

Exchange Rate Pass-through in ICT and Non-ICT Industries

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Abstract

We examine the exchange rate pass-through (ERPT) in the Korean ICT industry as new ICT price data are available. We also compare it with Non-ICT industry. Our findings are, first, for both ICT and Non-ICT industries the degree of ERPT is getting smaller as the price index moves from import prices to producer prices and to consumer prices. This result is consistent with previous studies. Second, the ERPT to ICT consumer price index is not significantly different from zero. This implies that as ICT portion is growing in an economy, the impact of exchange rate variation on consumer price index will be smaller.

Key words: Exchange rate, ERPT, MPI, PPI, CPI

1. Introduction

With the growing volume of international trade and greater fluctuation in exchange rates in recent time, exchange rate variation can be expected to have a greater impact on inflation in the importing country. Changes in exchange rates affect import prices, producer prices, and finally consumer prices. The degree of exchange rate pass-through (ERPT) measures the impact of changes in the exchange rate on domestic prices.

Literature on ERPT is far from short, and is extensively surveyed by Menon(1995) and Goldberg and Knetter(1997). Most of the empirical papers on ERPT are based on single equation estimation or panel estimation, for example, as in Yang(1997) with the US data, Takagi and Yoshida(2001) with Japanese data, Campa and Goldberg(2005) with 23 OECD country data, and Choi(2000) with Korean data.

Recently several papers examine ERPT along the pricing chain such as import price, producer price, and consumer price with macro data in a VAR system. Choudhri et al.(2005) examined non-US G-7 countries, Faruquee(2006) examined ERPT in the Euro area, and McCarthy(2007) nine industrialized countries including

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the US. Analyses with Korean data are found in Yi(2004) and Kim(2005). They all report that the degree of ERPT to import price is the greatest and that to consumer price is the smallest.

The previous studies on ERPT along the pricing chain investigate ERPT with general price indices which are weighted average of all industries. In our paper we focus on ERPT in the information and communications industry (ICT industry), and contrast this with ERPT in Non-ICT industries.¹⁾ The ICT industry is rapidly growing industry in many developed and emerging market economies. In Korea, the portions of ICT industry out of GDP, investment, and consumption have grown from 3.6%, 19.8%, and 3.9% in 1995 to 15.0%, 39.7%, and 9.6% in 2007, respectively. The portions of ICT industry out of total Korean exports and imports also increased from 29.6% and 21.5% in 2000 to 44.7% and 27.8% in 2007, respectively. Furthermore, ICT prices differ from prices in many other industries because they follow a decreasing trend, whereas other industry's prices generally increase with time.

Our empirical results indicate that ERPT in the ICT industry is lower than other industries, especially in consumer prices. This result implies that the rapidly growing share of the ICT industry in the economy would lower the impact of exchange rate variations on domestic inflation. This result is consistent with Lee et al.(2007) which analyses the relationship between ICT price indices and general price indices.

The paper is organized as follows. Section 2 introduces data and methodology. In section 3, empirical results are given. Section 4 is conclusions of this paper.

2. Data and Methodology

A comprehensive ICT price index data in Korea became available from the Institute for Information Technology Advancement (IITA), a Korean government think-tank for ICT development. The institute developed an ICT import price index (MPI) and an ICT consumer price index (CPI) for Korea following OECD (2002, 2003). An ICT producer price index (PPI) is published by the Bank of Korea (BOK). The data are monthly and span the period January 1995 to April 2008. The ICT MPI is composed of 29 items, including computer, printer, and network equipment. The number of the items in ICT PPI is 82, and it is 30 for

1) Kim and Oh(2008) also examined ERPT in the ICT industry. Since their paper focused on ERPT in import and export prices in the ICT industry, they did not go further into producer and consumer prices along the pricing chain. Moreover, a comparison of ERPT between ICT and Non-ICT industries was not performed in their paper because they did not derive Non-ICT price indices.

ICT CPI as shown in Appendix.

These three indices cover the same ICT industry, but the numbers of items in each index differ because of different categorization systems of the three indices. Moreover, the ICT PPI and CPI data include services as well as manufacturing items, while the MPI data include only manufacturing items.

