

E-Commerce in the Israeli CPI

Yoel Finkel and Merav Yiftach

Central Bureau of Statistics, Israel

The authors would like to thank Ms. Irit Mishali, Ms. Yafit Alfandari and Ms. Inbar Sabag from ICBS for their part in the data collection and editing processes. All errors are sole responsibility of the authors.

1. Introduction

In January 2003, the Central Bureau of Statistics in Israel (ICBS) updated the base period of the Consumer Price Index (CPI) to the annual average of 2002 = 100.0 points. The former CPI, computed during January 2001-December 2002, had the base period of the annual average of 2000 = 100.0 points.

The consumption weights for the basket of goods and services were derived from the annual Household Expenditure Surveys (HES) conducted by ICBS in 2000-2001. These surveys included questions relating to household consumption by electronic commerce and of Internet services.

ICBS has utilized these data and findings from other sources (media, journals, academic research, private firm surveys) to launch a project of pilot indices for specific goods and services consumed through electronic commerce and actual measurement of improved indices for Internet services in the current CPI.

In this paper we discuss the issues relating to the inclusion of E-commerce in the Israeli CPI, presenting preliminary results of the project. In the next section we define the basic objectives and questions that we set out at the beginning for constructing a CPI for E-commerce; this will be followed by sections on expenditure data from private sources and HES and actual measurement of pilot indices for the CPI. Afterwards we raise some additional questions concerning the measurement of Internet services and sum up by recalling on the main results, their limitations and some thoughts for future work.

2. E-commerce project in the Israeli CPI – the issues

The objective of the project was to construct a pilot series of indices for goods and services purchased via E-commerce. This includes analysis of consumer expenditure in the base period of the index (section 3), collection of prices and compilation of price indices for these goods and services and comparison of these indices to the "traditional" price indices from the actual CPI (section 4).

The goods and services to be included in the E-commerce index may be of the following nature:

- Purchased from internet sites that are "extensions" of the traditional shops (food from supermarket chains, items from department store sites, etc.).
- Unique to E-commerce (the goods may be similar to those of traditional outlets but may be sold exclusively on internet sites).
- Consumption patterns of services that did not exist in the pre-internet period (consuming services in different fashion than the regular index – like financial services, banking, stock markets or consumption of public services via internet and consuming goods and services by on-line auctions).
- Consumption of Internet provided services (connection to Internet and ISP added value services).

The two major issues that we were exploring included: analysis of price trends for goods and services provided by E-commerce (whether they differ from the price trends for the traditional outlets); and whether pricing methods for these deviated from the "normal" price schemes (like auctions). A positive answer for either or both of these questions would necessitate inclusion in the current CPI.¹

The general methodology for the project was (1) gathering of data on E-commerce consumption through media, research articles, surveys (public and private), IT related journals and other sources to determine weights (2) building an internet site "register" for current price collection based on data from major credit card companies or IT journals (3) collection of prices over time for regular and unique goods and services (4) compilation of price indices and comparison with the actual CPI.

Many issues had to be resolved in the process: which goods and services to choose, how to collect the same items on a monthly basis and from which sites, how to handle special pricing schemes, etc.

In the following sections we present findings of the project and answers to some of the questions raised. While we have had only partial success in dealing with the more difficult issues, the results indicate that E-commerce is an issue that can not be disregarded, at least in the Israeli CPI.

3. Consumer Expenditure through E-commerce

Stage one of the CPI E-commerce project was to obtain data on market shares of E-commerce. This was to give insight on areas where E-commerce would be considered to be a

¹ Since e-commerce is a fairly new phenomenon, many statistical agencies assume that consumption weights are negligible, and even if they were considerable then present methods for measuring the price changes of goods and services serve as a good approximate for price changes in the e-commerce domain.

*significant part*² of the consumption patterns. These goods and services would then be labeled as *areas of concern* for the index makers.

ICBS turned to two major sources to collect this data, (1) utilize data provided by private research firms, internet sites, credit card companies, IT journals, etc. (2) Annual Household Expenditure Surveys conducted by ICBS.

The advantages of private sector sources are:

- They may be conducted by companies with more professional experience than the statistical agencies in the E-commerce domain.
- There are many of them and we may cross-check and verify results.
- They may be based on many more observations than current surveys conducted by statistical agencies in other areas.
- They are usually for free and national statistical agencies are low on funds.

The major disadvantage is that the motivation for these market research data is self-induced promotion by the private companies. Therefore the statistical agency has no control over the methodology or the results. In addition, the classifications of goods and services are not consistent with an international standard (like COICOP). Whereas a survey conducted by the national statistical agency is objective, of sound methodology and according to scientific and international standards.

