Why Did the Demand for Cash Decrease Recently in Korea?

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Abstract

We explores why cash demand have decreased recently in Korea. The ratio of cash to consumption fell to 4.7% in 1999 while it had never been under 5% until then. The empirical analysis based on the model by Whitesell (1989) shows that a tax policy that was first introduced in 1999 accounted for most of the recent decrease in cash demand. The tax policy that gives tax deduction on credit card purchase to consumers decreased the cost of credit card transaction and, as a result, consumers used credit cards where they used to use cash. Without the policy, the ratio of cash to consumption would recover to 5.2% which is around long term average. Meanwhile, we also found that the usage of certified checks that are used as if thet were cash decreased as electronic payment including internet banking increased.

1. Introduction

The ratio of cash to consumption has fallen to 4.6% in 1999, which is the lowest level in Korea. Such decrease in cash demand is often told to be due to the increase in alternative payment tools such as credit cards. Many people also suspect that the demand of cash will diminish much further as the electronic cash is introduced and the internet shopping is widespread these days. We investigate the effect of the alternative money on the cash demand and the reason of the recent decrease in cash demand in Korea.

Most of the literature on cash demand shows inconsistent results about the effect of alternative payment tool to cash demand. While Kim (1995) argued that the increase in credit card purchase decreased the cash demand, Kim and Lee (1998) told that Kim's (1995) result is not significant with more recent data. Bang (2000) used a linear trend as a proxy of the trend of alternative payment usage and showed that the expansion of the alternative payment usage decreased the cash demand of the whole economy and the firms. Tack (2001) reported a little confusing result that the increase in the frequency of credit card usage decreases the cash

demand but the increase in the amount of credit card purchased does not. The reason why we have inconsistent results might be that all the empirical studies are based on the money demand model by Baumol (1952) and Tobin (1956). The Baumol-Tobin model considers money the only payment instrument so that it does not explain the relationship between cash and noncash and, as a result, researchers have chosen ad-hoc explanatory variables to see their effect on cash demand.

In this paper, we used Whitesell's (1989) model which explores the use of cash and checking account for payment and analyzed empirically the recent change of cash demand in Korea. We also studied on the demand of certified checks that is used almost as cash in Korea. The main results are following.

We found that the reason of the recent decrease in cash demand was a tax policy related to credit card usage. The tax policy which was effective first in 1999 gives a tax deduction to the credit card user depending on the amount of credit card purchases. The policy decreased the cost of credit card usage so that consumers used credit cards even where they used to use cash. Without the policy, the ratio of cash to consumption would recover to 5.2% which is near long term average.

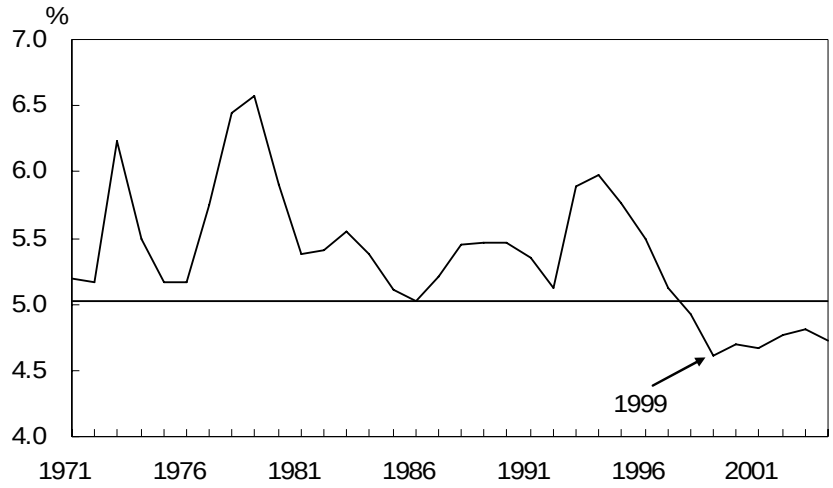
This paper proceeds as follows: Section 2 introduces the payment system of Korea. Section 3 explains Whitesell’s (1989) model to see what affects cash demand. Section 4 estimates the demand of cash and certified check. Section 5 concludes.

