PISSN 2508-1640 EISSN 2508-1667 an open access journal
East Asian Economic Review vol. 25, no. 3 (September 2021) 310-336
https://dx.doi.org/10.11644/KIEP.EAER.2021.25.3.399

A Study on Dynamic Asset Allocation Strategy for Optimal Portfolio Selection

Hojin Lee†
Myongji University
hlee07@mju.ac.kr

We use iterative numerical procedures combined with analytical methods due to Rapach and Wohar (2009) to solve for the dynamic asset allocation strategy for optimal portfolio demand. We compare different optimal portfolio demands when investors in each country have different access to overseas and domestic investment opportunities. The optimal dynamic asset allocation strategy without foreign investment opportunities leads domestic investors in Korea, Hong Kong, and Singapore to allocate more funds to domestic bonds than to domestic stocks. However, the U.S. investors allocate more wealth to domestic stocks than to domestic bonds. Investors in all countries short bills at a low level of risk aversion. Next, we investigate dynamic asset allocation strategy when domestic investors in Korea have access to foreign markets. The optimal portfolio demand leads investors in Korea to allocate most resources to domestic bonds and foreign stocks. On the other hand, the portfolio weights on foreign bonds and domestic stocks are relatively low. We also analyze dynamic asset allocation strategy for the investors in the U.S., Hong Kong, and Singapore when they have access to the Korean markets as overseas investment opportunities. Compared to the results when the investors only have access to domestic markets, the investors in the U.S. and Singapore increase the portfolio weights on domestic stocks in spite of the overseas investment opportunities in the Korean markets. The investors in the U.S., Hong Kong, and Singapore short domestic bills to invest more than initial funds in risky assets with a varying degree of relative risk aversion coefficients without exception.

Keywords: Dynamic Asset Allocation, Optimal Portfolio, Intertemporal Hedging Demand, Myopic Demand

JEL Classification: C13, C14, C15

† Address Correspondence to Hojin Lee, Department of Business Administration, Myongji University, 34 Geobukgol-ro, Seodaemun-Gu, Seoul 03674, Korea, or to hlee07@mju.ac.kr. This work was supported by the 2020 Research Fund of Myongji University.

I. Introduction

Dynamic portfolio choice with return predictability of multiple risky assets has drawn attention since the seminal work of Merton (1971). The complication, however, lies in the process of solving dynamic portfolio choice problems. Different approaches have been developed to measure the impact of return predictability on dynamic portfolio decision. Campbell and Viceira (1999), Kim and Omberg (1996), Barberis (2000), Brennan et al. (1997), Balduzzi and Lynch (1999), Lynch and Balduzzi (2000) and Lynch and Tan (2010) consider three dimensions that affect portfolio decision making of the investor, that is, predictability of returns, transactions costs and maximization horizon of the expected utility. Under these considerations, these studies numerically solve multiple-period portfolio choice problem.

In lieu of numerical solution to the intertemporal maximization problem, Campbell and Viceira (1999; 2001 and 2002) and Campbell et al. (2003) synthesize the approximate analytical approach with simple numerical methods for the optimal consumption and portfolio choice problems. They presume an investor with Epstein and Zin (1989 and 1991) utility whose goal is to maximize the expected lifetime utility function. In this framework, they show that return predictability of multiple risky assets plays an important role in dynamic asset allocation. In the extensive empirical work due to Rapach and Wohar (2009), they apply the approximate analytical approach and show how investors in the U.S., Australia, Canada, France, Germany, Italy, and U.K. intertemporally allocate their investable resources between U.S. stocks and bonds as well as across domestic bills, stocks, and bonds.

This paper aims to investigate the intertemporal hedging demand of long-term investors for a variety of domestic and foreign assets. Due to the lack of closed-form solutions for dynamic asset allocation problems, however, we use the iterative numerical procedure combined with analytical methods due to Rapach and Wohar (2009) to solve for the dynamic asset allocation strategy for optimal portfolio demand. We compare different optimal portfolio demands when investors in each country have different access to overseas and domestic investment opportunities.