3.1 Market Shares from private sources

The following is a description of the Israeli E-commerce market in 2002 based on multiple sources from the private sector:

- 41% of the population has internet access either at work or at home.
- 18% (with access) have purchased goods or services, at least once, through the internet.
- 39% of those connected to internet are "light surfers" (up to 4 hours per week); 31% are "medium surfers" (4 to 10 hours) and 30% are "heavy surfers" (at least ten hours per week).
- Site operators report large increases in sales in 2002 (between 40%-80%) with this trend escalating in the first quarter of 2003.
- 70% of revenues are from auction sales and many operators are moving from conventional selling methods to auction sales.
- 66% of auction purchases are by men (50% in "regular" e-commerce purchases).

² This includes traditional goods and services which now may be significantly purchased via E-commerce or the consumption of internet as a new service.

- Consumption patterns of e-commerce lean towards specific days of the week and specific hours during the day (working hours or 10-11 o'clock at night).
- Prices of goods and services purchased through auctions are usually cheaper than "regular" prices. Closing prices of auctions are similar over time, indicating a "mature" market.
- Popularity of auctions leads manufacturers and wholesalers to supply these sites with unique brands. This causes difficulties in comparing prices with traditional outlets.

Figure 1 below presents the distribution of purchases at E-commerce sites:



It should be stated that while larger quantities of books and smaller household items may be purchased over the internet, steeper prices of electronic equipment (refrigerators, washing machines, freezers, televisions, etc.) and computers lead to a much larger percent of the expenditure. In addition, the more expensive goods are mostly purchased through auction sales.

3.2 Market Shares from Household Expenditure Surveys (HES)

An alternative and more "scientifically respectable" source for consumption of E-commerce are the Household Expenditure Surveys, conducted annually by ICBS. HES were first performed in the early 1950's; until 1997 they took place approximately once every five years. Since 1997, ICBS has conducted the survey on an annual basis, among the total population of households.³ The survey aims to obtain data on the components of household budgets, as well as additional data that characterize various aspects of the living standard of households, such as consumption patterns, leisure activities and entertainment, level and composition of nutrition, level and composition of income and housing conditions. In addition, the survey is

³ For a more extensive description of survey methodology and findings see Household Expenditure Survey 2001, General Summary, Central Bureau of Statistics Israel, Publication #1201, April 2003.

used for market research, for construction of models to predict consumer behavior, for research on the effect of taxes among the various population groups, etc. One of the most important uses of the survey is to determine weights for the consumption basket of the CPI. As of 1997, the survey population includes 94% of the urban and non-urban household population. The *investigation unit* is the household, i.e., a group of people living in the same dwelling most days of the week with a shared budget for food expenditures.

3.2.1 Collection of survey data in the HES

Data were collected from each household in an integrated fashion, in the following ways:

- A questionnaire on household structure – filled out by the interviewer, providing basic demographic and economic data on each member of the household.
- A bi-weekly diary – in which the household independently records each member's daily expenditures over a period of two weeks.
- A questionnaire on larger expenditures and on income – filled out by the interviewer on the basis of household reporting, related to the three month period preceding the interview date. Of the 7,509 dwellings sampled in 2001 (results are similar for 2002, not yet published), 685 (9.1%) should not have been investigated (not belonging to survey population). The remaining 6,824 dwellings were inhabited by 6,938 households. 5,787 households (83.4%) participated in the final survey estimates.

Estimates from the bi-weekly surveys and quarterly questionnaires are "inflated" into yearly expenditures and divided into monthly expenditure estimates.

3.2.2 Usage of Internet services, HES 1997-2001

Percentage of households that used internet services grew from 4.6 percent in 1997 to 22.5% in 2001.

Table 1: Consumption of Internet services 1997-2001

Year	1997	1998	1999	2000	2001
Internet Services	4.6%	8.2%	11.9%	19.8%	22.5%

In 2001, the percentage of households that used the internet (had regular access) in the highest income decile⁴ was 49.2% compared to only 2.5% for the lowest decile.

⁴ Household population divided into ten equal parts according to some variable. In this case, the income deciles are divided according to net income per standard person – a household's total current gross income (including income in-kind from housing and motor vehicle consumption) after deduction of compulsory payments (income tax, social security and health taxes), divided by the number of standard persons in the household.

Table 2: Consumption of internet services by income deciles, 2001

Deciles	1	3	5	7	9	10
Internet Services	2.5	9.4	18.8	25.3	40.9	49.2

According to these data, potential of E-commerce consumption has grown at high rates over the previous years and is a common phenomenon, especially for the higher income groups in the population.

