set of dummy variables, including one representing the presence of nearby rival stores, to indicate that some of these price differences reflect pure price differences. The results in table 4.10 show that both regular and discount prices are significantly lower among stores with nearby rival stores.

Specifically, among small-scale stores with nearby rivals (RS), the regular price is 8.2 percent lower than in comparable stores without a nearby rival. The impact of a nearby rival on the discounted price is 15.5 percent. In other words, the results suggest that a significant portion of price differences between large-scale and small-scale stores reflects the effect of local competition on pricing, rather than differences in service quality.

The same source shows that 26 percent of small-scale regular stores reported no nearby rival, whereas for large-scale supermarkets, only 3.7 percent reported no nearby rival. Notice also that the impact of a nearby rival on prices is far smaller in the case of supermarkets, mass-marketing specialty stores, and co-ops. Setting aside the difference in geographical sizes of markets for respective types of stores, the data strongly indicates the monopolistic power of many small-scale retailers. We conclude from these results that sizable price differences exist between small-scale general retailers and large stores, and that some of these differences reflect lack of local competition for some small-scale retailers.

As indicated in table 4.8, continuing shifts in sales share away from small-scale to large-scale stores should have generated sizable price declines for average consumers. For the sake of argument, suppose that a 10 percent pure price difference exists between the two types of retailers on average. This implies a roughly 0.1 percent upward bias in the CPI from not accounting for the pure price differences resulting from shifting shares. This is computed by multiplying the 6.5 percent decline in the share of small-scale stores by the 10 percent price differential over five years. In any case, unless we know the extent to which the overlap method is used for each type of sample store replacement, the effect on CPI bias cannot be estimated with any degree of accuracy.

The current store selection method poses other problems. The price differences in table 4.9 are likely to generate sizable variations in average purchase prices across households, depending on residence location, income, member composition, age, and other attributes. Choice of a single representative store in each precinct for each item inevitably masks these variations. Such considerations are important if the CPI is used as a COLI. More generally, the current CPI system is ill suited for incorporating cross-sectional and intertemporal variations in shopping behavior, and this has consequences on the COLI.

4.6 A Curious Discrepancy between CPI and WPI

This section compares CPI and WPI data for two groups of commodities to get some idea of the likely magnitude of the bias created by quality change.

Until the mid-1990s, with the exception of consumer electronics, the CPI inflation rate tended to be higher than the WPI rate for most items common to both indexes. Circumstantial evidence suggests significant upward bias in CPI, or downward bias in WPI, or both due to quality changes in the longer run, although at least since the mid-1990s this may not be the case. In the last ten years, the annual impact of all quality change on the WPI is estimated to be around 0.3–0.4 percent by the Bank of Japan (2001b).

The groups being compared are processed food and consumer electronics. The likely magnitude of quality improvement in processed food in the WPI is around 0.1 percent per year (Bank of Japan 2001b). Given the magnitude of the estimation error, we take the effect as essentially zero, and this is the primary reason the group is used in the analysis as the benchmark. For consumer electronics, the potential impact of quality change on CPI bias is one of the largest among items in the index.[7]

7. Automobiles have the largest effect (–3.1 percent per year) on its subindex. However, the WPI has indexes for three different types of passenger cars, while the CPI has only one. Hence we decided to use consumer electronics as an example.

Table 4.11 Comparison of CPI and WPI (annual percentage rates)

	1980–2000		1990–2000	
	CPI	WPI	CPI	WPI
Food	0.83	0.68	0.25	–0.35
Consumer electronics	–3.33	–1.49	–6.12	–3.32
Import price index	n.a.	n.a.	–5.76	–2.49

Note: CPI weights are used for both CPI and WPI. n.a. = not available.

Using CPI weights, the average inflation rates of the two indexes for the two groups using only items commonly found in both is shown in table 4.11. The result for consumer electronics implies retail prices declined relative to wholesale prices by as much as 25 percent during the 1990s. If the sample period is extended back to 1980, the average annual difference is 1.9 percentage points, which translates into a decline in relative retail price of as much as 66.4 percent. This is suspect because the distribution margin is at most around 30 percent of the retail price and available statistics suggest at most a modest decline in the retail margin during the period—perhaps a few percentages of the retail price. In other words, either CPI, or WPI, or both must contain sizable biases.

One possibility is that WPI severely underrepresents the price declines. In the 1990s, many consumer electronics firms relocated plants to Asian developing economies and the import of these goods quickly replaced domestic production. In the 1995 revision of WPI, the Bank of Japan started collecting import price indices of these products.

The bottom row of table 4.11 shows the weighted inflation rate of consumer electronics during 1995–2000, with WPI replaced by the corresponding import price index. The result is essentially the same. Although the coverage of imported price indexes is far from exhaustive, it seems unlikely that the deviation can be due solely to the rapid price decline of imports. Another possibility is that the large difference in price levels between domestic and imported products is the root cause. The rapid decline of retail prices could reflect rapid replacement of high-priced domestic items by cheaper imports, even if the imported goods' prices did not decline faster than the domestic ones.

It is conceivable that the Bank of Japan has severely underestimated the underlying quality changes of these products, more so than Sōmusho did for the CPI. We consider this highly unlikely, given the nature of the debate between Bank of Japan and Sōmusho on the possible upward bias of CPI. Another possibility is that CPI overestimates quality change, and so it underestimates the inflation rate for this group. There is reason to believe that this hypothesis has merit and thus needs further investigation.

There are differences in quality adjustment methods between the two indexes. According to Bank of Japan (2001b), the most popular method for dealing with quality change in the WPI is cost comparison. It is used for about 30 percent of WPI items. In contrast, Sōmusho states that the CPI uses either the overlap or the direct comparison method. Although Sōmusho does not reveal how many items are quality adjusted and by which methods, it says that "whenever a sample brand is replaced, unless there are reasons to believe that the new and old brands are essentially the same quality, the overlap method is used" (2000a, 114; author's translation). Hence, it is reasonable to say that virtually all substantive quality adjustment in CPI is done using the overlap method. Bank of Japan also uses the overlap method, but only on about 10 percent of WPI items.

Overlap methods can generate sizable overestimate of quality change if the retail price of the existing brand declines substantially in anticipation of a forthcoming future brand. Suppose the CPI survey collects prices for brand b until period t and then replaces it with b' at $t + 1$. Replacement typically occurs because of a decline in the brand's market share or its disappearance from the sample store. Overlap methods treat the price differential between the current and replacement brand b' as reflecting an underlying quality difference, so the price index for item i is computed as

(2)
$$p_t^i = \frac{\mathrm{rp}_t^b}{\mathrm{rp}_0^b}$$

$$p_{t+1}^i = \mathrm{p}_t^i \frac{\mathrm{rp}_{t+1}^{b'}}{\mathrm{rp}_t^b}$$

where rp^b is the survey price of a particular brand. Substantial overestimate of the quality change can occur if the relative price

$$\frac{\mathrm{rp}_{t+1}^{b'}}{\mathrm{rp}_{t+1}^b}$$

does not properly represent the quality difference. In particular, a disappearing brand might be heavily discounted around the time of replacement. In that case, quality improvement is overestimated, and the method introduces downward bias in the inflation rate.

Sōmusho (2000), using color televisions as an example, reports that a chained index using overlap methods generates a 46 percent decline in the index for the three-year period 1995–1998, which can be compared to a decline of 27 percent in the hedonic price index and 25 percent in the published CPI index. On the other hand, estimates by Shiratsuka (1997), discussed earlier, suggest significant upward bias in CPI due to underestimation of quality change during the first half of 1990s. Our previously shown results cast some doubt on the alleged upward bias in CPI for this reason.

All in all, for the late 1990s, we cannot make any definitive statement on even the direction of bias created by quality change. But, in any case, it is certain that there are important inconsistencies in quality adjustments between the CPI and WPI for at least some product groups.

4.7 Impact of Shopping Patterns on COLI

The current CPI almost totally ignores the impact on COLI of diverse shopping patterns by different types of consumers. This is also true of CPIs in most other countries. In Japan, there are supplementary CPI indexes incorporating differences in consumption patterns across different types of households. They do not incorporate the impact of shopping patterns on the respective COLI, however.

In appendix B we develop a simple model of cost minimization and demonstrate the impact of shopping and storage costs on shopping and purchase decisions. Two points emerge: First, pricing patterns of retail stores significantly influence consumer decisions on shopping timing and purchase. Second, large variations in shopping and storage costs, as well as average purchase price, result from variations in pricing policy across different types of stores. Moreover, variations in consumer shopping and storage costs influence which store is the optimal choice. These results suggest that the variation in COLI across regions and household types can be much larger than what the current CPI indicates.

4.8 Estimation of Commodity CPI Biases

Inevitably, estimation of bias involves many subjective judgments and is likely to contain sizable errors. The potential impact of each source of bias differs across categories, as does our ability to estimate its direction and magnitude. For this reason, our analysis on bias will be confined to the commodity CPI; services are not considered.

Commodity CPI comprises 51 percent of overall CPI. We provide two results: The first compares CPI with COLI using unit prices in FIES, the second is the COLI for fourteen selected items using POS-SRI. The two are consistent in suggesting sizable upward bias in commodity CPI.

Table 4.12 compares four COLI indexes for a variety of CPI categories. In the comparison, unit price indexes in FIES are used because CPI item selection is based on FIES, which collects unit prices for about 200 items.