The empirical results show that optimal dynamic asset allocation strategy without foreign investment opportunities leads domestic investors in Korea, Hong Kong, and Singapore to allocate more funds to domestic bonds than to domestic stocks. However, the U.S. investors allocate more wealth to domestic stocks than to domestic bonds. Dynamic asset allocation strategies of the investors in the four countries show distinct differences between two groups, that is, Korea, Hong Kong and Singapore versus the US. The investors in the former group put more portfolio weights on domestic bonds than domestic stocks, however, the opposite is true for the U.S. investors when there is no overseas investment opportunities.

We also investigate dynamic asset allocation strategy when investors have access to foreign markets. While investors in Korea put higher portfolio weights on domestic bonds and foreign stocks, they put lower portfolio weights on foreign bonds and domestic stocks. Compared to the results when the investors only have access to domestic markets, the investors in the U.S. and Singapore increase the portfolio weights on domestic stocks in spite of the overseas investment opportunities in the Korean markets. The investors in the U.S., Hong Kong, and Singapore short domestic bills to invest more than initial funds in risky assets with a varying degree of relative risk aversion coefficients without exception. The sources of conspicuous differences in dynamic asset allocation strategies among these four countries are beyond the scope of this paper. However, it is clear that the investors in Korea have the highest preference for foreign stocks and bonds and the lowest preference for domestic stocks and bonds.

According to Rapach and Wohar (2009), the intertemporal hedging demands for domestic and foreign stocks are triggered by the combined dynamics of the excess stock returns and the dividend yield under return predictability. That is, when there is a negative shock to excess stock returns this period the increase in intertemporal hedging demands for stocks would follow next period due to return predictability. This phenomenon is also substantiated in the U.S., Hong Kong, and Singapore in our work. However, it does not seem that the mechanisms of dynamics of the excess stock returns and the dividend yield would work in the Korean stock market. The fact that the Korean investors have lower hedging demand for domestic stocks and higher hedging demand for foreign stocks is conspicuous. The intertemporal hedging demands for domestic vis-à-vis foreign stocks in Korea are quite different from those in other countries. This paper aims to show how different two groups of investors are in the intertemporal hedging demands for domestic vis-à-vis foreign stocks, that is, the Korean investors versus the investors in the U.S., Hong Kong, and Singapore.

The remainder of the paper is organized as follows: Section II briefly describes the Campbell-Chan-Viceira (hereafter, CCV) model and the empirical procedure; Section III presents our empirical results; and Section IV concludes.

II. Modelling

1. The Model

The multi-period portfolio choice problem of an investor who maximizes the expected lifetime recursive utility of an infinite stream of consumption in our study is based on the Campbell et al. (2003) model. The real return on the portfolio which is composed of *n* risky assets is

$$\boldsymbol{R_{p,t+1}} = \sum_{i=2}^{n} \boldsymbol{\alpha_{i,t}} \left(\boldsymbol{R_{i,t+1}} - \boldsymbol{R_{1,t+1}}\right) + \boldsymbol{R_{1,t+1}}, \tag{1}$$

where $R_{1,t+1}$ is the real return on a short-term instrument, and α_i is the portfolio weight on asset *i*. We define the real return on assets, $r_{i,t+1} \equiv log\left(R_{i,t+1}\right)$, and represent the log excess returns, x_{t+1} as follows:

$$x_{t+1} \equiv \begin{bmatrix} r_{2,t+1} - r_{1,t+1} \\ r_{3,t+1} - r_{1,t+1} \\ \vdots \\ r_{n,t+1} - r_{1,t+1} \end{bmatrix}, \tag{2}$$

where $r_{1,t+1}$ is the real return on short-term bill, $r_{2,t+1}$ is the real return on stock index, and $r_{3,t+1}$ is the real return on long-term bond. The state variables, s_{t+1} in the model include deviations in the nominal 3-month government bill yield from a 1-year backward-looking moving average, dividend-price ratio, and term spread as the difference between the nominal 10-year government bond yield and the nominal 3-month government bill yield. The state vector z_{t+1} is assumed to follow a VAR(1) representation:

$$z_{t+1} = \Phi_0 + \Phi_1 z_t + v_{t+1}, \tag{3}$$

where ν_{t+1} are the independently and identically distributed over time and cross-sectionally correlated disturbances to the state variables.