3.2.3 Expenditure on E-Commerce, HES 2002⁵

Data from private sector sources (section 3.1 above) indicated that 2002 was a "breakthrough" year for E-commerce sites with revenue growth ranging from 40-80% for several operators. Therefore, much effort was put into extracting preliminary E-commerce expenditure data from HES 2002 (yet to be published).

Household expenditure on E-commerce was 2.04% of total household expenditure in 2002. E-commerce expenditure on *questionnaire* items (the "expensive" items like electronic and durable goods) was 2.48% and expenditure on *diary* items (the daily, more frequent expenditures, like food) through E-commerce was less than a 1/2% of total diary expenditure.

Table 3: Distribution of expenditure in diary and questionnaire, 2002

Percentages	Total for sub-groups	E-commerce
Diary expenditures	21.6%	0.43%
Questionnaire	78.4%	2.48%
Total expenditure	100%	2.04%

The expenditure on E-commerce from HES data is presented in two ways (1) expenditure on items through E-commerce, out of total E-commerce consumption and (2) items in which consumption of them through E-commerce is substantial. These can be divided into diary expenditures and questionnaire expenditures. It should be stated that many of the goods and services may be reported in both methods; however, due to the preliminary nature of the data, they have yet to be aggregated. Another advantage (or disadvantage) of the present data is the high resolution of the estimates as they have been taken directly from the HES database, before aggregation into upper-level consumption groups.

⁵ Expenditure on E-commerce as reported by households. In the survey, households are required to state place of purchase, both in diary and questionnaire. Purchases via catalogues, television, duty-free, etc. are reported separately by households.

Figure 2 below presents the expenditure on items through E-commerce out of total E-commerce *questionnaire* expenditure:

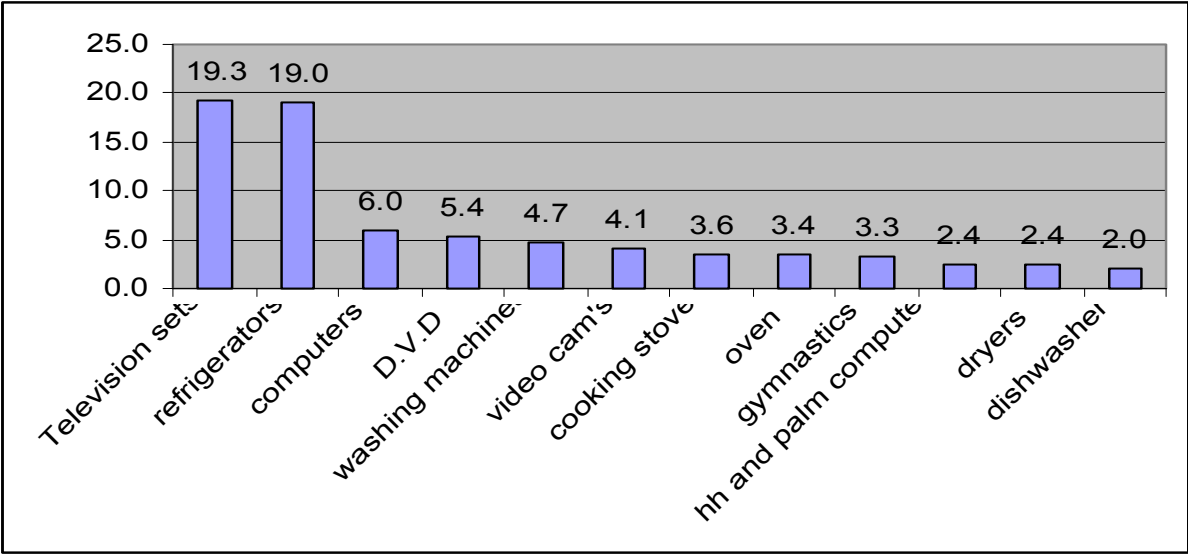
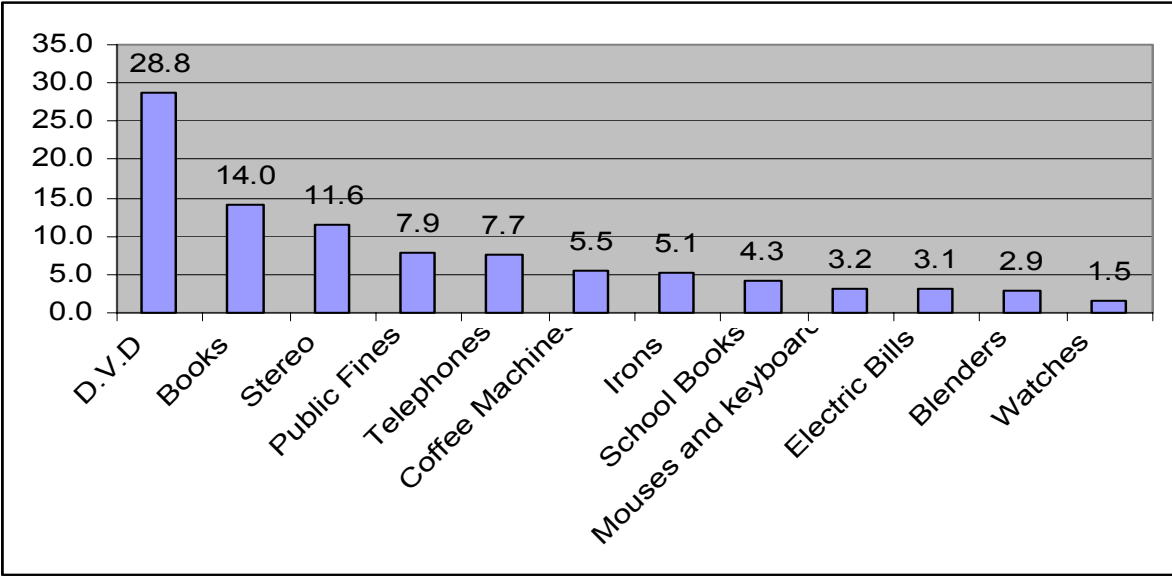