The large deviation between the two indexes for clothing (2 percent per year) is consistent with consumers rapidly shifting from domestic to imported and from small-scale to mass-marketing specialty stores. This shift started with the rapid expansion of several chain stores specializing in men's suits and other formal clothing. The department stores, traditionally the most popular choice for such items, lost share. Beginning in the late 1990s, the shift has been concentrated in more casual clothing and under-

Table 4.12 COLI Average Annual Inflation in CPI and FIES (%)

	(C,C)[a]	(C,K)[b]	(K,C)[c]	(K,K)[d]	CPI-FIES[e]
		1980–2000			
Food	0.83	0.70	0.44	0.56	0.27
Clothing[f]	1.31	1.41	0.20	0.03	1.28
Consumer electronics	–8.62	–6.05	–4.80	–3.41	–5.21
Six items in *Survey of Prices*	0.11	0.45	–0.55	–0.69	0.80
CPI except CE	0.57	0.67	0.32	0.45	0.12
CPI except services and CE	0.63	0.75	0.32	0.59	0.14
Overall CPI versus overall FIES[g]	1.54	n.a.	n.a.	0.64	0.90
		1990–2000			
Food	0.25	0.20	–0.54	–0.35	0.60
Clothing	0.72	0.73	–1.19	–1.39	2.09
Consumer electronics	–6.12	–5.92	–2.89	–3.32	–2.80
Six items in *Survey of Prices*	0.03	0.38	–0.81	–1.43	1.46
CPI except CE	0.32	0.26	–0.46	–0.40	0.72
CPI except services and CE	0.11	0.20	–0.81	–0.51	0.62
Overall CPI versus overall FIES[g]	0.89	n.a.	n.a.	–0.46	1.35

Note: CE = consumer electronics. n.a. = not applicable.

[a]Original CPI fixed-weight Laspeyres index.

[b]The CPI price data and FIES monthly expenditure share used to compute a Tornqvist index.

[c]The CPI fixed weights and FIES unit prices used.

[d]Tornqvist index using unit prices and expenditure shares from FIES.

[e]Difference between CPI inflation rate and unit-price inflation rate in FIES.

[f]1987–2000.

[g]Baskets in two indexes differ.

wear. Among others, the UNIQLO chain registered explosive growth in sales and profits.

Table 4.13, comparing POS-SRI Data with the CPI shows an upward bias in the CPI on the order of 1.5 percent per year. For six of fourteen items selected in the *1997 National Survey of Prices*, FIES also reports unit prices. The difference from the CPI for these groups is again around 1.5 percent per year. These estimates are very close to the bias estimated in table 4.13. Although the two baskets differ, an index computed by aggregating all FIES items yields a 1.35 percent lower inflation rate than the overall CPI.

The conclusion is that, for at least food and clothing groups, the CPI since the mid-1990s has sizable upward bias, most likely in the range of 1.5 percent to 2 percent per year. We believe a bias of similar magnitude exists for other items commonly sold at mass retail stores (such as appliances and toiletry goods), so that roughly two-thirds of commodity CPI belongs to groups we believe are biased upward by 1.5–2.0 percent per year.

To be conservative, assume the bias arises only for purchases of these commodities at large retailers and that two-thirds of purchases are at mass

Table 4.13 Inflation Rates for Sixteen Selected Items (%)

	1995	1996	1997	1998	1999	2000	1995–2000 Average
POS-Laspeyres	–5.15	4.32	–7.66	0.72	–2.85	–6.47	–2.85
POS-Tornqvist	–5.05	3.17	–7.95	1.85	–2.80	–5.74	–2.75
CPI	–2.15	–2.07	–0.30	–1.00	–0.95	–2.28	–1.46

Notes: The numbers shown are annual inflation rates. The first two use POS-SRI data (see appendix A for the data source). The first row uses CPI weights and computes Laspeyres index, whereas the second is a chained Tornqvist using annual weights computed from the sales data in POS-SRI. The last row is computed using item level indexes and respective weights in CPI.

retailers. Applying the low end of the bias range, 1.5 percent per year, suggests a bias of 0.67 percent in the CPI. Using 2.0 percent, the impact on CPI is roughly 0.9 percent. Even assuming the CPI bias is zero for other commodities and also for samples taken at small-scale stores, the effect on overall commodity CPI must be 0.5 percent to 1.0 percent per year. The difference between unit price inflation in FIES and the CPI inflation rate among comparable items, other than consumer electronics and services, is about 0.6 percent per year (table 4.12), which is within the range just estimated.

We believe that 0.5 percent to 0.6 percent per year is a conservative estimate of the upward bias in the CPI as a measure of COLI because service prices, which comprise roughly 50 percent of the overall CPI, have not been covered in the analysis. Upward biases in many important items in this category is likely. On the other hand, the comparison of CPI with WPI indicates a potential downward bias in the CPI.

4.9 Some Suggested Ways to Improve CPI

Japan's CPI contains upward biases and has other problems. Some of the problems can be corrected or at least alleviated. The following sections make some suggestions for improving the CPI.

4.9.1 Upgrade Statistics Sections

The Statistics Bureau of Sōmusho, and most other statistics sections of Japan's central government, are seriously understaffed and suffer from meager budget allocations. There are fewer highly trained statisticians than is appropriate for the work, and there are no staff members with advanced economics degrees. Not only must more people be hired, but the new hires should be specifically skilled.

Staff and budget constraints severely limit the options available to improve CPI. For example, use of POS data is highly expensive because Sōmusho has to purchase them from the outside private sector. Needless to say, collecting POS data in itself is even costlier and practically impossible. Systematic attempts to estimate hedonic price indexes require large resources for data collection and estimation. In the United States, the Bureau of Labor Statistics (which prepares the U.S. CPI) quickly incorporated the recommendations of the Boskin Commission report on problems with the U.S. CPI (Schultz and Mackie [forthcoming]). Given the budget and staff size limitations, it seems very difficult for Sōmusho to carry out similar research with comparable speed.

4.9.2 Improve Data Collection

Many aspects of data collection methods need to be changed, most of them fundamentally. First, the revision of item selection and weights must be done more frequently. In principle, to the extent that the CPI uses FIES, this is a matter of automatic adjustments. FIES is monthly, but annual CPI revision is a more realistic goal. The need for continuity can easily be met by tracking CPI component indexes based on weights and item selections in the past. The additional tasks created by annual revision may not be large.

Utilizing other official data sources in compiling the CPI offers significant benefits. For example, the gain from coordinating data collection and compilation for CPI and WPI is obvious. Coordinating with other agencies also should be done, especially regarding service prices. In particular, there should be large gains in accuracy from utilizing other sources of data on medical and health care and housing expenses.

Seeking alternative data sources is a more fundamental change. Current collection relies exclusively on surveying sample retail firms. Given the time and resource constraint, the margin of improving data quality in commodity CPI may be fairly narrow to the extent that the current method is retained. However, we propose two alternative (complementary) data methods.

The first is to use POS data, which is available on a daily basis for essentially all the brands sold in sample retail stores. Moreover, POS data contain quantity data totally missing in the current survey. Such data are important for several reasons. Even if Sōmusho retains its current position that the CPI should be based on representative brands, POS data provide more accurate and timely information on which brand is the most popular. Being available on a daily basis makes allowing for sales and temporary price markdowns easy and straightforward. Sōmusho has used POS for collecting price information on one item—personal computers—since 2000.

The second complementary data source is to improve and modify FIES to make it usable as a source of CPI price information. The advantages of using consumer-side information are numerous. The consistency between the CPI basket and the actual consumption basket would be improved greatly. For the purpose of COLI, the actual mix of brands within each item and expenditure shares of items are the ideal set of information. To the extent that FIES accurately represents these choices, there should be no disagreement on how to best represent the consumption basket and relevant purchase prices. Improving the selection of sample retail outlets will not be necessary, as consumers themselves make the choice, which can be observed.

Adjustments to incorporate quality change are the most difficult and this paper has not covered the issue in any detail. We are sure there are important inconsistencies between CPI and other price data, especially WPI. The discrepancies are quantitatively large. Both CPI and WPI will benefit from proper coordination and joint work by Sōmusho and Bank of Japan.

4.9.3 Create an Independent Research and Appraisal Body

Resources should be used to establish an independent body to conduct research and systematic appraisal of major statistics. Such research is especially important for statistics compiled from many primary statistics, such as the National Accounts. Given the current state of information disclosure and the inevitable informational advantage of inside staff, such research must be conducted within the government rather than completely outsourced, although the research would benefit from using outside consultants.

The Statistics Council is a committee overseeing statistics collection and compilation activities of the central government. Although in the past the council made important policy recommendations to improve the official statistics, its current abilities are limited. Like other government councils, members are nongovernment officials and meet only a few times a year. Without a research staff working on a regular basis to monitor official statistics, its recommendations are necessarily abstract in nature and often too late. Given the autonomy of individual ministries, it is unclear to what extent the council has influence on changes in individual statistics produced in different ministries.

4.10 Conclusion

We have employed a variety of data and alternative aggregation evaluation methods to estimate biases in Japan's CPI. The results strongly suggest the presence of sizable upward bias in the commodity CPI. Our best estimate is at least 0.5 percent per year, excluding biases in services and from quality changes. The true bias is likely to be larger than this estimate, but far more extensive research is needed to obtain a more reliable figure.

After a journey into a maze of price data, we come back yet again to one of our first points: The Japanese government should allocate far more resources to collection, compilation, and timely disclosure of statistics. Although private data collection services have grown rapidly since the late 1980s, the need for official statistics is obvious and compelling. No private sector entity can realistically replace the statistics collection activities of the central government.

The potential benefit from improvement in indexes such as the CPI can be enormous, given that so much decision making is linked explicitly or implicitly to the CPI. Although many suggestions for improvements can be implemented within the current budget and staff allocations, the more fundamental, necessary changes require sizable increases in budget and staff.

We have pointed out several times the need for coordination within the government. This is straightforward. Statistics based on the same population of samples should use compatible data strata and the same method for coding, and the actual surveys should be merged to the maximum extent possible in order to minimize costs to respondents. Furthermore, there needs to be an independent body within the government conducting research and appraising the statistics.

Although we have focused on data collection and lower-level aggregation issues in CPI mismeasurement, we concur with the majority that the problems associated with quality adjustments and introduction of new goods are by far the most important and challenging. Moreover, shopping behavior and retail competition needs to be incorporated into CPI. These and other issues are left for future research. The central message of this paper is the need for fundamental changes in the way CPI is collected and compiled.

Appendix A

Comments on the Data

Four sets of data are used in the analysis of potential mismeasurements of CPI.

1. FIES (Somusho, various years)

The CPI uses this survey for the selection and weights of items. Aside from the expenditure records of the roughly 8,000 sample households, FIES also reports average unit purchase prices for 200 items. We use these unit price data as the benchmark for COLI estimates.