2. Small Amount Payment System of Korea

2.1. Cash

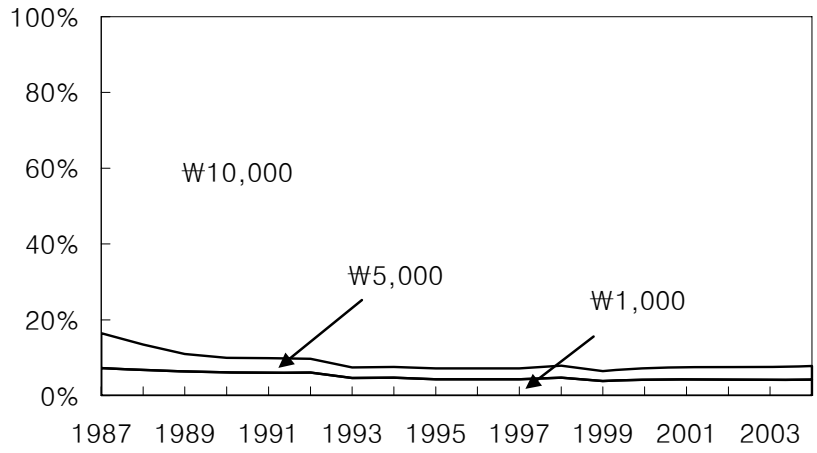
In general, cash demand increases as the economy grows. Therefore, the ratio of cash to nominal consumption or nominal output may represent changes of cash demand. Figure 1 shows the cash/consumption ratio of Korea. The first two peaks in 1970s seem to be related to the oil shocks. The third peak in the mid 1990 is associated with a policy that illegalized borrowed or fake name financial transactions. The ratio, never below 5% until 1998, fell to 4.6% in 1999 and did not recover to over 5%. The purpose of this paper is to explain why the ratio remained under 5% since 1999.

Figure 1. Cash to Consumption Ratio in Korea



We have banknotes of three different denominations- ₩10,000, ₩5,000, and ₩1,000. The number of denomination is relatively small and the highest denomination is just around $10. As a result, the use of ₩10,000 is dominant in Korea as Figure 2 shows. For a large amount transaction, the Korean use certified check or credit card which will be explained in the next subsections.

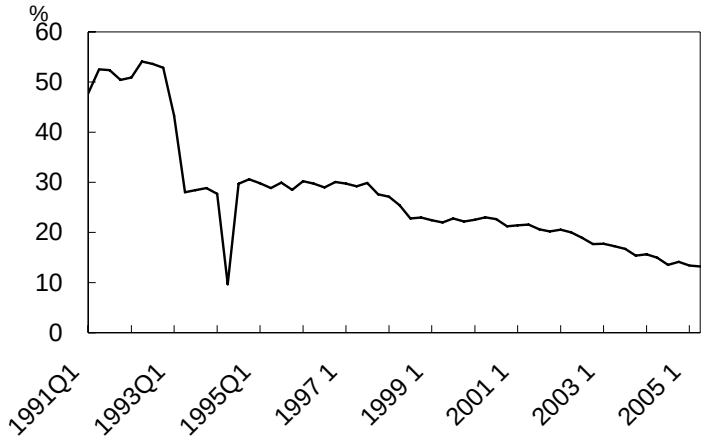
Figure 2. Use of Three Denomination Banknotes in Korea (in cumulated stock)



2.2. Certified Check

Personal checks are not popular in Korea. Instead, certified checks are widely used for a large amount transaction. Different from certified checks in America, however, the certified checks in Korea do not show any prior recipient. That is, it functions almost as cash. Certified check denominated as ₩100,000 can be withdrawn at any ATM. However, ₩100,000 certified checks are not as safe as cash because certified checks are more easily forged than cash. The usage of ₩100,000 certified checks are decreasing as Figure 3 shows.