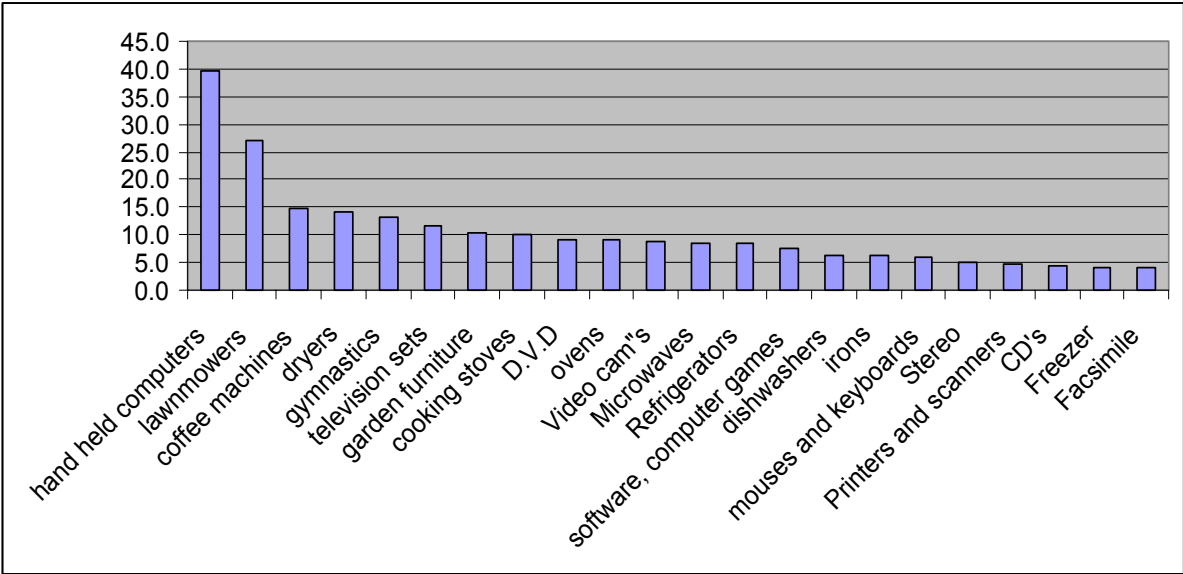
Figure 3 below presents the expenditure on items through E-commerce out of total E-commerce *diary* expenditure:



These data are consistent with the private research firm sources that reported higher distribution of expenditure (out of total E-commerce expenditure) on electronic equipment, computers and books. The inclusion of books from the diary expenditures is also consistent with the findings in section 3.1 (figure 1) above.