There are three major problems with using these unit prices as the COLI. First, the data cover only subsets of consumption expenditure and do not cover services. Second, they are averages of nominal purchase prices and do not incorporate any changes in quality. Third, there are large monthly fluctuations in the data, partially reflecting measurement errors.

There are several advantages, however, over the current CPI as the benchmark of COLI. The unit price data reflect the average of the actual choices by sample households of items, brands, quality, and different types of stores, thus incorporating substitutions by households across the same categories. To the extent that quality changes not reflected in prices are not quantitatively important, the unit price and expenditure data provide the most natural measure of COLI. Another notable advantage is that the survey can be used to estimate COLI across different types of households: Although the current CPI supplements include a CPI series for several different types of households, they incorporate only the differences in weights across households (using the common average prices taken from the *Survey of Prices*).

2. *1997 National Survey of Prices, Special Volume on Bargain Prices* (Sōmusho 1998)

This survey selected sixteen items and collected cross-sectional data on regular and discount prices across regions, types of stores, and variety of other attributes, such as location characteristics and store sizes. We use data for fourteen of these sixteen items. We deleted two items, eggs and beef, because of the potentially large quality differences across samples.

3. POS-SRI (SRI, various years)

The POS data are compiled by the SRI on sixteen items for the seventy-two month period January 1995 through December 2000 for twenty stores in metropolitan Tokyo belonging to a national chain of supermarkets. The report provides average monthly prices and sales separately for regular and discount sales. We use the same fourteen items selected above.

4. POS-DEI (DEI, various years)

The POS data compiled by the DEI includes six items among the fourteen selected items above. The data are daily price and sales records for roughly 320 brand-store combinations for twenty-four months between April 1995 and March 1997.

Appendix B

Shopping-Storage Model

Consider a household that consumes at constant rate c per day. Assume it visits a retailer each $1/s$ days. The price of the consumption good is randomly drawn from a known distribution $F(p)$. Normalize this price so the highest price is 1. Shopping costs are δ per visit, storage cost is ε per day per unit, and costs associated with stock-out (i.e., running out of stocks or inventory) are ignored. For simplicity, assume the same amount, q, is purchased on each visit if the price is below some threshold level, $\hat{p}$. Since the amount purchased per visit must on average equal consumption (c), then

(A1) $$sqF(\hat{p}) = c.$$

Thus the amount of purchase per visit is given by

(A2) $$q = \frac{c}{sF(\hat{p})}.$$

The average time needed to consume the stored good is q/c. On average, the amount in storage is half the amount purchased, so the average storage cost per unit of time is

(A3) $$\frac{1}{2}\varepsilon q = \frac{c\varepsilon}{2sF(\hat{p})}.$$

The household minimizes average total cost (per unit of time) by the choice of $\hat{p}$ and s, taking δ, ε, and F as given.

(A4) $$\min_{(\hat{p},s)} \cdot \left[\mathrm{c} \int^{\hat{p}} p dF(p) + s\delta + \frac{c\varepsilon}{2sF(\hat{p})} \right]$$

The POS-DEI data set can be used to obtain an empirical price distribution for the simulation. The data include daily sales and price data for six items sold at fourteen sample stores. Each data item includes twenty to thirty different brands. The top five brands by unit sales are chosen from each store for the simulation. The data span the two-year period, 7 April 1995 to 7 April 1997. Daily price data are used to compute the kernel price density function for each brand, each item, and each store.[8]

The range of parameters we used in simulation are:

$c = 0.2$ (one unit of purchase is equal to 5 days' consumption)
$\varepsilon = 0.001 \sim 0.01$
$\delta = 0.05 \sim 0.14$.

All are measured in rates per day. For example, $\varepsilon = 0.001$ is equivalent to depreciation at 0.1 percent per day if the good is purchased at the regular (high) price. Using the minimum wage in Okinawa (the lowest) of around ¥600 per hour to set the low end and assuming about one to two hours for shopping, shopping cost per visit ranges from ¥500 to ¥1,400, which translates to 5 percent to 14 percent of ¥10,000 of groceries. The upper limit corresponds to the roughly two-hour minimum wage in the Tokyo metropolitan area (= ¥708 per hour).

Table 4B.1 shows that across-store variations in total shopping cost and average purchase price are large. For the top five brands, total shopping cost varies by over 8 percent between store eight, the lowest, and store two,

8. The pricing patterns are not uniform, and the optimal shopping behavior incorporating the periodic price discounts are highly complex. For simplicity, we assume a random drawing of prices from the empirical price distribution. See Ariga, Matsui, and Watanabe (2000) for the dynamics of pricing strategy and shopping behavior.

Table 4B.1 **Variations in Total Cost and Average Purchase Price across Fourteen Stores (%)**

	Total Cost		Average Purchase Price	
Sample Store	Top 5 Brands	Cheapest	Top 5 Brands	Cheapest
1. Co-op 1	+3.42	+8.75	+2.46	+10.33
2. Co-op 2	+3.51	+8.17	+2.65	+7.83
3. National chain A1	–2.731	–0.33	–6.15	+1.51
4. National chain A2	–0.58	–3.03	–2.83	–2.56
5. Unknown	–2.02	+6.62	–6.55	+8.16
6. Unknown	+0.26	–1.10	–2.33	–0.85
7. Unknown	–0.71	+8.06	–2.66	+9.66
8. Unknown	–4.74	+0.92	–6.63	+1.36
9. National chain B1	–2.53	–3.38	–3.49	–1.11
10. National chain B2	+.00	+2.68	–1.68	+6.64
11. Regional chain C1	–4.02	+2.44	–6.60	+6.67
12. Regional chain C2	+0.19	+2.23	–1.10	+4.87
13. National chain D1	+0.23	+3.00	–0.61	+4.20

Note: Numbers shown are percentage differences from Store 14 (not shown), which is used as the benchmark.

the highest. For average purchase prices, the range is also more than 8 percent (between stores eight and two). If consumers choose to buy the cheapest product, variations are even larger: more than 12 percent in total costs (stores nine and one) and close to 13 percent in average purchase prices (stores four and one). Variations in total shopping costs are smaller than those for average purchase prices because volume shopping of discounted items increases inventory holding costs.

Notice that the two co-ops tend to be more expensive, especially for bargain hunters. This reflects the fact that periodic discounts are less common in those stores than in supermarket chains.

Across-store variations in pricing patterns alone can give rise to sizeable variations in shopping frequency and storage. The other side of this fact is that consumers with different shopping and storage costs choose different stores, even if all the stores are identical except for the pricing policy. This follows from the large variation in optimal shopping and storage costs across stores even after controlling for unit shopping and storage costs. For example, when $\delta = 0.05$ and $\varepsilon = 0.001$, the shopping cost for the top-selling brand of item one varies between 0.045 and 0.113 and storage cost varies between 0.023 and 0.057.

To demonstrate this, table 4B.2 shows the cost-minimizing choice of store as unit shopping and storage costs are varied for the top-selling brand of item one. In this specific case, store five minimizes the total shopping cost for those with lower shopping and storage costs. For those with some-

Table 4B.2 Optimal Store Choice for Item 1, the Top Brand

	δ									
ε	.001	.002	.003	.004	.005	.006	.007	.008	.009	.010
.05	5	5	5	5	5	5	5	5	5	5
.06	5	5	5	5	5	5	5	5	5	5
.07	5	5	5	5	5	5	5	5	5	5
.08	5	5	5	5	5	5	5	5	5	5
.09	5	5	5	5	5	5	5	2	2	9
.10	5	5	5	5	5	5	2	9	9	9
.11	5	5	5	5	5	2	9	9	9	9
.12	5	5	5	5	2	9	9	9	9	9
.13	5	5	5	2	9	9	9	9	9	9
.14	5	2	9	9	9	9	9	9	9	9

Note: The optimal choice of store under each configuration of ε and δ is shown in each cell.

what higher costs, store two becomes the best choice, reflecting the fact that the optimal shopping and storage policy for store five involves sizable purchase at occasional but deep discounts. At even higher shopping and storage costs, the optimal choice shifts to store nine.

This example is not exceptional. Among the 3,000 simulation cases, each of the fourteen stores is the cost-minimizing choice in at least one case, although store ten has only one such case. Store three is the overall winner, being the best choice in 509 cases.

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5

Regulation, Distribution Efficiency, and Retail Density

David Flath

Japan's distribution sector employs about one-sixth of the nation's labor force and accounts for around one-eighth of the gross domestic product (GDP), large enough to matter for any economy-wide assessment of barriers to growth and efficiency. Moreover, the phrase "inefficient distribution" has been repeated so many times in reference to Japan that one might suppose the evidence of gross distortion is overwhelming: It is not.

Certainly, regulatory limits on large stores have had an effect on the numbers of stores of differing formats, but the undeniable peculiarities of Japan's distribution sector can be explained by the fundamentals: car ownership, size of dwelling, and geography. Accounting for such fundamentals explains much of the variation in retail density between Japan and other countries, as well as across prefectures within Japan. Moreover, changes in these factors can be related to changes in the structure of retailing.[1]

This chapter does three things: First, it compiles facts on the state of Japan's distribution system and puts them in historical and international context. This includes an explanation of retail store density and its relation to wholesale channels. Second, the chapter describes the logical frame-

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1. Other investigators who argue that factors besides regulation are important in discussions of Japan's distribution system include Nariu (1994), Maruyama et al. (1991), and Miwa and Ramseyer (2002). For an overview of my work and that of some other scholars, see Flath (2000, chap. 14).

work behind the still widely held view that regulation, in particular the Large Store Law (repealed in 2000), is the key determinant of the structure of Japan's distribution system, and then derives some testable predictions about what this implies. Third, it provides new evidence on whether the testable predictions are true. This includes looking at differences among prefectures and over time in retail density and format.

5.1 Characteristics of Japan's Distribution Sector

The peculiarities of Japan's distribution sector include the myriad of small stores and lack of large stores, multiple wholesale steps, and ubiquity of vertical restraints. Some relevant data are in table 5.1.