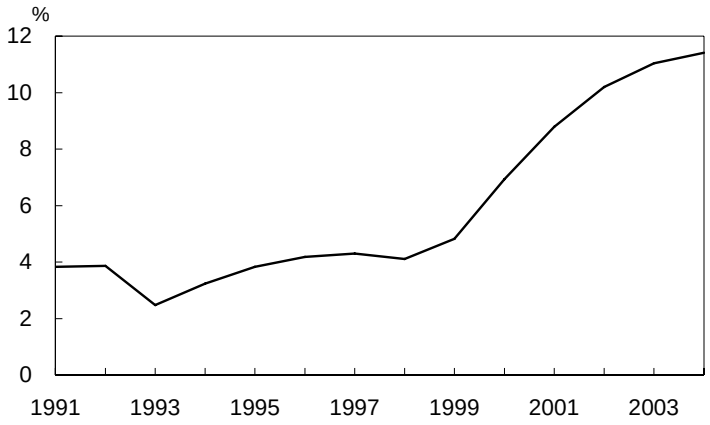
Figure 3. Ratio of ₩100,000 Certified Check to Consumption



2.3 Card

The usage of credit card is dominant over any other debit card or prepaid card in Korea. The transaction amount of credit card accounts for 98% among all the card transactions. The credit card purchase has increased a lot since 1999, as Figure 4 shows. This might be due to a tax policy that gave tax deduction on credit card purchase. The policy was at first effective in May 1999 and revised in January 2001 and in January 2005.

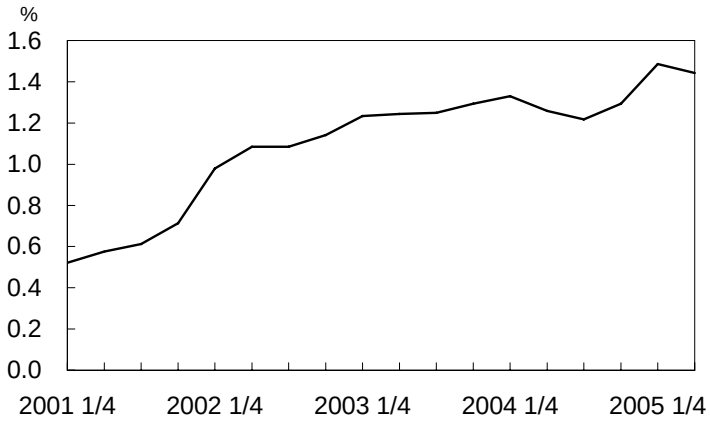
Figure 4. Credit Card Purchase



2.4. Internet Shopping

Internet shopping is also increasing as Figure 5 shows. Yet internet shopping purchase accounts for a very small fraction of consumption, compared with certified check or credit card. Credit card and online transfer are the main payment instruments in internet shopping. Electronic money is not yet widely used.

Figure 5. Internet Shopping



3. Theoretical Approaches on Cash Demand

3.1 Baumol-Tobin Model

Why do we need cash for transaction? The first reason is that the time when income happens is not necessarily the time when we want to spend. The second reason is that there is a cost when we withdraw cash from bank account. Based on this reasoning, Baumol (1952) and Tobin (1956) introduced the following cash demand theory.

A consumer deposits her income (Y) to her saving account when she gets her income. Spending happens continuously during a period. She needs cash for transaction and cash does not provide any interest. The saving account is not used for transaction but interest accrues from it. Whenever she withdraw cash from her saving account, there happens a cost α_{SC}, which is sometimes called "bank visit cost." Then she chooses the number to visit bank (n) to solve the following minimization problem,

$$\underset{n}{Min}\frac{i_S}{2n}Y + \alpha_{SC}n$$

where i_s is the interest rate of saving account. The optimized average cash holding is

$$\overline{C}^* = \sqrt{\frac{Y\alpha_{SC}}{2i_S}}\,.$$

The Baumol-Tobin model does not consider checking account, that is, alternative payment instruments other than cash. Therefore, it does not fit to explain the effect of noncash to cash demand.

3.2. Whitesell Model

Whitesell (1989) suggested a model which considers both cash and credit card as payment instruments. This section describes the model and provides us with theoretical background of the empirical work which is done in the next section.

A consumer deposits her money (Y) on her checking account (D). Some amount is withdrawn as cash (C) and the other is used for check issuing or credit/debit card payment. For the convenience of analysis, we assume that credit card is the only alternative payment instrument based on checking account. Interest accrues on the checking account by interest rate, i_D, and cost follows when one withdraws cash from her checking account by α_{DC}.