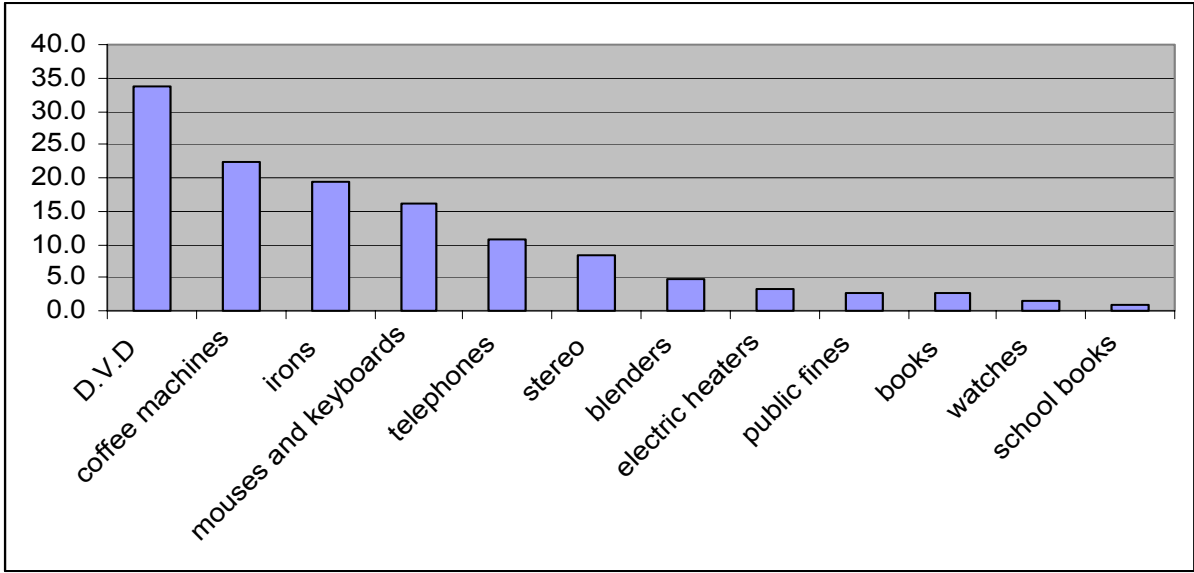
Now we present additional findings from HES on E-commerce consumption of specific items, out of the total expenditure for that item. In other words, although total expenditure on E-commerce may be a fragment of total expenditure (which seems *not* to be the case so far), expenditure on specific items may be significant and may negate the possibility of estimating the price changes through "traditional" outlets alone.

Figure 4 below presents items with significant expenditure through E-commerce (out of total expenditure for that item) from the HES *questionnaires*:



As can be seen in figure 4 above and figure 5 below, electronic equipment and computer peripherals are amongst the items that are purchased, with a relatively high percentage, by E-commerce.

In **Figure 5** below we present items with significant expenditure through E-commerce (out of total expenditure for that item) from the HES *diaries*:



We may now establish that market shares for E-commerce are significant for electronic equipment, computers and computer peripherals, books and other household items. These are evident from private research firm surveys, data from internet service providers and especially from HES conducted by ICBS. Based on these data, we can assign relative consumption weights for E-commerce in those items with a significant portion of E-commerce. However,

are we able to construct a workable sample of outlets and prices to compute price changes over time? These will be determined in the following section.

4. E-commerce – price measurement

Anticipating an exponential increase in E-commerce expenditure, ICBS began price collection of several internet based goods and services in January 2001. During the 2 year period of January 2001-December 2002, over 1,700 prices were collected from 97 Israeli based internet sites (extracted from private firm surveys and IT journals), covering 72 consumption sub-groups in the CPI. The number of prices collected from these sites varied between single prices for certain sites and between 50-200 prices in others. Five of the 97 sites (books and CD's) accounted for more than 40% of the prices. Five other sites (electronic equipment) accounted for another 20% of the prices collected by ICBS. These data are consistent with the expenditure data from HES and private research firms. The distribution of prices collected according to the 10 major consumption groups are:

Table 4

Main consumption groups	CPI weight	% of e-commerce prices
Food	13.48	0.2
Fruits and Vegetables	3.51	0
Housing	23.16	0.2
Household maintenance	9.75	0
Furniture & Household Equipment	4.75	25.1
Clothing and Footwear	2.9	0.6
Health services	4.85	0.8
Education, culture & entertainment	12.93	62.3
Transportation & communications	20.26	3.2
Miscellaneous goods & services	4.41	7.6

Electronic equipment, computers and computer peripherals, books and CD's are classified in the Furniture & Household equipment and education, culture & entertainment consumption groups; therefore having the highest percentage of E-commerce prices.

We encountered the following difficulties while attempting to compute price indices for specific items in the pilot E-commerce CPI:

- Inability to collect enough price observations for narrowly defined items in the regular CPI. Therefore we computed indices for sub-aggregates like refrigerators, washing machines, books, cosmetics, etc.
- We did not have enough price observations for each and every month during January 2001-December 2002. Therefore price indices were not necessarily computed at monthly intervals.
- Indices in the E-commerce indices may have varying number of observations between months. This is inconsistent with the regular CPI computation methods.