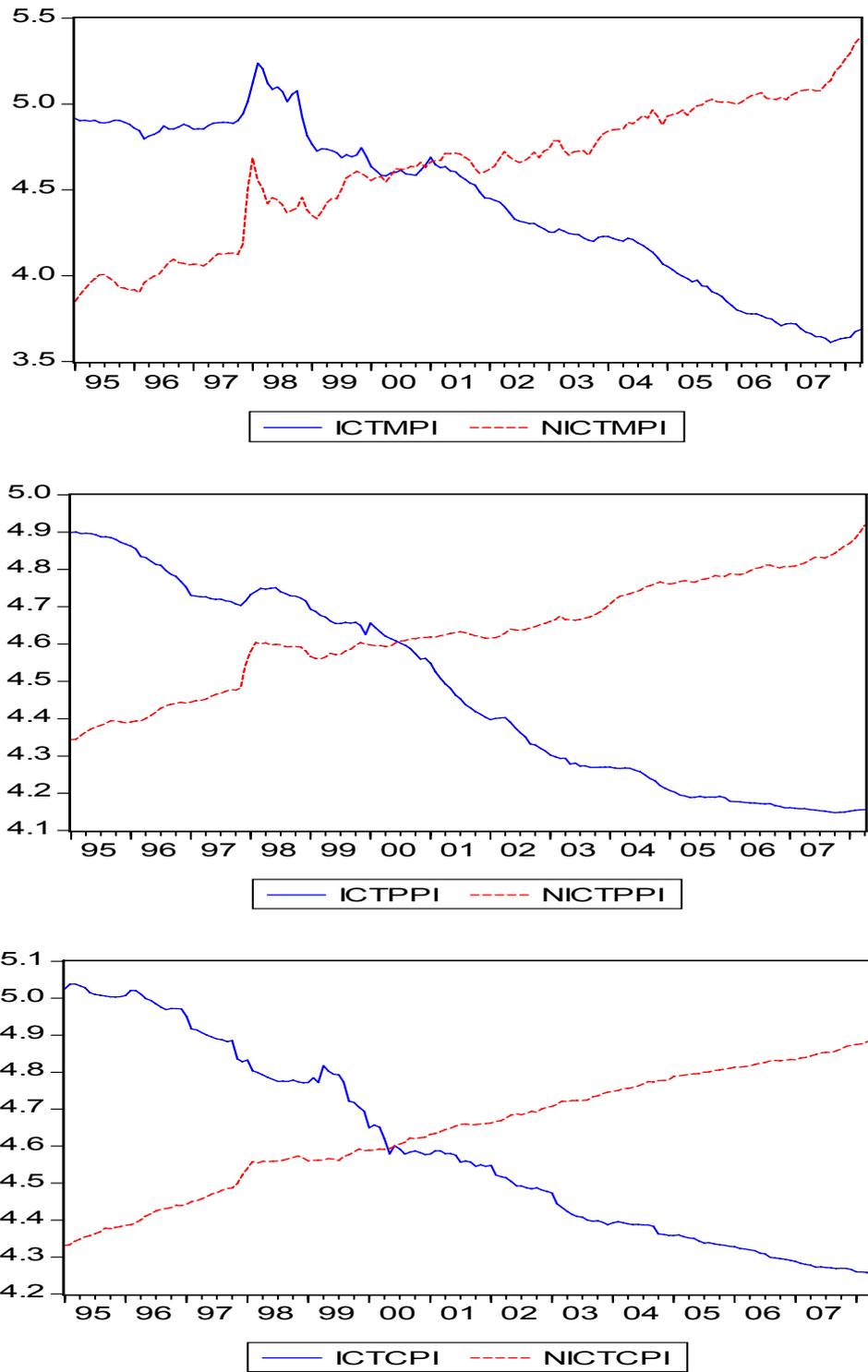
To examine the difference between ICT and Non-ICT industries, we calculated Non-ICT price indices based on weights in total price indices as IITA and BOK did for the calculation of ICT price indices. The price indices of ICT and Non-ICT are shown in Figure 2.1. The trend differences are striking. ICT prices are decreasing, while Non-ICT prices are increasing. This implies that an increase in the share of the ICT industry in the economy would help lower inflation pressure in that country.