Why do we need check account other than cash for transaction? For a large amount transaction, to pay it by credit card or check which is based on check account is safer and more convenient than cash. On the otherhand, paying by the alternative payment instrument accompanies cost. Whitsell (1989) assumed that the cost which follows credit card transaction, which we call credit card cost and denote by α_{DG}, has the following form:

$\alpha_{DG} = u + vT$

where T is the amount of one transaction. u is the fixed cost of the credit card cost, such as inconvenience coming from signature and time to wait to be authorized. vT is the variable cost to transaction amount.

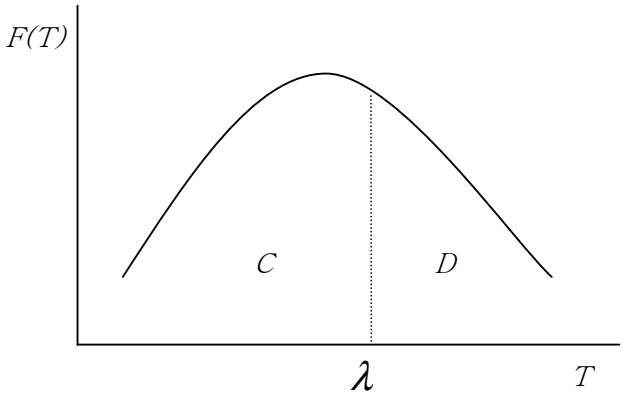
Let F(T) be a function representing transaction amount per each transaction and total expenditure is expressed as follows:

$Y = \int_0^{\infty} F(T)dT$.

Consumer pays by cash when the transaction amount is less than λ. Over the amount, she pays by credit card. Figure 6 shows the behavior of her.

$C = \int_0^{\lambda} F(T)dT$

Figure 6. Usage of cash and credit card in Whitsell model



Let n be the number to withdraw cash from check account. Then the consumer chooses λ and n so that she minimizes cost coming from holding cash as follows

$$\underset{\lambda,n}{Min}\left(\frac{i_D}{2n}\int_0^{\lambda} F(T)dT + \alpha_{DC}n + \int_{\lambda}^{\infty} \alpha_{DG}\frac{F(T)}{T}dT\right).$$

As one notice, the first two parts of the above cost are similar to Baumol-Tobin model. The third part represents the cost related to credit card purchases since F(T)/T can be considered the number of purchasing T amount. Assuming interior solutions, we get the following FOCs:

$$\frac{i_D}{2n} = v + \frac{u}{\lambda}$$

$$\alpha_{DC} = \frac{i_D}{2n^2}\int_0^{\lambda} F(T)dT \ .$$

Let λ^* and n* be the solutions. Then, we can get cash demand of Whitsell model like this:

$$\overline{C}^* = \frac{1}{2n^*}\int_0^{\lambda^*} F(T)dT \ .$$

Even though the Whitsell model is a simple model which does not consider alternative payment instruments other than credit card, it gives several insights about the relationship between cash and noncash.

First, cash demand is a function of consumption and checking account interest rate. This is contrary to the case of the Baumol-Tobin model where cash demand depends on income and saving account interest rate.

Second, cash demand is dependent on the change of the credit card cost rather than credit card usage itself. When the credit card cost decreases, that is, u or v decreases, λ^* decreases $(\partial\lambda^*/\partial u \rangle 0 \ , \partial\lambda^*/\partial v \rangle 0)$[1] and, as a result, cash demand decreases $(\partial\overline{C}^*/\partial\lambda^* \rangle 0)$[2]. Of course, when the credit card cost goes down, credit card usage also increases. Increase in credit card transaction, however, may not necessarily mean a decrease in the credit card cost. It may result from the changed relation between credit card and other alternative payment instrument. This is why one might get unreliable results when cash demand is set to depend on credit card transactions. The Whitsell model argues that cash demand be a function of the credit card cost.

Third, the Whitsell model implies the same results about debit cards or checks. Like credit card, their usage is based on checking account and they are more convenient for large amount payments. Therefore, we can infer that cash demand also depends on the cost following debit card or check transaction.