In the late 1990s, Japan had eleven stores per thousand inhabitants, almost twice the United States and four times the United Kingdom levels. The typical U.S. supermarket in 2000 was almost five times the size of the Japanese equivalent, which was not quite the size of two basketball courts. Many stores in Japan are family enterprises with even smaller

Table 5.1 Features of the Japanese Distribution System

Indicator	United States	Japan
Small Stores		
Stores per 1,000 persons (U.S. 1996, Japan 1997)[a]	6.1	11.2
Workers per store (U.S. 1992, Japan 1997)	11.7	5.1
Number of typical supermarkets[c] (U.S. 2000, Japan 1999)[d]	31,830[b]	18,709
Average store's floor space in m^2 (U.S. 2000, Japan 1999)[d]	4,143[e]	832
Average store's annual sales in respective millions (U.S. 2000, Japan 1999)[d]	$12	¥895
Long and Complex Wholesale Marketing Channels		
Percentage of labor force employed in		
Wholesale (1990–1993)	4.1	8.0
Wholesale (Japan 1996–1997, U.S. 1997)	3.8	5.9
Retail (1993)	11.4	10.4
Retail (Japan 1996–1997, U.S. 1997)	10.9	11.2
Percentage of wholesale sales to other wholesalers:[f]		
1985–1986	25	42
1997	n.a.	35

Source: Data are from table 5.2, except as indicated.

Note: n.a. = not available.

[a]The United Kingdom had 3.4 in 1994.

[b]Stores with annual sales of $2 million or more.

[c]In Japan, called "food specialty stores."

[d]For Japan, MITI (various years), and for the United States, the U.S. Food Marketing Institute (available at http://www.fmi.org/facts_figs/keyfacts/).

[e]That is 44,600 square feet, which is slightly smaller than a U.S. football field.

[f]For Japan, MITI (various years), and for the United States, Ito and Maruyama (1991).

floor space. The average number of workers per store in Japan is half the U.S. figure.

Fragmentation of the retail sector in Japan is accompanied by long and complex wholesale marketing channels. This is evident in several statistics. Japan's distribution sector employment is disproportionately concentrated in wholesaling compared to the United States, and the fraction of wholesalers' revenue from sales to other wholesalers is much higher in Japan.

Finally, the ubiquity of manufacturer-imposed pricing rules, customer assignments, and stipulations of exclusivity can be judged from the large fraction of wholesalers reporting participation in manufacturer-initiated distribution *keiretsu*: The figure was 45 percent in 1992, although this is down from 70 percent in 1986 (Small and Medium Enterprise Agency 1994, 180, table 9). No direct comparison with the United States can be made, but such practices frequently run afoul of U.S. antitrust laws and thus undoubtedly are less widespread.

5.2 International Perspective

This section presents a comprehensive comparison of Japan's distribution sector with those of other nations. Table 5.2 depicts statistics for the Organization for Economic Co-operation and Development (OECD) member countries on density of retail stores, employment per store, and value-added and employment in wholesaling and retailing. The countries are listed in ascending order of stores per thousand inhabitants in the mid-1990s. Japan is in the bottom third of the list, having moved up since 1982 when it had 14.3 stores per thousand.

A simple index of the average productivity of labor employed in the distribution sector relative to the average productivity of labor in the overall economy can be obtained by dividing the share of distribution sector value-added in GDP by the share of distribution sector employment in the total labor force. Countries with higher standards of living (i.e., relatively high gross national product (GNP) per person in purchasing power parity (PPP units) tend to have wider discrepancies in average labor productivity between distribution and other sectors. (The United States is a regression outlier, but Japan is not). This has a simple interpretation: It reflects the generally slower pace of technical change in services compared to manufacturing something first noted by William Baumol.[2]

Japan's index stands at 0.69, which is below the 0.75 average for all the countries. This is expected, given the high standard of living. (The United

2. A simple ordinary least squares (OLS) regression of the natural logarithm of the labor productivity index (for 1996–1997) on the natural logarithm of GNP per person measured in purchasing power units (for 1998) is ln (Index) = 4.1 – 0.45 ln (GNP per person in PPP units), where t-stat = –3.8 number of observations = 20, and $R^2 = 0.44$.

Table 5.2 **International Comparison of Distribution Sectors**

	Retail outlets[a]			Share of Distribution in Total Employment					Share of Retail in Total Employment	
				Value-Added to GDP						
	Year of Data	Number	Employment Per Outlet	1993[b]	1996–1997[e]	Retail Only	1996–1997[e]	1993–1997[e]	1990[b]	1996–1997[e]
Luxembourg	n.a.	n.a.	n.a.	13.5	10.2	3.4	15.9	21.1	9.7	10.0
United Kingdom	1993	3.3	15.4	12.8	10.7	n.a.	17.1	16.4	11.3	10.0
Austria	1996	3.7	8.4	12.8	11.9	4.3	14.4	13.4	7.5	6.6
Australia	1992	4.0	10.8	n.a.	10.8	n.a.	20.8	17.4	13.1	9.9
Germany	1996	4.9	6.7	7.8	10.0	4.1	11.3	15.5	8.3	8.2
Sweden	1993	4.9	6.5	8.3	9.5	n.a.	11.9	12.9	6.9	4.6
Turkey	1996	5.0	0.9	16.0	14.4	5.4	12.5	n.a.	4.8	4.3
United States	1992	6.1	11.7	15.7	13.6[d]	6.7[d]	15.5	14.7[d]	11.4	10.9[d]
Denmark	1995	6.3	5.8	10.7	11.5	3.8	10.8	15.9	7.8	6.9
France	1996	6.6	3.7	12.2	9.2	4.0	13.8	13.8	9.3	7.2
Czech Republic	1996	6.7	13.3	10.7	10.8	3.7	16.4	15.0	13.6	8.5
Iceland	1990	6.7	n.a.	8.9	n.a.	n.a.	11.9	13.6	6.4	7.0
Canada	1985	6.8	8.3	10.0	9.3	n.a.	16.4	18.7	10.4	12.7
Netherlands	1996	7.4	5.0	12.7	12.0	3.7	16.2	15.1	12.3	6.9
Finland	1997	7.6	2.5	8.4	9.4	3.1	12.5	11.9	6.7	6.0

Switzerland	1996	7.7	6.5	14.7	n.a.	n.a.	13.9	n.a.	10.6	9.4
European community	1996	7.8	5.3	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Norway	1996	9.3	4.6	9.7	9.8	n.a.	13.9	15.2	6.0	8.8
New Zealand	1990	9.5	4.4	15.2	n.a.	n.a.	12.4	15.3	10.0	6.8
Italy	1996	9.8	2.6	15.3	12.6	2.9	19.3	17.3	10.3	7.6
Japan	**1997**	**11.2**	**5.1**	**12.5**	**11.8**	**5.0**[e]	**18.4**	**17.1**	**10.4**	**11.2**
Hungary	1997	12.1	1.5	10.8	10.2	4.7	12.4	13.9	11.5	10.7
Mexico	1993	13.0	13.2	n.a.	15.1	n.a.	14.9	n.a.	n.a.	15.2
Belgium	1996	13.7	1.9	n.a.	10.9	n.a.	15.9	13.3	7.3	12.7
Spain	1992	14.2	2.7	14.2	13.3	n.a.	16.7	22.3	11.0	12.8
Ireland	1997	14.4	2.5	7.9	n.a.	n.a.	14.3	n.a.	11.8	9.6
Portugal	1996	15.2	2.4	8.9	13.3	4.4	16.4	17.2	5.2	8.4
Greece	1993	17.6	3.1	9.6	13.1	6.5	15.5	14.4	9.3	15.6
Korea	1997	18.5	2.2	11.7	n.a.	n.a.	22.0	n.a.	n.a.	9.2
Poland	1997	24.8	1.0	18.9	18.4	n.a.	16.4	13.2	5.2	7.4

Note: Value added to GDP by retail sector. n.a. = not available.

[a]OECD (2000), except as noted.

[b]Pilat (1997, 17, table 2.1).

[c]Boylaud and Nicoletti (2001, 256, table 1).

[d]Statistical Abstract of the United States (available at http://www.census.gov/prod/www/statistical-abstract-02.html).

[e]McKinsey Global Institute (2000, exchibit 1).

States does not fit the pattern; its index of 0.92 is above the international average.) The upshot is that the variation in the index across countries probably is more reflective of international differences in average productivity of manufacturing than of distribution. Countries with lower standards of living tend to have more stores per person and smaller average store size (measured as average employment per store). The association often made between Japan's ubiquity of small stores and economic backwardness is based on this pattern.

5.3 Explaining Retail Store Density

There are two broad types of economic models for explaining the overall density of retail stores: the social optimality approach, which presumes that the density of stores attains the economic optimum without explicitly modeling how prices are set, and the explicit pricing and free entry approach, which presumes that the density of stores is the maximum consistent with positive profits given some explicit model of pricing by firms. Flath (1990) and Matsui and Nariu (2001) adopt the social optimality approach; Heal (1980) and Gabszewicz and Thisse (1986) model pricing explicitly and presume free entry.

The comparative statics of store density are qualitatively the same for both types of models. A proliferation of stores shifts some costs of storing and transporting goods from households to the distribution sector. Thus, it is appropriate to base empirical analysis of international variation in retail density on factors associated with the costs of transporting and storing goods of both households and firms. This is exactly the approach taken by Flath and Nariu (1996) using data from the early 1980s. Here that exercise is repeated with more recent data.

Table 5.3 presents data on some variables associated with the costs and benefits of a proliferation of stores for various OECD nations, mostly from around 1996. The variables are proxies for things that affect the relative efficiency of households and firms at storing and transporting goods.

Crowded living space (CRWDNG) increases willingness to pay a premium to shop nearby. Car ownership (CARS) lowers household costs of shopping and thus lowers the premium. The more urbanized an economy (URBAN), then for any given expansion in the number of stores per person, the smaller the effect on the average distance between stores and residences, and so the smaller marginal benefit from proximity. If a nation is geographically compact (LENGTH) like Japan, rather than dispersed over half a continent like the United States, the added cost of restocking a multiplicity of stores is reduced. A proliferation of trucks (TRUCKS) and the infrastructure of roads that make it worthwhile to use trucks lower the added costs of restocking a multiplicity of stores as opposed to a smaller number of larger ones.