We also gathered data on the exchange rate, international oil price, and output gap. The exchange rate is the Korean won price of the US dollar.²⁾ The international oil price is the simple average of WTI, Brent and Dubai prices in US dollars, and the output gap is the difference between the actual industrial production index and the Hodrick-Prescott filtered trend in Korea. International oil price data are from International Financial Statistics, and the data of exchange rate and industrial production index are from the Bank of Korea. We add a dummy variable to control unusual movements in exchange rate and other variables during the Korean currency crisis(1997:11~1998:12).

To investigate the impact of exchange rates on ICT prices, we estimate a VAR model based on a distribution chain of pricing in the ICT industry similar to Faruquee(2005) and McCarthy(2007). International oil price is included to incorporate supply shocks. Demand shocks are identified from the output gap after taking into account the contemporaneous effects of the supply shock and the exchange rate shock. The structural shocks are identified using the Cholesky decomposition from the estimated reduced form VAR. The ordering of variables in the VAR is international oil price, exchange rate, output gap, MPI, PPI, and CPI. International oil price comes first because of its exogenous nature in the system, and the ordering of exchange rate, MPI, PPI and CPI is determined by the causal relationship in pricing chain.³⁾ The ordering of exchange rate and output gap could be reversed in the VAR, but we find no significant difference in the estimation results from the alternative ordering.

2) The portion of US dollar denomination in Korean import trade is 81.3% in 2005. Because of the dominant position of US dollar and the lack of data on ICT import from individual countries, we use US dollar exchange rate rather than the effective exchange rate weighted by import trade volumes from individual countries.

3) This kind of ordering is adopted in Yi (2004) and McCarthy (2007).



<Figure 2.1> Price Indices of ICT and Non-ICT in Logarithm

The impulse response functions of MPI, PPI, and CPI for both ICT and Non-ICT industries will be examined. The degree of ERPT is calculated as:

$$ERPT_{t,t+i} = \frac{P_{t,t+i}}{E_{t,t+1}}$$

where $ERPT_{t,t+i}$ is the ERPT from t to $t+i$, $E_{t,t+1}$ is the initial response in exchange rate due to an exchange rate shock, and $P_{t,t+i}$ denotes the accumulated response of price from t to $t+i$.

3. Empirical Results

We use the Phillips–Perron (1988) method to test for the existence of unit roots and to identify the order of integration for each variable. Unit root tests are done with and without a time trend. As shown in Table 3.1, all variables except the output gap are I(1). The output gap is I(0). Since output gap is stationary, we do not consider cointegration relationship among the variables. Instead, we take first differences of I(1) variables and estimate a VAR system. The VAR lag length is chosen using Akaike Information Criterion. The optimal lag length is two in all cases.

Figure 3.1 shows accumulated impulse responses of MPI, PPI, and CPI for both ICT and Non-ICT to an exchange rate shock.⁴⁾ Note that the response of ICT CPI to the shock is insignificant. The comparison of ERPT among price indices is given in Table 3.2. First, for both ICT and Non-ICT, the size of ERPT among the price indices is $MPI > PPI > CPI$. That is, degree of ERPT decreases as we move from MPI to CPI. These results are consistent with previous studies using macro data. The portion of services in each price index could provide a possible reason for the different size of ERPT among the three price indices. As shown in Table 3.3, the weight of services in price index is the greatest in CPI, the second in PPI, and zero in MPI. This is the same in both ICT and Non-ICT industries. Service prices are generally less affected by the changes in exchange rates.

Second, for both PPI and CPI, the ERPT of ICT is smaller than that of Non-ICT. Again, this result can be explained by the importance of service sector in each industry. As shown in Table 3.3, for the case of PPI, the weight of services in ICT industry is 39.5 percent while that of Non-ICT industry is 23.7 –

4) We also derived generalized impulse response functions of Koop et al.(1996) and Pesaran and Shin (1998) which do not depend on orderings of the variables in a VAR model. The results are very similar to Figure 3.1.