- Certain items may have enough observations, but are from different sites. Therefore price indices were computed according to changes in average prices and not the average change in prices.
- Most of the internet sites for large electronic equipment were auction sales. We have yet to devise suitable methodology to measure price changes for auction prices (electronic equipment). However we did manage to compute price indices for washing machines and dryers.

Taking into consideration all of these limitations, we succeeded, at this stage, to compute fairly robust price indices, during January 2001-December 2002, for the following four consumption groups: books, CD's, cosmetics and washing machines and dryers.

In figures 6-9 below we present these indices compared to the indices computed in the actual CPI.

Figure 6: Comparison of E-commerce and actual CPI for Books

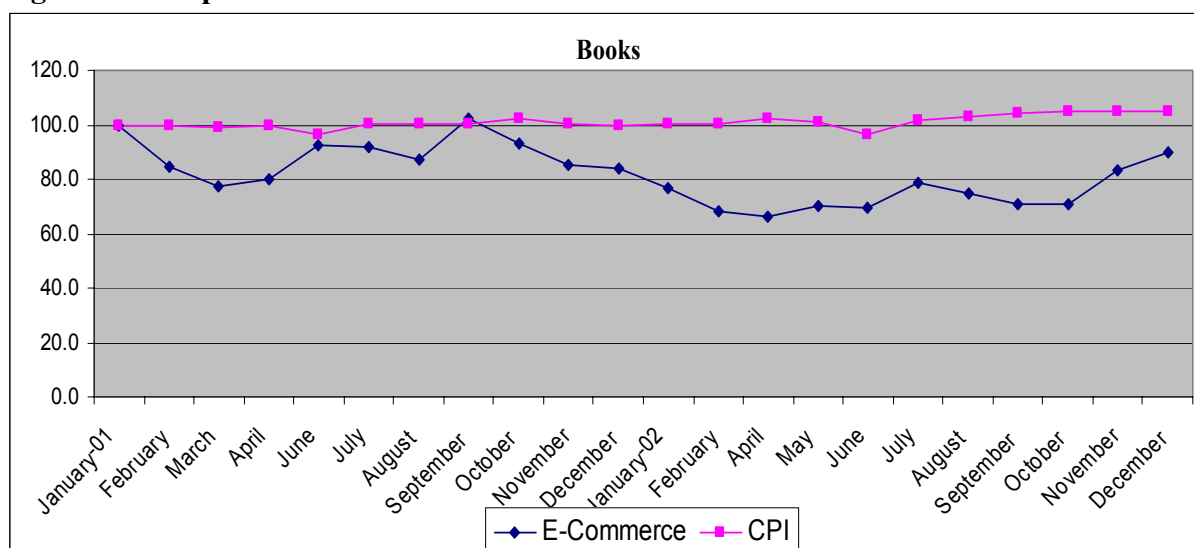


Figure 7: Comparison of E-commerce and actual CPI for CD's

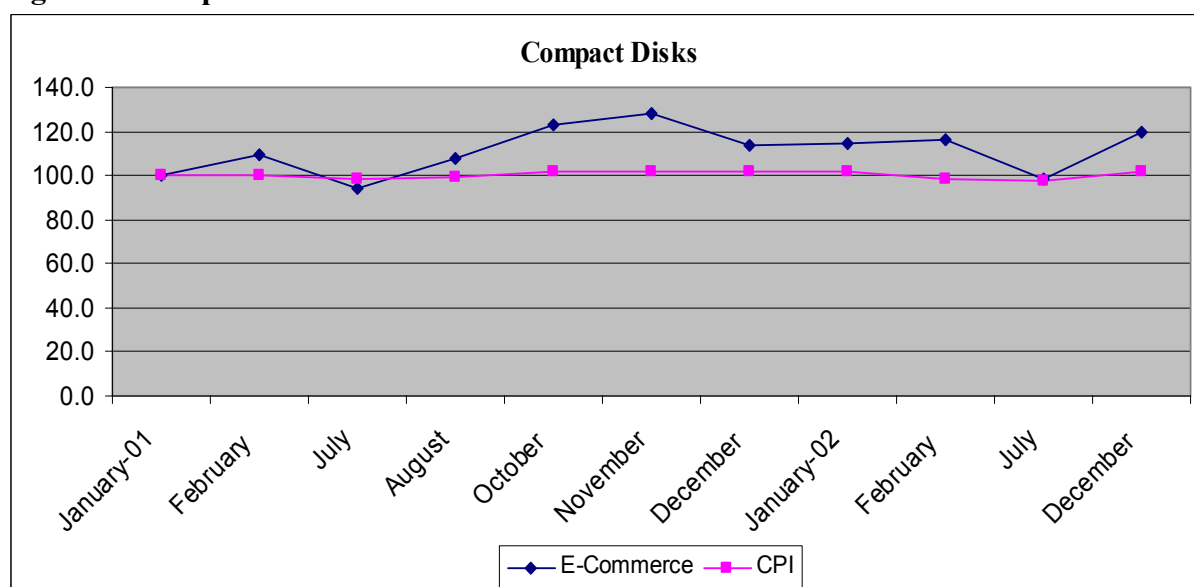


Figure 8: Comparison of E-commerce and actual CPI for cosmetics⁶

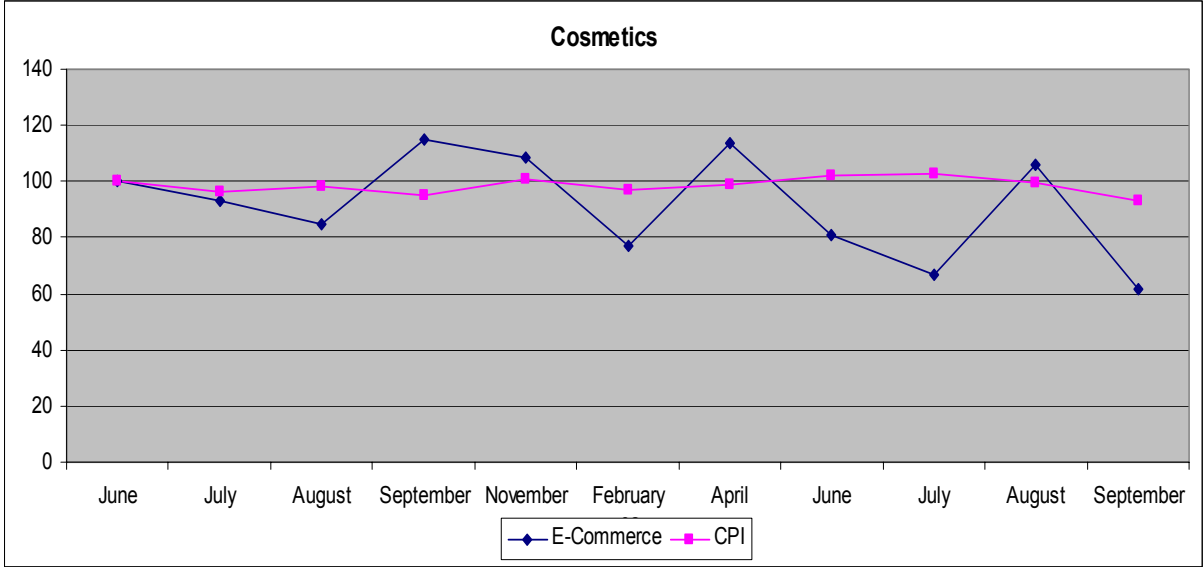
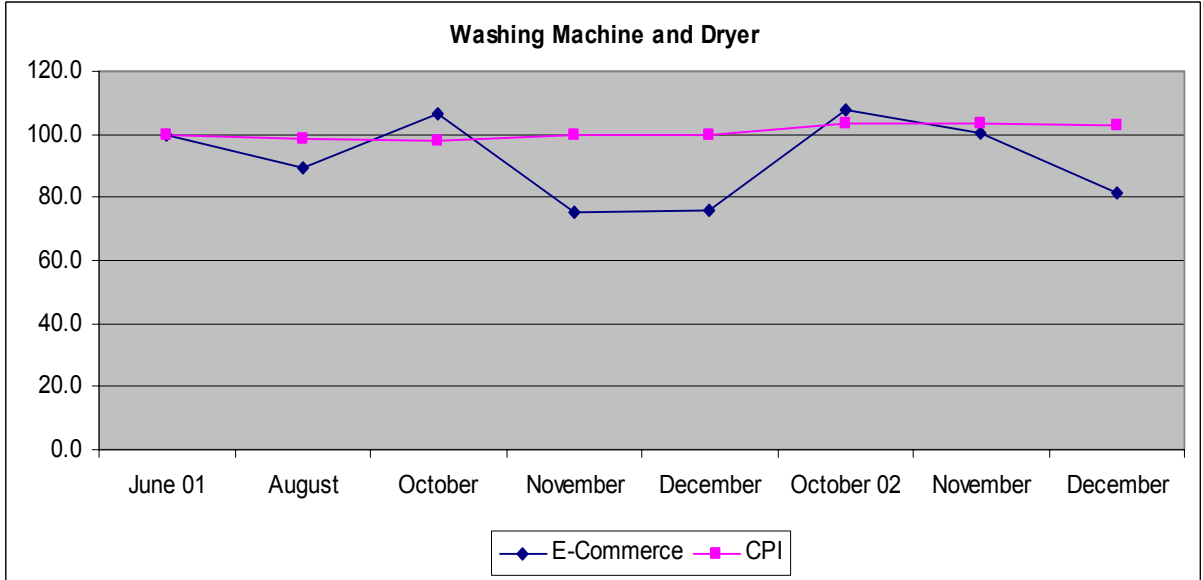