Table 5.3 **Factors in Retail Density, 1998**

Variable[a]	STORES[b]	CRWDG[c]	CARS[d]	URBAN[d]	LENGTH[f]	TRUCKS[g]	GNPPP[g]	GNP[h]
United Kingdom	0.5	3.4[i]	374.2	89	15.7	47.1	20,640	21,400
Austria	0.6[j]	3.7	479.9	65	9.2	38.3	22,740	26,850
Australia	n.a.	4.0	472.3	85	88.0	110.5	20,130	20,300
Germany	0.5	4.9	507.6	87	18.9	28.9	20,810	25,850
Sweden	0.6[j]	4.9	426.1	83	21.2	38.0	19,480	25,620
Turkey	1.3	5.1[i]	63.8	73	27.8	15.7	n.a.	3,160
United States	0.5	5.8[i]	480.6	77	96.8	280.9	29,340	29,340
Denmark	n.a.	6.3	354.2	86	6.6	56.2	23,830	33,260
France	0.7	6.6	455.8	75	23.5	92.1	22,320	24,940
Iceland	n.a.	6.7	510.9	92	10.1	62.0	22,830	28,010
Canada	0.5	6.8	440.8	77	99.9	121.2	24,050	20,020
Czech Republic	1.0	6.8[i]	358.0	66	8.9	41.1	n.a.	5,040
The Netherlands	0.7	7.4	566.3	89	6.4	100.6	21,620	24,760
Finland	0.7[j]	7.6	388.7	64	18.4	54.0	20,270	24,110
Switzerland	0.6	7.7	476.5	62	6.4	37.6	26,620	40,080
Norway	0.6	9.3	405.9	74	18.0	88.9	24,290	34,330
New Zealand	0.5	9.5	440.5	87	16.5	99.7	15,840	14,700
Italy	0.8[j]	9.8	538.2	67	17.3	50.7	20,200	20,250
Japan	**0.6**[j]	**11.2**[i]	**395.1**	**79**	**19.4**	**163.8**	**23,180**	**32,380**

(*continued*)

Table 5.3 (continued)

Variable[a]	STORES[b]	CRWDG[c]	CARS[d]	URBAN[d]	LENGTH[f]	TRUCKS[g]	GNPPP[g]	GNP[h]
Hungary	0.5	12.1	234.2	66	9.6	32.2	n.a.	4,510
Mexico	1.4	13.0	97.8	74	44.2	45.9	8,190	3,970
Belgium	0.5[j]	13.7	437.1	97	5.7	45.0	23,480	25,380
Spain	0.7[j]	14.2	389.2	77	22.5	81.6	16,060	14,080
Ireland	n.a.	14.4	266.8	58	8.4	31.1	18,340	18,340
Portugal	0.7	15.2	308.0	61	9.6	36.3	14,380	10,690
Greece	n.a.	17.6	254.9	60	11.5	93.2	13,010	11,650
Korea	1.1	18.5	163.4	84	10.0	46.1	12,270	7,970
Poland	2.0	24.8	229.7	65	18.0	40.8	6,740	3,900

Notes: Data are for 1998 or nearest year for which data are available. n.a. = not available.

[a]Name of variable in regression analysis.

[b]Store density; stores per 1,000 inhabitants (table 5.2, except as noted).

[c]Crowding; rooms per person (United Nations Statistics Division 2003, except as noted).

[d]Car density and truck density; such vehicles per 1,000 inhabitants (Statistics Bureau 2001, table 8-2).

[e]Urbanization; Urban population as percentage of total (World Bank 2001, 232, table 2).

[f]Square root of the country's area (1,000 square kilometers, World Bank 2001, 232, table 2).

[g]The GNP per capita adjusted to PPP in U.S. dollars.

[h]The GNP per capita in U.S. dollars.

[i]Using data from Boylaud and Nicoletti (2001, 256, table 1); Czech Republic, Japan, and Turkey are 1997 figures; United Kingdom is 1994 figures; United States is 1996 figures.

[j]Statistics Bureau (2001), rooms per dwelling (p. 296, table 13–6) divided by persons per household (p. 32, table 2-10).

Table 5.4 OLS Regressions Explaining International Variation in Density of Stores

Variable	With CRWDNG	With CRWDNG Japan Excluded	Without CRWDNG	Without CRWDNG Japan Excluded
Constant	3.4	3.5	5.6	5.6
	(1.9)	(1.8)	(5.2)	(5.1)
URBAN	–0.4	–0.4	–1.4	–1.4
	(–0.4)	(–0.4)	(–1.7)	(–1.7)
ln CARS	–0.3	–0.3	–0.6	–0.6
	(–1.0)	(–1.0)	(–2.9)	(–2.8)
ln TRUCKS	0.5	0.5	0.5	0.5
	(2.1)	(1.9)	(2.6)	(2.4)
ln LENGTH	–0.3	–0.03	–0.4	–0.4
	(–2.0)	(–1.9)	(–2.8)	(–2.8)
ln CRWDG	0.6	0.6	n.a.	n.a.
	(1.5)	(1.5)		
Number of observations	23	22	28	27
R^2	0.40	0.39	0.40	0.41
Predicted value of STORES for Japan,				
t-test statistic for difference from	n.a.	11.8	n.a.	11.7
actual value (11.3)	n.a.	(0.08)	n.a.	(0.13)

Note: Dependent variable = ln STORES. Coefficients, with t-statistics in parentheses. n.a. = not applicable.

Table 5.4 shows that all of these contribute to the cross-country variation in number of stores per person in the expected way. The estimates in the first two columns include the average number of persons per room as an explanatory variable and a proxy for the dearness of household storage space. This variable is available only for some of the countries. Excluding it, and thus enlarging the sample, narrows the standard errors of estimates of the other coefficients. This possibly reinforces confidence that the results are qualitatively valid.

Japan is not a regression outlier. Stores per thousand persons predicted by regressions excluding Japan are 11.8 with crowding and 11.7 without, statistically indistinguishable from the actual value of 11.3. These results very much resemble those obtained in Flath and Nariu (1996) for a slightly different set of countries using data from around 1980.

The conclusion remains that Japan's relatively high density of retail stores is due to its paucity of private cars, confined household living space, geographic centricity, and superabundance of trucks. All of this pointedly leaves regulation out of the picture. Partly this reflects the lack of a suitable proxy for regulation that can be included in the regression equation, but it also reflects a judgment that regulation is a corollary of economic variables like the ones already in the equation. I return to this point later.

5.4 Wholesale Channels

The focus so far has been on the density of stores. A related issue is the extent to which Japan's complex wholesale marketing channels are induced by its high retail store density, as opposed to reflecting some idiosyncrasy.

Proliferation of stores induces branching of logistical arteries to economize on transport costs. Such branching does not by itself imply a multiplicity of wholesale steps, but would seem to lower the costs of a profusion of wholesalers.

Evidence suggests Japan's high retail density and wholesale complexity are intertwined. Nariu and Flath (1993) construct estimates of the average number of steps in matched wholesale industries of Japan and the United States for the early 1980s. Besides confirming that Japanese wholesale channels have, on average, more steps (1.8) than U.S. ones (1.4), we also showed that the variation in number of steps across wholesale marketing channels is highly correlated between Japan and the United States, and for consumer products, it is also related to the relative density of stores.[3]

In other words, there are common influences operating on the length of wholesale channels in both countries. Also, the number of wholesale steps in Japan is greater for products (such as food) that have many retail stores compared to the United States. This suggests that Japan's elephantine wholesale sector is to some extent due to its proliferation of stores.

5.5 The Large Store Law

The regulation that bears most directly on the density of retail stores in Japan is the Large Store Law. It is the essential reason why Japan has far fewer department stores and general merchandise superstores per person than the United States, as McCraw and O'Brien (1986) were early to recognize.

Bureaucratic obstacles have been placed on establishment of large stores since the Department Store Act of 1937. Suspended in 1947, but reinstated in 1956, it required approval of the national government for the opening of the new department stores anywhere in Japan. In 1974, the Large Scale Retail Store Law replaced the Department Store Act. It made the extent of floor space, rather than the nature of the store, the criterion for necessitating approval. The cut-off was 3,000 square meters in the largest cities and 1,500 square meters everywhere else. At the time, almost all stores larger than the cut-offs were department stores. In 1978, the law was completely revamped to broaden coverage to include all new stores over 500 square meters, which meant it would apply to many grocery stores.

3. In Nariu and Flath (1993, 94, table 6-3) we present an OLS regression: 0.30 + 0.60 (number of steps in matching U.S. wholesale industry) + 0.09 (stores per household in Japan divided by stores per household in the United States for retail category corresponding to the wholesale industry), where t-stat = 4.1; t-stat = 3.3; number of observations = 24; and $R^2 = 0.57$.

The process of securing approval to open a large store was torturous, typically requiring two years or longer. The process, directed by the Ministry of International Trade and Industry (MITI), involved hearings before local panels that included owners of existing stores that would suffer if the proposal was approved. The panels tended either to recommend against approval or propose restrictions on the hours or days the store could operate. In many cases they proposed such onerous requirements as offering of classes in cultural activities, like calligraphy or floral arrangement, at prices that did not cover costs. The MITI tended to adopt these recommendations and proposals; Larke (1994) offers further detail on the process. Unsurprisingly, following adoption of the 1978 amendments, applications to open new stores dropped to a trickle: in 1984 there were fewer than 500.

In 1989, the U.S. government identified the Large Store Law as a structural impediment to the sale of U.S.-made consumer products in Japan, arguing in negotiations with Japan for repeal or relaxation of the law. Japan responded first by amending the law in 1992 to shorten the process for reviewing applications, then in 1994, by raising the cut-off to 1,000 square meters, which is about one-fourth the size of the typical U.S. grocery store.

As shown in table 5.5, the number of large stores in operation did increase after 1994. However the overall number remains low compared to the United States. In 1997, there were only around 24,000 stores larger than 1,000 square meters in all of Japan.