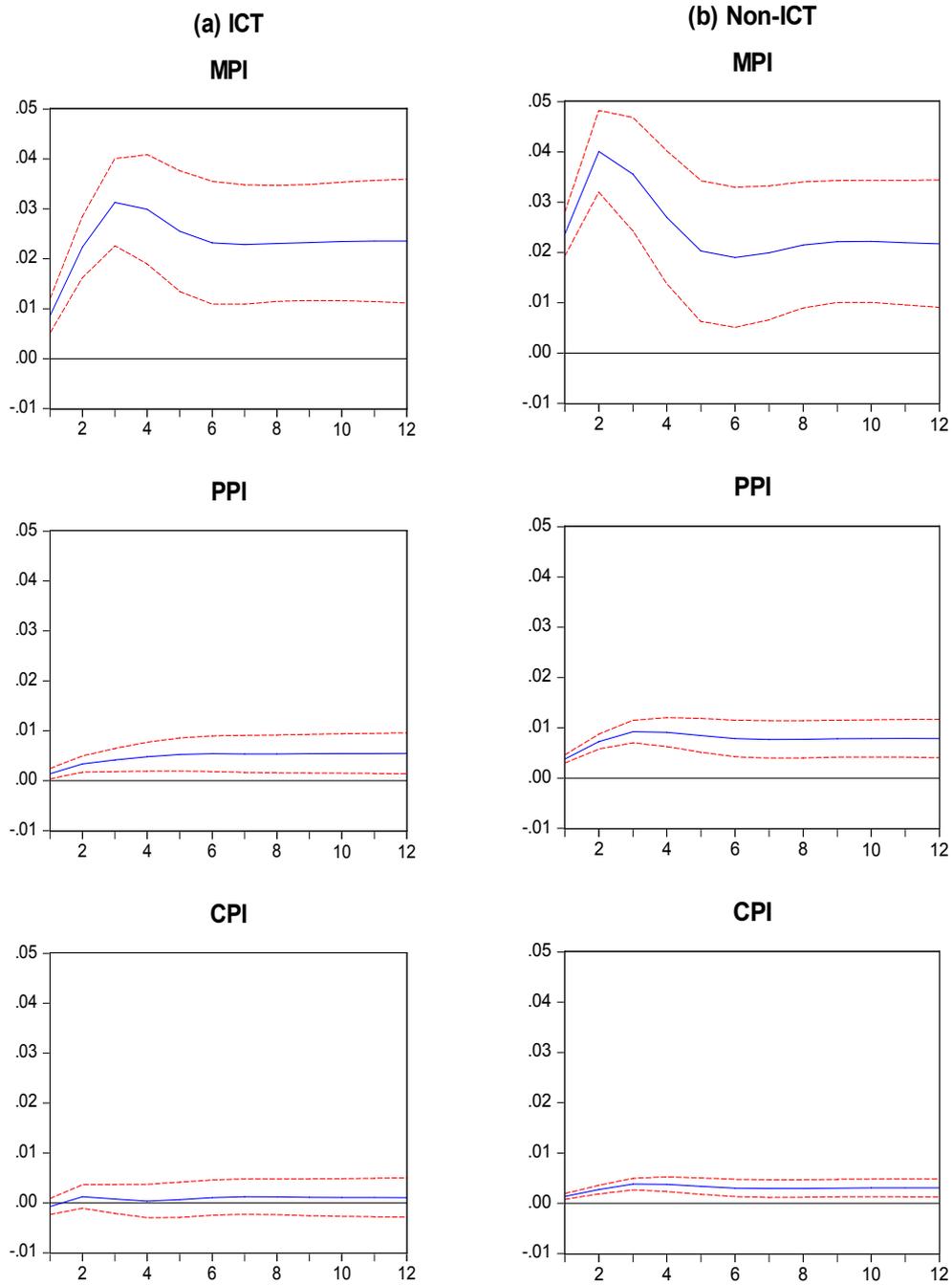
<Table 3.1> Phillips and Perron Unit Root Test