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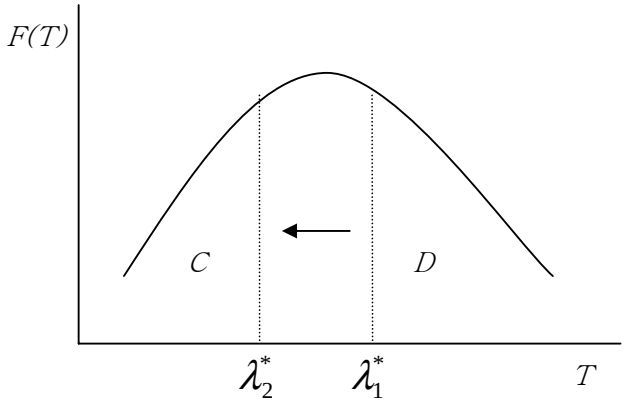
[1] See Whitsell (1989) for proof.

[2] See Whitsell (1989) for proof.

Figure 7. Effect of decrease in credit card cost



Fourth, electronic money or smart chip money does not fit the Whitsell model since it is designed to relieve the inconvenience which comes from small amount transaction. However, we can conjecture that cash demand depends on the cost following electronic money transaction.

Fifth, the increase in internet shopping might decrease cash demand since internet shopping could decrease offline shopping where cash is used for payment.

In summary, cash demand is a function of consumption, checking account interest rate, bank visit cost, costs following alternative payment instruments transactions, and internet shopping. Cash demand increases when consumption or noncash cost increase and interest rate or internet shopping decrease[3]. This can be presented as follows:

$$CASH = f(\underset{+}{CSUM}, \underset{-}{i}, \alpha_{DC}, \underset{+}{\alpha}, \underset{-}{E})$$

where *CASH* is cash, *CSUM* is consumption, *i* is interest rate, α_{DC} is bank visit cost, α is noncash transaction cost, and *E* is internet shopping.

[3] As Whitsell (1989) pointed, the effect of bank visit cost on cash demand is not known in the model. When bank visit cost increases, n decreases and cash demand increases, but, at the same time, λ also decreases and cash demand decreases.

4. Estimation

4.1. Cash Demand

Based on the Whitsell model, we set up an empirical model to estimate cash demand in Korea. We use quarterly data from 1997:1 to 2005:2. All data can be downloaded from ECOS at Bank of Korea. Several features are considered to set up a model.

First, for a variable that represents cash demand, we use the cumulated stock of cash divided by consumption. This helps us avoid spurious regression problem because both cash and consumption turned out to be nonstationary in ADF test.

Second, we didn't consider bank visit cost and internet shopping since they are not easily quantified and do not seem to affect cash demand much during the period which we consider. We also didn't regard noncash cost except credit card cost by the same reason.

Third, we suspect that credit card cost affected cash demand during the period. The problem is that the credit card cost is not observable and we need to quantify it to do empirical works. We took the following steps to measure credit card cost. We estimated the following model for credit card usage:

$$\frac{CRD_t}{CSUM_t} = 0.007 + 0.011D_{1t} + 0.012D_{2t} + 0.003D_{3t} + 1.12\frac{FRN_t}{CSUM_t} + \varepsilon_t \qquad (1)$$

where CRD is credit card purchase, CSUM is consumption, D is dummy variables for credit card tax policy (there were three revisions.), and FRN is the number of credit card franchises. Based on the estimated result, we take the following equation as credit card cost variable:

$$COST_t = -(0.011D_{1t} + 0.012D_{2t} + 0.003D_{3t}) . \qquad (2)$$

Fourth, the credit card installment purchase increased a lot from 1998:1 to 2000:2. This was due to the decrease in installment purchase amount per transaction, which implies that consumers who were in a recession after the financial crisis paid smaller amount by credit card. Purchasing small amount by credit card might decrease cash demand. Though this effect might be temporary, we consider this phenomenon.