In May 1998, the Diet replaced the old law with a new one (actually with three new laws) that place details of the regulation of large stores under control of prefectural governments but mandates that they consider only environmental factors, such as noise and traffic, and not any economic

Table 5.5 Number of Large Stores in Japan, 1985–1999

	Large Stores						All Stores	
	Class 1[a]	%[c]	Class 2[b]	%[c]	Total	%[c]	Total	%[c]
1985	3,662	n.a.	9,624	n.a.	13,286	n.a.	1,628,644	n.a.
1988	4,027	3.2	10,605	3.3	14,632	3.3	1,619,752	–0.2
1991	4,429	3.2	11,082	1.5	15,511	2.0	1,591,223	–0.6
1994	3,351	–8.9	14,292	8.8	17,643	4.4	1,499,948	–1.9
1997	4,350	9.1	17,542	7.1	21,892	7.5	1,419,696	–1.8
1999	n.a.	n.a.	n.a.	n.a.	23,897	4.5	1,406,884	–0.5

Source: MITI (various years).

Note: n.a. = not applicable.

[a]Class 1 includes larger stores (over 3,000 square meters in most regions, 6,000 square meters in selected wards of Tokyo and other large cities).

[b]Class 2 covers remaining large stores. In the 1999 Census of Commerce the distinctions were abandoned.

[c]Annual average percentage change since prior census.

harm to incumbent owners of small stores. The line between environmental factors and economic ones is sufficiently fuzzy that some prefectures may actually enact more severe restraints than existed under the previous regime (although I consider this unlikely). Other prefectures may remove the restraints on large stores altogether.

5.6 Regulatory Distortions

Regulatory distortions definitely exist in Japan's distribution sector; table 5.6 summarizes them. The sparseness of large stores clearly is the result of regulations. Restricting the number of large stores may have had a secondary, distorting effect on Japan's foreign trade insofar as imported consumer products until the 1990s were generally more effectively distributed through large, upscale department stores, such as Mitsukoshi and Takashimaya.

The multiple wholesale steps and disproportionately large employment in wholesaling may in large part also be a secondary effect of the proliferation of small stores and thus an indirect result of regulatory protection of small stores. For example, Nariu and Flath (1993) offer a regression equation linking multiplicity of wholesale steps and proliferation of stores.

Regulations regarding inward foreign direct investment (FDI) may have

Table 5.6 **Regulations Distorting Distribution Sector Resource Allocation**

Regulation	Nature of Effect on Distribution Sector	Comment
Large Store Law 1974–2000	The law severely limited number of stores with large floor space, including department stores and general merchandise superstores and contributed to survival of small traditional stores.	The law was repealed in 1998, but in effect until April 2000 and administered by national government.
Large-Scale Retail Store Location Law 2000–Present	The law was enacted with repeal of the Large Store Law.	The law vests prefectures and municipalities with authority to limit large stores (1,000 square meters or greater). Supposedly, criteria is to be confined to environmental factors only, such as noise and traffic, but skepticism is warranted.
Automotive inspection (*shaken*)	The Road Vehicles Act (revised 1995) mandates comprehensive safety inspections of private passenger vehicles every two years beginning with the third year the car is in operation.	This usually entails purchase of numerous replacement parts. The cost inhibits car ownership and thus helps perpetuate the advantage of nearby small neighborhood stores over larger, more distant stores.

had a relatively large effect on distribution. A disproportionately large share of FDI in Japan (and elsewhere) is in wholesaling. Japan's vanishing small stock of inward FDI, in comparison with the United States and the European Union (EU), has been linked to Japanese government restrictions relaxed around 1980. The relative absence of foreign-affiliate wholesalers in Japan could inhibit competition and protect inefficient domestic incumbent producers and distributors. (For a close investigation of FDI in Japan's wholesale industry and its effects on import penetration, see Flath 2001.)

Enforcement also matters. Vertical restraints are often presumptively in violation of the antimonopoly law of Japan, but they nonetheless appear to be widespread. Penalties for violations are notoriously weak and the resources devoted to enforcement are quite parsimonious. See Flath (1989) for a discussion of vertical restraints in Japan.

Large stores do not necessarily compete only with small ones: they also complement them, perhaps offering agglomeration economies. In other words, there are possible negative effects on small stores from regulatory limits on large ones. Empirical analysis is needed here.

5.6.1 Evidence Regarding Regulatory Distortion

As a first pass at assessing whether the distorting effects of these regulations might be significant, consider some data from the McKinsey Global Institute (2000). The authors construct estimates of value-added per hour of labor across stores of different kinds in Japan and the United States in the mid-1990s. They conclude that traditional mom-and-pop stores in Japan have lower average labor productivity than do large stores in Japan and that they account for a disproportionately large share of total labor input, as compared to the United States (table 5.7).

Overall average labor productivity in Japan's retail sector is only about half that of the United States. Closing that gap would increase Japan's GDP measurably. How much? Here is a rough calculation. Suppose, for the sake of argument, that only regulatory barriers limit the number of general merchandise stores and supermarket groceries and that eliminating those barriers would double the labor hours that each group worked in 1997 (to roughly match the U.S. pattern), shifting workers from traditional stores. Also suppose that as this occurred, value-added in traditional stores fell in proportion to the withdrawal of labor, while value-added in other stores remained unchanged as wages displaced their profits. Each year this would eliminate a deadweight loss equal to about 0.25 percent of Japanese GDP.[4]

4. If labor hours in general merchandise stores and supermarkets doubled from the 1997 levels with no change in value-added (as wages displaced profits), the value-added per hour would fall by half in each. The deadweight loss thus eliminated equals the area of a Harberger triangle with right sides equal to the initial labor hours and half the initial value-added per labor hour. In other words, the recovery of deadweight losses amounts to about 25 percent of initial value-added: 0.25 (2.2 + 3) = ¥1.3 trillion, which is around 0.25 percent of Japan's GDP.

Table 5.7 **Comparison of Retail Stores in Japan and the United States**

	Total Sector	GMS[a]	Supermarkets	Specialty Chains	Convenience Stores	Department Stores	Traditionals
Share of sales							
Japan 1988	n.a.	7	7	34	3	10	37
Japan 1997	n.a.	8	12	36	4	9	30
United States 1995	n.a.	15	24	35	3	7	17
Share of labor hours							
Japan 1997	n.a.	4	8	23	2	8	55
United States 1995	n.a.	14	21	35	3	8	19
Value-added							
Japan 1997[c]	25.5[b]	2.2	3.0	12.0	1.0	2.0	3.0
Per hour Japan 1997[d]	50	106	73	102	96	48	19
As percentage of the United States	50	93	60	84	88	70	33

Source: McKinsey Global Institute (2000, 27, exhibit 4 and 28, exhibit 5).

Note: Categories of stores do not correspond exactly to those of the Census of Commerce of Japan. Presumably, this is because of the need for correspondence between the types of stores in Japan and the United States. n.a. = not applicable.

[a]Discount and general merchandise stores.

[b]Five percent of GDP.

[c]In ¥ trillions.

[d]U.S. retail average = 100.

Furthermore, suppose that as a result of the changes in retailing, Japan's wholesale sector also evolved to more resemble U.S. wholesaling in terms of labor productivity. Employment would fall by 2 percent to 4 percent of the labor force, freeing millions of workers for employment elsewhere in the economy. If this reasoning holds any validity, the distortions afflicting Japan's distribution sector are enormous. But the calculation is highly suspect.

With the obvious difficulties in measuring labor hours and productivity in small, family-operated stores set aside, the calculation accepts that any differences between Japan and the United States in allocation of labor across store types and between the retail and wholesale sectors are wholly the result of distortions and could be eliminated by an act of government policy. If this were true, then large stores of Japan ought to be immensely profitable. They are not. The bankruptcies of the Sogo department store chain and MyCal supermarket chain are reminders of this fact.

5.6.2 Vehicle Inspections

Although the following analysis suggests that the distorting effects of the Large Store Law may have been less than is often supposed, it also indicates that regulations not specifically focused on that sector may have a distorting effect. Regulations that unnecessarily or wastefully increase the cost of owning and operating a private car indirectly favor small stores over large ones by enhancing household willingness to pay for proximity to stores.

Japan does indeed have such a regulation, the requirement that private car owners submit their vehicles to comprehensive inspections every two years beginning with the car's third year on the road. These vehicle inspections (*shaken*, in Japanese) are made unnecessarily expensive by the limited number of shops licensed to conduct them and by the onerous requirement that numerous working parts be replaced if an older car is to pass (Beck 1993). This is widely cited as the reason why the average vehicle age in Japan is 5.8 years compared to 8.3 years in the United States, and the average annual mileage per car in Japan is only about half that of the United States (Japan External Trade Organization [JETRO] 2002).

As recently as 1990, Japan had a mere 291 cars per thousand persons. As a first pass at assessing whether increasing car ownership may have run its course, consider a simple regression of cars per thousand persons on GNP per person in purchasing power units using 1998 data. The predicted value for Japan is 450.1, while the actual number is 395.1. The 12 percent difference is not statistically significant.[5]

5. The log linear OLS regression is ln (cars per thousand) = –2.9 + 0.9 ln (GNP in PPP units) – 0.13 (dummy equal to one for Japan), where t-stat = 6.6; t-stat = 0.5; number of observations = 26; and $R^2 = 0.65$.

My guess is that a further dramatic increase in car ownership in Japan is unlikely, but a lagged response of retail structure to the past increase in car ownership may still play out over the coming decade and beyond.

5.7 Retail Formats

Japanese statistics define eight store formats (table 5.8). Format is determined by whether or not a store is self-service and by the mix of merchandise it offers in three broad categories (clothing, food, and living [*jun-kanren*]). Large stores are primarily department stores, general merchandise superstores, and specialty superstores. Similarly, these formats tend to be large stores. The essential difference between general merchandise superstores and department stores is that the former are self-service stores while the latter are not.

Table 5.9 provides time series on the numbers and average scale of stores in each format. Note the 1997 changes in the definitions of specialty superstores and convenience stores. Before 1997, the specialty superstore category included stores larger than 500 square meters, which meant they were all subject to the Large Store Law. Then, stores as small as 250 square meters were reclassified from other superstores to specialty superstores if their product-mix concentration met the specialty requirement. This tripled stores in the category. Department stores and general merchandise superstores have decreased in number from 1997 to 1999, their travails documented in numerous news accounts.