Variable	Without a time trend	With a time trend
Oil price	0.5261	-1.6698
Exchange rate	-2.0395	-1.8463
IPI gap	-4.1444*	-4.1305*
ICT MPI	0.2086	-2.3079
ICT PPI	-1.2912	-0.5972
ICT CPI	-1.1929	-1.1417
Non-ICT MPI	-0.5748	-3.0837
Non-ICT PPI	-0.4694	-2.3050
Non-ICT CPI	-2.2790	-2.2399
Δ Oil price	-12.2097*	
Δ Exchange rate	-6.8717*	
Δ ICT MPI	-7.5193*	
Δ ICT PPI	-10.1716*	
Δ ICT CPI	-12.6874*	
Δ Non-ICT MPI	-9.2060*	
Δ Non-ICT PPI	-6.8432*	
Δ Non-ICT CPI	-9.1488*	

Note: * indicates rejection of the unit root null hypothesis at 5% significance level.

percent. For the case of CPI, it is 83.8 percent for ICT and 43.3 percent for Non-ICT. Thus, the relatively large portion of services in ICT industry appears to contribute lower ERPT in ICT industry. Third, when we consider the difference (Non-ICT - ICT), the relative size of ERPT after 6 or 12 months from the exchange rate shock is shown as PPI > CPI > MPI.⁵⁾ Since the estimates of the CPI ERPT are much smaller than the PPI ERPT, we do not interpret the finding of 'PPI > CPI' as a substantial drop in the difference of ERPTs between ICT and Non-ICT industries from the PPI level to the CPI level.

5) We check the sensitivity of the results by changing the ordering of variables in the VAR model. First, when the output gap is located between international oil price and exchange rate, the estimated ERPTs for ICT industry in 12 months are 0.698 for MPI, 0.171 for PPI, and 0.048 for CPI. Second, when the ordering of the three price indices is set as CPI, PPI, and MPI instead of MPI, PPI, and CPI, the results are 0.738 for MPI, 0.178 for PPI, and 0.034 for CPI. Thus, we find that the estimated ERPTs are not sensitive to the ordering of the variables.



Note: Accumulated responses to one standard deviation innovations with ± 2 standard errors
<Figure 3.1> Impulse Responses to an Exchange Rate Shock

<Table 3.2> Comparison of ERPT for ICT and Non-ICT Price Indices

	MPI			PPI			CPI		
	t=1	t=6	t=12	t=1	t=6	t=12	t=1	t=6	t=12
ICT (A)	0.274	0.735	0.746	0.044	0.170	0.173	-0.023 ⁺	0.032 ⁺	0.033 ⁺
Non-ICT (B)	0.765	0.616	0.704	0.122	0.254	0.254	0.044	0.097	0.098
Non-ICT - ICT (B-A)	0.491	-0.119	-0.047	0.078	0.083	0.081	0.067	0.065	0.064

Note: + insignificant from zero as shown in the impulse responses in Figure 3.1

<Table 3.3> Weights of Services in Price Indices

(Unit: %)

Variable	MPI	PPI	CPI
ICT	0.0	39.5	83.8
Non-ICT	0.0	23.7	43.3

Note: Weights from the base year of 2005

It is clear that ICT CPI has distinguishing characteristics compared to ICT MPI. ERPT on ICT CPI is much smaller than ERPT on ICT MPI. ERPT on ICT MPI is 0.746 in 12 months, while ERPT on ICT CPI is 0.033. The smaller magnitude of ERPT on CPI relative to MPI is also found in the Non-ICT industry. A more important finding is that ERPT on ICT CPI (3.3% in 12 months) is very small and insignificant, while that on Non-ICT CPI (9.8% in 12 months) is much larger than ICT and significantly different from zero. Therefore, as the ICT share increases, the effect of the exchange rate on the overall CPI will be smaller. This implies that the growing ICT industry share would help price stability.⁶⁾ With opposite trends between ICT and Non-ICT prices as shown in Figure 2.1, our empirical results points out the importance of the ICT industry.⁷⁾

6) The share of ICT consumption out of total consumption is increased from 3.9% in 1995 to 9.6% in 2007. In addition, that of ICT consumption out of GDP is increased from 2.3% in 1995 to 4.8% in 2007.

7) Our VAR model may need to incorporate the factors that are related to the decreasing trend of ICT prices in the sample periods as shown in Figure 2.1. For this purpose, we add the ICT import price index for the US as a proxy for international price of ICT products which is considered in Kim and Oh (2008). In the ordering of the VAR model, the ICT import price for the US is added after the international oil price. However, the estimated ERPTs are very similar to the results in Table 3.2. For example, the estimated ERPTs for ICT industry in 12 months are 0.738 for MPI, 0.178 for PPI, and 0.034 for CPI.