Considering all the points, we set up the following model for cash demand:

$$\frac{CASH_t}{CSUM_t} = \beta_0 + \beta_1 i_t + \beta_2 COST_t + \beta_3 INST_t + \gamma_1 Q_{1t} + \gamma_2 Q_{2t} + \gamma_3 Q_{3t} + \varepsilon_t \quad (3)$$

where *INST* is installment purchase per transaction and Q_i is a seasonal dummy.

Table 1 shows the result of cash demand model. As the theory predicts, the sign of interest rate is minus and that of credit card cost is plus. As Equation 2 shows, the credit card cost decreased three times, so the plus sign of credit card cost coefficient means the decrease in cash demand. The estimate implies that cash demand decreased by 2.9 billion won at 2005:2 because of the credit card tax policy.

Table 1. Estimation of Cash Demand

Constant	*I*	*COST*	*INST*	*Q1*	*Q2*	*Q3*
18.46**	**-0.27***	**85.02****	**0.008****	**1.66****	**0.70****	0.32
(0.64)	(0.13)	(15.86)	(0.001)	(0.25)	(0.17)	(0.18)
adj.R^2=0.82	D.W.=1.61					

Note: 1) ** and * refer to statistical significance at the 1% and 5% level, respectively.

2) Newey-West Heteroskedasticity Consistent Standard Errors are in parentheses.

Figure 8 shows the effect of the credit card tax policy on cash demand. The dotted line represents the cash-consumption ratio which could be without the tax policy ($CASH_t/CSUM_t - \hat{\beta}_2 COST_t$). If there was no credit card tax policy, the cash-consumption ratio would rise up to 5.2% in 2004.

We applied the same model to banknotes and coin and reported the results of the denomination demand in Table 2. It turned out that the credit card tax policy decreased the demand of ₩10,000 banknote and ₩1,000 banknote while the demand of ₩5,000 banknote and coin was not affected. All denominations showed significant seasonal fluctuations. Different from other denominations, coin showed strong autoregressive property. This implies that coins are easily hoarded for changes.

Figure 8. Effect of the Tax Deduction on Cash Demand

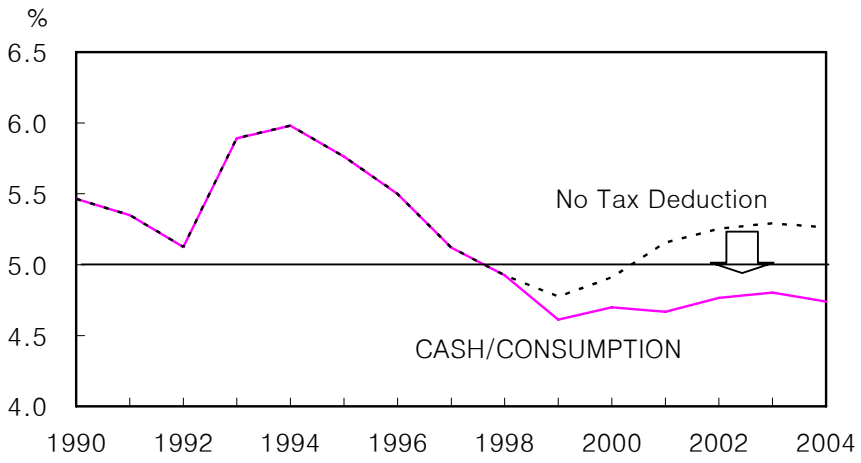


Table 2. Demand for Banknotes and Coins

Denom.	Cons	*i*	*COST*	*INST*	*Q1*	*Q2*	*Q3*	adj.R^2
10,000	16.01**	-0.09	55.89**	0.006**	0.80*	0.16	0.14	0.51
	(0.64)	(0.12)	(16.25)	(0.001)	(0.31)	(0.24)	(0.32)	
5,000	0.62**	-0.007	-0.70	$-2*10^{-5}$	0.09**	0.008	0.015**	0.84
	(0.03)	(0.008)	(1.08)	($5*10^{-5}$)	(0.01)	(0.005)	(0.003)	
1,000	0.82**	0.012	3.00*	$-0.4*10^{-5}$	0.09**	0.037**	0.039**	0.93
	(0.04)	(0.009)	(1.24)	($4*10^{-5}$)	(0.01)	(0.006)	(0.005)	
Coin[3)]	0.95**	0.001	0.48	0.0002	0.04**	0.052**	0.030**	0.67
	(0.05)	(0.006)	(1.70)	(0.0001)	(0.01)	(0.010)	(0.003)	

Note: 1) ** and * refer to statistical significance at the 1% and 5% level, respectively.