Figure 9: Comparison of E-commerce and actual CPI for washing machines and dryers



The variance of price changes in the e-commerce series is much larger than the actual CPI. While some of this variance can be explained by the limitations stated above, it seems that both conditions to justify special (additional) indices for E-commerce have been fulfilled. Consumption weights for e-commerce are significant for several items in the index; trends of

⁶ The base period for the comparison of the actual and e-commerce indices for cosmetics and washers and dryers is June 2001. While the period is shorter, the same trend of variability in the e-commerce index vs. the actual index is evident in this series as in the other indices presented in this paper.

price changes may be substantially different and can not be approximated by the actual CPI. The following table compares the standard deviations of price changes for the two series.

Table 5

STD of price changes	E-commerce	Actual CPI
Books	0.096	0.022
Compact disks	0.127	0.021
Cosmetics	0.349	0.041
Washers & dryers	0.242	0.018

While presenting an exhaustive discussion of E-commerce, we have yet to recount the measurement of internet services (monthly connection fees to ISP's). These are usually included in national CPI's and seem to be straightforward. While this is outside the scope of this paper, in section 5 we present some thoughts on the complications of internet services.

5. Internet Services

Internet services are becoming more difficult to measure in a CPI framework. In the beginning, a consumer was required to pay a monthly fee for unlimited connection or various hourly fees. With the introduction of wideband services and fierce competition among internet service providers (ISP's) which led to sinking relative prices, they are now seeking ways to differentiate themselves from each other. A similar process occurred among cellular phone companies and cable television providers in previous years. In order to "capture" the consumer and encourage loyalty to a specific company, cellular and cable operators devised complicated pricing schemes with many value added services.

5.1 Value added services provided by ISP's

- Enlargement of e-mail: all providers offer a standard 5 MB for regular modem connections and 10 MB for wideband internet. The providers are willing to enlarge e-mail boxes to 50 and 100 MB at extra cost.
- Private e-mail boxes for each family member: for an added cost, companies may provide up to 3 boxes and others an unlimited amount for extra monthly fees.
- Content services: these are split into three kinds (1) free entrance or minimum fees for sites with admission fees (2) free subscription to printed magazines and (3) newspapers and newsletters that are sent directly to the e-mail of the user.
- Other services are faxes, call mail, screening services of pornographic sites and anti-viruses.

Index compilers will have to deal with pricing and quality adjustment issues of these added value services. They may be similar to those of other telecommunication services, discussed in papers on measurement of cellular phones and cable services (estimation of consumer profiles, sample of consumers from companies, etc.).

6. Summary

ICBS launched a multi-year project to compute price indices for goods and services consumed by E-commerce. Like all indices in the CPI, we must define the E-commerce domain, calculate consumption weights, construct survey samples (outlets, items, prices) and measure price changes on a current basis. Although we encountered several difficulties in performing these tasks, we report partial success and have come to the following conclusions:

Data received from private sector sources and Household Expenditure Surveys (usually conducted by national statistical agencies) *are sufficient* for deriving consumption weights of E-commerce.

In Israel, market shares of E-commerce were calculated in two ways: (1) percentage of e-commerce consumption for goods and services in the CPI basket; (2) percentage of goods and services consumed in E-commerce. The findings are that *significant market shares* "of" E-commerce and "by" E-commerce were reported for electronic equipment, computers and peripherals, books and CD – both from the private sector sources and reiterated from the "more scientific" HES.

Measurement of e-commerce price changes was attempted for these and many other consumption groups, however, fairly robust indices were computed for only four groups: e-commerce consumption of books, CD's, cosmetics and washers and dryers. These showed *large variance* in the e-commerce series, compared to the indices computed in the actual CPI.

During 2003-2004, ICBS will continue price collection and measurement of price changes in order to improve the execution of pilot indices⁷ and expand the realm of consumption groups that are covered; these shall be introduced into the official CPI at its next major update, in January 2005.

Many methodological and processional problems are to be solved in the future: international standards for definition and classification of e-commerce, constructing of outlet (e-commerce sites) registers, measurement of prices and price changes for auction sales, questions of disappearing items and quality adjustment for e-commerce, etc.

Sharing experiences with other national statistical agencies will be helpful in devising an improved methodology in months to come.

⁷ For example, some of the variance may be explained by the small amount of price observations for each good and service; enlargement of price sample may reduce this.