4. Conclusions

With growing volume of international trade and importance of price stability of importing countries, the ERPT is getting more attention in recent periods. In this paper, we focused on ICT industry in estimating ERPT. There are two reasons for the need to focus on ICT industry: (i) The ICT share out of GDP is increasing in many countries. (ii) The ERPT in ICT industry is different from Non-ICT. We already know that ICT prices are generally decreasing whereas Non-ICT prices are increasing. Because of the different nature of the two industries, the impact from an exchange rate shock on prices would not be the same between the two groups which could provide a new policy implication to price stability.

We examined ERPT along the pricing chain such as import price, producer price, and consumer price. Our empirical results showed that for both ICT and Non-ICT, the relative size of ERPT is $MPI > PPI > CPI$, which is consistent with previous studies. Our results also indicated that the ERPT of ICT industry is lower than other industries, especially in consumer prices. This implies that as the portion of ICT industry is getting larger, the impact of exchange rate variations on domestic inflation is getting smaller. Thus, growing ICT industry would help price stability and lessen the need for monetary policy response to exchange rate fluctuations.

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Appendix. ICT Price Index items

	Items
ICT MPI (29)	Cable, Transistor, Diode, Optic elements, Uncut wafer, Integrated circuit, Integrated circuit components, LCD, Crystal quartz vibrator, Printed circuit board, Capacitor, Resistor, Computer, Computer parts, Peripheral storage units, Printer, Monitor, Portable electronic storage, Network equipment, Wireless communications device parts, Color TV receiver, Digital Camera, Audio, Loud speaker, Microphone, TV accessories, Testing machines & instruments, Electronic measuring instruments, Physical or chemical analysis instruments
ICT PPI (82)	Server computers, Desk-top personal computers, Notebook computers, Hard disk drives, Optical disk drives, Key entry system, Computer printers, Computer monitors, Graphic card, Transformers, Rectifier, Inverters, Electricity distribution & control equipment, Uninterrupted power supply, Battery chargers, Adapter, Earth leakage breakers, Switches, Magnetic switches, Connectors, Relays, Coaxial cables, Fiber-optical cables, Insulated electric wires, Lithium ion battery, Transistors, Diodes, Lighting emitting diode, Wafers, Quarts crystals, MOS logic, Dynamic random access memory, Static random access memory, Analogue integrated circuits, Micro component, Color cathode-ray tube, Industrial color cathode-ray tube, Phenol printed circuit boards, Epoxy printed circuit boards, Copper sheet piled boards, Photomask, Electrolytic fixed capacitors, Ceramic fixed capacitors, Fixed resistors, Variable resistors, Thin film transistor-Liquid crystal display, Back light unit, Shadow masks, Lead frames, Ferrite cores, Deflection yoke coil, Ordinary telephone sets, Cordless telephone sets, Telephone switching systems, Key phones, Facsimile machines, Video doorphones, Portable cellular phones, Cellular phone switching system, Satellite broadcasting receiver, Closed circuit camera, Televisions, Camcorders, Digital cameras, DVD - Player, MP3-Player, Deck mechanism, CD pick-up, Basic charge for fixed line, Local area charges, Domestic long distance charges, International long distance charges, Public phone charges, Leased line charges, LM charges, Mobile phone charges, Special telecom (telephone) charges, Internet access charges, Information service charges, Data processing fees, Computer programming fees, Computer repairing charge
ICT CPI (30)	Telephone, Mobile phone, Telephone charges, Local area call rate, Long distance call rate, Public telephone charges, International call rate, Cellular phone call rate, Land to mobile call rate, Wire telephone additional service fee, Using fee for internet, Cellular phone data call charges, Television, Audio equipment, Video equipment, Camcoder, Camera, Computer main unit, Monitor, Notebook computer, Printer, Electric dictionary, Computer supplies, Record medium, Using fee for PC, TV receiving fee, Image medium rent, Using fee for web information contents, Using fee for mobile contents, Using fee for e-learning

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