Table 5.8 Store Formats in Japan

Category	Product Mix,[a] Other Requirements
	Self-Service[b]
General Merchandise superstores	At least 10%, but no more than 70%, of sales in each category
Specialty superstores	At least 70% of sales in a category[c]
Convenience stores	Includes food. Open at least 14 hours per day[d]
Other superstores	Self-service stores not in the other three categories
	Non-Self-Service
Department stores	At least 10%, but no more than 70%, of sales in each category
Specialty stores	At least 90% of sales in one category
Semispecialty stores	Between 50% and 90% of sales in one category
Other non-self-service stores	Non-self-service stores not in the other three categories

Note: as established by the Census of Commerce of Japan for 1997 and later years.

[a]Within three categories: clothing, food, and living (*jun-kanren*).

[b]A store is self-service if at least half the floor space is devoted to sale of merchandise in prepackaged or final form, at a price marked on the product, to customers who move freely about the store with a cart or handbasket, and who pay no fee to enter the store.

[c]Size is greater than 250 square meters. Before 1997, threshold was 500 square meters.

[d]Size range is 30–250 square meters. Before 1997, range was 50–250 square meters.

Table 5.9 **Characteristics of Stores in Japan, 1985–1999**

	1985	1988	1991	1994	1997	1999
			All Retail Stores			
Number	1,628,644	1,619,752	1,591,223	1,499,948	1,419,696	1,406,884
Employees[a]	3.9	4.2	4.4	4.9	5.2	5.7
Area (m^2)	n.a.	n.a.	79	93	105	111
Sales[b]	62	71	88	96	104	102
			Department Stores			
Number	438	433	455	463	476	394
Employees[a]	431	446	456	444	392	427
Area (m^2)	n.a.	n.a.	15,063	16,340	17,133	19,134
Sales[b]	17,762	20,930	25,086	22,981	22,416	24,633
			General Merchandise Superstores			
Number	1,389	1,478	1,549	1,804	1,888	1,670
Employees[a]	138	136	142	151	160	192
Area (m^2)	n.a.	n.a.	5,659	6,316	7,166	8,020
Sales[b]	4,258	4,491	5,268	5,175	5,274	5,299
			Specialty Superstores			
Number	5,873	6,397	7,130	9,354	11,656	14,455
Number[c]	n.a.	n.a.	*20,827	*25,171	*32,209	*35,531
Clothing	520	571	618	849	*4,549	*4,780
Food	4,707	4,877	5,185	6,231	*17,623	*18,707
Living	646	949	1,327	2,274	*10,037	*12,044
Employees[a]	37	38	37	39	*24	*29
Area (m^2)	n.a.	n.a.	n.a.	1,207	*731	*840
Sales[b]	983	1,000	1,122	1,115	*635	*668
			Convenience Stores			
Number	29,236	34,550	41,847	48,405	33,167	37,025
Number[c]	n.a.	n.a.	*23,837	*28,226	*36,631	*39,628
Employees[a]	7	9	8	10	*11	*14
Area (m^2)	n.a.	n.a.	*94	*98	*99	*103
Sales[b]	116	145	167	172	*143	*155
			Other Superstores			
Number	59,643	53,834	67,473	80,036	103,273	67,476
Number[c]	n.a.	n.a.	*72,027	*84,878	*120,721	*86,367
Employees[a]	6	7	6	6	*4	*6
Area (m^2)	n.a.	n.a.	n.a.	128	*89	*110
Sales[b]	124	144	143	132	*83	*98
			Specialty Stores			
Number	1,004,883	1,007,756	1,000,166	930,143	839,969	920,277
Clothing	149,246	151,370	154,656	147,478	126,383	134,329
Food	290,789	293,203	283,570	263,681	230,163	249,287
Living	564,848	563,183	561,940	518,984	483,423	536,661
Employees[a]	3	4	4	4	4	5
Area (m^2)	n.a.	n.a.	53	61	63	63
Sales[b]	47	51	65	66	71	68

(*continued*)

Table 5.9 (continued)

	1985	1988	1991	1994	1997	1999
			Semispecialty Stores			
Number	524,885	513,338	470,289	429,108	385,748	319,685
Clothing	74,232	78,608	76,903	65,733	62,882	54,928
Food	271,593	253,352	224,756	185,509	154,736	131,465
Living	177,644	179,715	166,740	175,857	168,130	133,292
Employees[a]	3	3	4	4	4	4
Area (m^2)	n.a.	n.a.	62	69	74	76
Sales[b]	47	54	67	76	82	75

Source: MITI (various years).

Note: Asterisks indicate data based on 1997 definitions rather than earlier ones. n.a. = not available.

[a]Average number per store.

[b]Average annual sales in ¥ millions.

[c]Using 1997 definitions, for which see text.

Table 5.10 **Composition of Total Sales Across Formats of Stores, 1985–1999 (%)**

	1985	1988	1991	1994	1997[a]	1999[a]
Department store	7.6	7.9	8.1	7.4	7.2	6.7
General merchandise superstore	5.8	5.8	5.8	6.5	6.7	6.2
Specialty superstore	5.7	5.6	5.7	7.3	*13.8*	*16.5*
Convenience	3.3	4.4	5.0	5.8	*3.5*	*4.3*
Other superstore	7.3	6.8	6.9	7.4	*6.8*	*5.9*
Specialty	46.0	45.2	45.9	42.6	40.4	43.5
Semispecialty	24.0	24.2	22.4	22.9	21.3	16.7
Other	0.2	0.1	0.2	0.0	0.2	0.3

Source: MITI (various years).

[a]Changes in definitions of specialty superstores, convenience stores, and other superstores in 1997 increases specialty superstores relative to the other two formats and makes the series for the three formats discontinuous. Data using the new definitions are in italics.

There is no category for small family-owned stores as such: Most are either specialty or semi-specialty stores. Two-thirds of them are sole proprietorships. Only 5 percent of specialty superstores and no large stores are sole proprietorships.

Between 5 percent and 10 percent of specialty and semispecialty stores are contained within the premises of large stores (i.e., boutiques within larger stores). The total number of such stores (not themselves large, but contained within the premises of ones that are large) has remained around 100,000 since 1991.

Table 5.10 shows the time series for composition of total sales across the types of store. These data reflect the same trends in numbers of stores.

Table 5.11 Spread of Car Ownership, 1965–1998

	Cars Per 1,000 Persons[a]	Change (%)[b]
1965	22	n.a.
1970	85	30.7
1975	154	12.7
1980	202	5.6
1985	230	2.6
1990	291	4.8
1995	360	4.4
1998	394	3.1

Source: Government of Japan (various years).
Note: n.a. = not applicable.
[a]Passenger cars.
[b]Average annual percentage change from previous entry.

5.7.1 Influences on the Number of Stores by Format

The Large Store Law has limited the number of stores with large floor space. Almost all of these are department stores, general merchandise superstores, or specialty superstores. The law also ought to have induced increased numbers of stores of other formats. These include small family-owned, non-self-service stores that are mostly classified as specialty stores or semispecialty stores. Our next task is to measure these effects.

In measuring the effect of regulatory change on the number of stores, it is necessary to control for changes in other factors influencing retail density. These include increasing ownership of passenger cars, increasing average space per person in dwellings, and declining population density in cities as the suburbs expand. Increasing car ownership favors evolution towards a retail sector with fewer, larger stores. Declining population density per se has the opposite effect on retail density, but is probably itself an inevitable accompaniment of the move toward car ownership and larger dwellings. All three trends can be placed under the heading "suburbanization." Tables 5.11, 5.12, and 5.13 document them.

More living space means that storage space is less constrained, enabling households to shop less frequently for daily necessities and to maintain larger stocks, eroding the value to households of proximity to stores selling nondurables. The effect of larger, less crowded dwellings on the numbers of stores selling durables is possibly the opposite, leading to more such stores. But stores selling nondurables, such as food and daily necessities, are more numerous than the ones selling durables, such as furniture.

As population density becomes less, the marginal benefit to households of a proliferation of stores becomes greater. This effect arises because, as households are more diffuse, any given number of stores per household en-

Table 5.12 Changes in Japanese Dwellings, 1965–1998

	Rooms Per Dwelling	Persons Per		Area (m²) Per		Change in Area Per Person[a]
		Dwelling	Room	Dwelling	Person	
1963	3.82	4.43	1.16	72.52	16.36	n.a.
1968	3.84	3.96	1.03	73.86	18.63	2.6
1973	4.15	3.63	0.87	77.14	21.26	2.7
1978	4.52	3.47	0.77	80.28	23.17	1.7
1983	4.73	3.35	0.71	85.92	25.69	2.1
1988	4.86	3.21	0.66	89.29	27.86	1.6
1993	4.85	3.02	0.62	91.92	30.46	1.8
1998	4.79	2.83	0.59	92.43	32.70	1.4

Source: Government of Japan (various years).

Note: n.a. = not applicable.

[a]Average annual percentage change between years shown.

Table 5.13 Measures of Population Density, 1965–1995

	District Density[a]		Overall Density	
	Population[b]	Area[c]	Average[d]	Change[e]
1965	48.1	1.23	10,263	n.a.
1970	53.5	1.71	8,678	–3.3
1975	57.0	2.19	7,712	–2.3
1980	59.7	2.65	6,983	–2.0
1985	60.6	2.80	6,938	–0.1
1990	63.2	3.11	6,661	–0.8
1995	64.7	3.24	6,630	–0.1

Source: Government of Japan (various years).

Note: n.a. = not applicable.

[a]Densely inhabited districts are contiguous census districts with high population density (in principle, 4,000 inhabitants or more per square kilometer) within the boundary of a city, ward, town, or village constituting an agglomeration of 5,000 or more inhabitants.

[b]Population of densely inhabited districts as a percentage of Japan's total population.

[c]Densely inhabited districts as a percentage of Japan's total area.

[d]Overall population density per square kilometer.

[e]Annual average percentage change in density since previous census.

tails a greater average distance from each household to the nearest store, and the reduction in that distance with each given increase in number of stores becomes correspondingly greater. (See Flath [1990] for an algebraic treatment of this phenomenon.) The point here is that the gradual decline in average population density that has accompanied the proliferation of cars and increased spaciousness of dwellings has possibly in and of itself slowed the push towards fewer, larger stores in Japan.