2) Newey-West Heteroskedasticity Consistent Standard Errors are in parentheses.

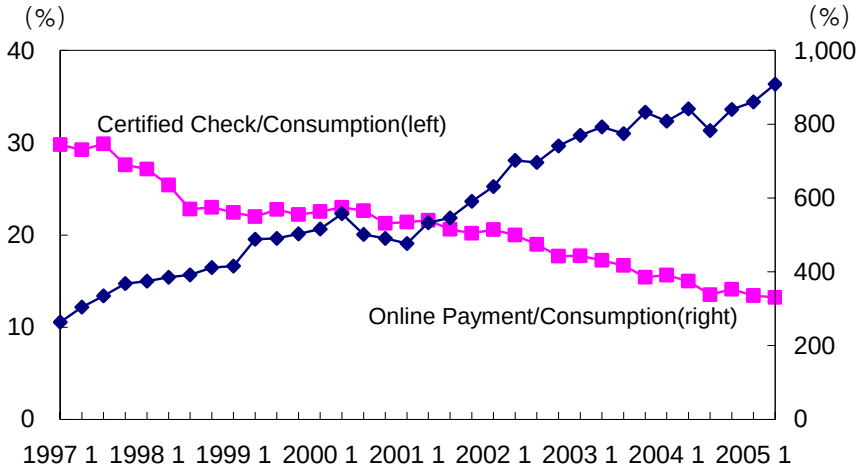
3) Estimated with AR(1).

4.2 Certified Check

As noted earlier, since the highest denomination in Korea is very low, certified checks are used for large amount transactions. ₩100,000 Certified checks can be withdrawn in ATMs so that the withdrawing cost of ₩100,000 certified checks is same as that of cash. However, one needs to present her ID or sign on the back of certified checks. Also, certified checks are forged more easily than cash. There is a discussion about issuing higher denomination banknote, such as ₩100,000 in Korea. This subsection explores the usage of ₩100,000 certified checks to get implications for the issue.

One can see that the usage of ₩100,000 certified checks are very different from that of cash. The ratio of ₩100,000 certified checks transactions to consumption is continuously decreasing and does not show seasonal fluctuations, as shown in Figure 9. This means that ₩100,000 certified checks are not popular as cash and they have limitations to represent the demand of ₩100,000 banknotes.

Figure 9. Certified Check and Online Payment



Then, why the usage of ₩100,000 certified checks are decreasing? Online payment including internet banking could be a reason of that. Figure 9 shows that the ratio of online payment transactions to consumption is continuously increasing. We found that the two ratios have one cointegration vector significantly at 1% level by Johansen's test. The estimated cointegration equation is

$$\frac{CHK_t}{CSUM_t} = \underset{(62.2)}{0.327} - \underset{(-28.9)}{0.022}\frac{OLP_t}{CSUM_t}.$$

where CHK is ₩100,000 certified check transaction, CSUM is consumption, OLP is online payment transaction, and t-values are in parentheses. This equation shows that the usage of ₩100,000 certified checks is decreasing as online payment transactions are increasing.

5. Conclusion

We find that the cash-consumption ratio fell below long term average in 1999 and explore whether alternative payment instruments decreased cash demand in Korea. According to Whitesell's (1989) model, when the noncash transaction cost decreases, noncash transaction increases and cash demand decreases. Our empirical results show that the tax policy that

provided tax deduction on credit card purchase decreased the credit card cost and, as a result, lowered cash demand. In addition, the tax effect explains most of falling of cash-consumption ration below long term average. This implies that the recent decrease in cash demand was not due to the technical progress in alternative payment system but due to a government policy.

The result of estimating the demand for banknotes showed that the credit card tax policy decreased the demand of ₩10,000 banknote and ₩1,000 banknote while the demand of ₩5,000 banknote and coin was not affected. All denominations showed significant seasonal fluctuations.