5.8 Results from Analyzing Prefectural Differences

Regulatory effects should vary among prefectures because, although a national statute, the Large Store Law was implemented through locally administered advisory panels in each municipal jurisdiction. To measure these regulatory effects, I ran a set of regressions (detailed in box 5.1); the results are in table 5.14.

An examination of the first column estimates in table 5.14 reveals that car ownership and urban population density have influenced the overall density of stores in the expected way. Disappointingly, size of dwelling has

Box 5.1 Prefectural Regressions

To explain the numbers of stores of different kinds per person, I ran OLS regressions using data for each of Japan's 47 prefectures from five consecutive Censuses of Commerce of Japan (1985, 1988, 1991, 1994, and 1997; MITI, various years). The dependent variable is the natural log of the number of stores per 1000 persons. There is a different equation for each different format of store and for all stores.

The independent variables are the same in each equation and, as in Matsui and Nariu (2001), include a dummy variable for each prefectures. I do not report the estimates of coefficients on these dummies.

The independent variables of interest include the natural logs of the three variables being discussed, observed for each prefecture: passenger cars per 1,000 persons, dwelling floor space per person, and 1,000 persons per square kilometer in densely inhabited districts. To further control for the diffusion of population, I included the fraction of each prefecture's population residing in densely inhabited districts. It was necessary to log linearly interpolate between, or extrapolate from, housing census years and population census years respectively. Annual data are available for passenger car registrations.

The natural logarithms of the number of class 1 large stores and of class 2 large stores are included to measure the severity of regulation of large stores. So, for example, after 1994, large stores with floor space between 500 square meters and 1,000 square meters were automatically approved by MITI, but in the Census of Commerce these were still classified as large stores.

Table 5.14 OLS Log Linear Regressions Explaining the Numbers of Stores of Different Kinds Per Person, with Fixed Effects for Each of Japan's Forty-Seven Prefectures

Independent Variables	All	Department	General Merchandise Superstore	Specialty Superstore[a]	Convenience[a]	Other Superstore[a]	Specialty	Semi-specialty
Passenger cars per	–0.17	0.57	0.19	0.46	0.72	0.89	–0.23	–0.35
1,000 persons	(–7.99)	(1.99)	(1.06)	(3.24)	(4.66)	(4.21)	(–7.07)	(–8.64)
Dwelling floor space per	–0.01	–2.92	3.05	–0.15	0.74	–0.83	0.45	–0.60
person (m^2)	(–0.09)	(–1.51)	(2.51)	(–0.15)	(0.65)	(–0.54)	(2.03)	(–2.16)
1,000 Persons per km^2 in	–0.37	2.68	0.00	–0.29	0.73	0.32	–0.67	–0.62
dense areas[b]	(–4.12)	(2.22)	(0.00)	(–0.44)	(1.02)	(0.33)	(–4.85)	(–3.58)
Fraction of population in	–0.36	0.42	–2.21	2.27	2.11	–2.75	0.25	–0.45
dense areas[b]	(–2.09)	(0.18)	(–1.52)	(1.74)	(1.47)	(–1.40)	(0.94)	(–1.37)
Class 1 Large Stores[c] per	0.01	0.23	–0.04	–0.16	0.06	–0.21	–0.01	–0.01
1,000 Persons	(0.88)	(1.48)	(–0.41)	(–1.61)	(0.57)	(–1.39)	(–0.81)	(–0.62)
Class 2 Large Stores[c] per	–0.10	–0.18	0.39	0.42	0.02	–0.08	–0.19	–0.11
1,000 Persons	(–6.57)	(–0.85)	(3.01)	(3.37)	(0.17)	(–0.43)	(–7.89)	(–3.84)
R^2	0.98	0.71	0.84	0.98	0.98	0.96	0.96	0.98

Note: Dependent variable is number of stores per 1,000 persons. Coefficient estimates and t-statistics in parentheses. Each column is a different store type. All variables are in natural logs except the fraction of population residing in densely inhabited districts. Number of observations (except for specialty superstores and convenience stores); 235 = 47 prefectures × 5 years of observations. Sample = 5 successive Census of Commerce reports (1985, 1988, 1991, 1994, and 1997) by prefecture, except as noted. Coefficients on prefecture dummies are not reported.

[a]No observations for 1997.

[b]Densely inhabited districts are contiguous census districts with high population density (in principle, 4,000 inhabitants or more per square kilometer) within the boundary of a city, ward, town, or village constituting an agglomeration of 5,000 or more inhabitants.

[c]Class 1 and class 2 large stores are defined in table 5.6.

not exerted a statistically significant effect on overall density of stores (nor a coherent effect on numbers of stores of particular formats).

The number of class 1 large stores (floor space of 3,000 square meters or more, except in the central parts of major cities where it is 6,000 square meters or more, and a proxy for regulation) has no measurable effect on the overall number of stores. However, the density of class 2 large stores (those that are not class 1, and another proxy for regulation) is inversely related to the overall number of stores, as expected. Possibly this reflects the much greater temporal variation in the number of class 2 stores than in class 1 stores (shown in table 5.5).

All of the variables, including the number of class 2 stores, have inelastic effects on the overall number of stores. Over the period 1985–1997, the number of class 2 stores grew about 5 percent per year, while the overall number of stores shrank about 1.1 percent. Given the estimated elasticity of overall number of stores with respect to number of class 2 stores of –0.10, expansion of these large stores by itself accounts for a little less than half of the constriction in overall number of stores.

Relaxed regulation is a contributing factor to reduction in number of stores, slightly less important than increasing car ownership. The inelasticity of overall number of stores with respect to number of class 2 large stores of –0.10 generally argues against regulatory limits on large stores as being in any way crucial in explaining the proliferation of small stores. For example, quadrupling or quintupling the number of class 1 and class 2 stores would roughly match the density of such stores per person in the United States, but based on these estimates would still not dramatically reduce the overall number of stores in Japan.

If regulation mattered greatly, one would expect that in prefectures where the large store law was more loosely applied, overall retail density would be dramatically smaller than elsewhere. This does not appear to have been the case. Fundamentals, including those embedded in the prefecture by fixed effects, account for far more of the variation in overall store density both across prefectures and over time than does the regulatory-determined number of large stores.

The influences of the regulation variables and car ownership on density of stores of each format instill more confidence in the economic model underlying the specification and the interpretation of results just offered. The positive influence of the regulation-determined number of class 1 large stores on the number of department stores is evident, as is the positive influence of the number of class 2 large stores on the number of general merchandise superstores and specialty superstores. This comports with the fact that most of the department stores have very great floor space and thus are in class 1.

Car ownership generally undercuts specialty stores and semispecialty stores and promotes convenience stores, department stores, and self-service stores (i.e., superstores) of all kinds. The very large, positive influence of increasing car ownership on the number of convenience stores may be an important reason for their recent very rapid growth.

The size of the effect of car ownership on overall number of stores shown in table 5.11 (elasticity = –0.17) is quite a bit less than in the cross-country regression of table 5.4 (elasticity = –0.3). (The larger coefficient estimate [–0.6] from table 5.4 is perhaps biased by exclusion of the variable CRWDNG pertaining to size of dwelling.) There is a simple explanation for this: The regulatory limit on the number of large stores in Japan is dampening the response of number of stores to increasing car ownership.

If this is true, then it suggests a way of quantifying the likely ultimate effect of deregulation on the overall number of stores: It might be roughly equivalent to the effect of doubling the responsiveness of overall numbers of stores to increased car ownership from an elasticity of 0.17 to 0.30. That is, one might expect the overall number of stores in Japan ultimately to fall by about 15 percent from its 1997 level (11.3 per thousand persons) to around 9.6 per thousand.

The picture that emerges is one that matches the earlier analysis of international data: Regulatory distortions account for little in explaining Japan's high density of stores.

5.9 Conclusion

The Japanese distribution sector certainly exhibits peculiarities. It has vastly more stores per person than most other rich countries. It also has particularly complex wholesale marketing channels with multiple steps and ubiquitous vertical restraints. This chapter has explored the reasons and found them to relate more to economics than to regulation. It also has shown how the peculiarities are complementary.

Scarcity of living space and the inconvenience of owning and operating a car has enhanced Japanese households' willingness to pay for nearby shopping. Japan's geographic centricity has facilitated development of a transport system and complex logistical arteries that lower the costs of continually restocking the many retail outlets. These factors combine to make a proliferation of stores in Japan not only inevitable, but also efficient. Given this, regulations protecting small stores from competition by large ones (mostly in the form of the Large Store Law and its successor, the Large Store Location Law) imply only minor economic distortions and encounter little effective political resistance. But as car ownership has grown, the distorting effects of regulations limiting large stores have become greater and politically less tenable.

A proliferation of small stores increases the economic advantages of logistical arteries with many branches, which in turn lowers the costs of a multiplicity of wholesale steps. The implied ubiquity of retailers and wholesalers increases the horizontal externalities that arise in promoting and marketing goods and that are the target of vertical restraints, such as customer assignments and exclusive dealing stipulations. The distortions that are an unwanted consequence of these sorts of stipulations lead to further manufacturer- and wholesaler-initiated stipulations on pricing and shipment quantities, which are tolerated by lax enforcement of antimonopoly laws.

Some of the fundamental forces accounting for Japan's proliferation of small stores are changing. For example, car ownership increased dramatically during the 1990s, and the average size of dwelling also is steadily increasing. Probably as a result, in the 1990s, grocery supermarkets and general merchandise superstores increased in number in Japan even as the overall number of stores steadily declined. Changes in implementation of the Large Store Law introduced in 1994 and its ultimate repeal and replacement with the Large Scale Retail Store Location Law in 2000 also have contributed to changes in the number and composition of Japan's stores.

Government policies shape the economy, but the reverse also is true. Regulations emerge from a political process in which economic forces operate (Becker 1983). In Japan, as elsewhere, the economy has shaped regulations, and regulation has reinforced inherent tendencies rather than fundamentally altered them.

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