The recursive utility function of the following specification is assumed as in Campbell et al. (2003) and Rapach and Wohar (2009)

$$\mathrm{U}\big(C_t, E_t(U_{t+1})\big) = \left[(1-\delta)C_t^{(1-\gamma)/\theta} + \delta\left(E_t\big(U_{t+1}^{1-\gamma}\big)\right)^{1/\theta}\right]^{\theta/(1-\gamma)}, \quad (4)$$

where C_t is consumption at time t, γ is the degree of relative risk aversion, $\theta = (1-\gamma)/(1-\psi^{-1})$, and ψ is the elasticity of intertemporal substitution. $0 < \delta < 1$ is the time discount factor. Under the intertemporal budget constraint in (5), the Euler equation for consumption is expressed in (6) and the optimal consumption can be derived from the equation.

$$W_{t+1} = (W_t - C_t)R_{p,t+1}, \quad (5)$$

$$E_t\left[\left\{\delta\left(\frac{C_{t+1}}{C_t}\right)^{-1/\psi}\right\}^{\theta} R_{p,t+1}^{-(1-\theta)} R_{i,t+1}\right] = 1 \quad (6)$$

where W_t denotes wealth at time t.

The analytical solution to the Euler equation is not generally obtainable. However, the investor can maximize the expected lifetime utility by selecting a myopic portfolio demand with the $\gamma = 1$ constraint. Campbell and Viceira (1999 and 2001) and Campbell et al. (2003) develop the approximate analytical procedure to a multivariate dynamic portfolio selection problem except for the case, $\gamma = \psi = 1$ where the optimal portfolio rule is characterized by a myopic demand.

The Euler equation (6) with the budget constraint (5) can be solved for the portfolio weight α_t and the optimal consumption-wealth ratio $c_t - w_t$ by assuming the following two equations (7) and (8).[1]

$$\alpha_t = A_0 + A_1 z_t \quad (7)$$

$$c_t - w_t = b_0 + B_1' z_t + z_t' B_2 z_t \quad (8)$$

The coefficient matrices A_0, A_1, B_1 and B_2 are functions of $\gamma, \psi, \delta, \Phi_0$ and Φ_1 and can be obtained using an iterative numerical procedure. Then, according to

[1] The approximate model estimation methodology employed in this paper was introduced in Campbell and Viceira (1999), and applied in Campbell et al. (2003).

Campbell et al. (2003), the myopic and intertemporal hedging demand for the assets are functions of the underlying parameters of the following form.

$$A_0 = \left(\frac{1}{\gamma}\right) \Sigma_{xx}^{-1} [H_x \Phi_0 + 0.5\sigma_x^2 + (1-\gamma)\sigma_{1x}] + \left[1 - \left(\frac{1}{\gamma}\right)\right] \Sigma_{xx}^{-1} \left[-\frac{\Lambda_0}{(1-\psi)}\right] \quad (9)$$

$$A_1 = \left(\frac{1}{\gamma}\right) \Sigma_{xx}^{-1} H_x \Phi_1 + \left[1 - \left(\frac{1}{\gamma}\right)\right] \Sigma_{xx}^{-1} \left[-\frac{\Lambda_1}{(1-\psi)}\right] \quad (10)$$

where H_x is a matrix that extracts excess returns from the state vector z_t, and Σ_{xx} is a variance-covariance matrix for the innovations to the excess returns. Λ_0 and Λ_1 are matrices composed of the underlying parameters in equation (8). The first term in equations (9) and (10) is the myopic asset demand where investors maximize expected lifetime utility over one-period. The second term in equations (9) and (10) is the intertemporal hedging demand where investors optimally allocate across assets over a multi-period horizon. We report the estimation results of the myopic and intertemporal hedging demand for domestic and foreign assets from equations (9) and (10) in Tables 2-7.

III. Estimation

1. Data

The data for Korea, the U.S., Hong Kong, and Singapore are collected from Global Financial Data. Each country has a different span of data due to availability. The sample spans from December, 1963 to February, 2016 for the U.S., from January, 1991 to February, 2016 for Korea, from June, 1993 to January, 2016 for Hong Kong, and from January, 1988 to February, 2016 for Singapore. The log real return on a government bill is the difference between the log nominal return on a total return index for a bill and the inflation from the consumer price index. The log excess return on the stock index is the difference between the log return on a total return index for stock index and the log return on a total return index for a three-month bill. The log excess return on a treasury bond is the difference between the log return on a total return index for a ten-year bond and the log return on a total return index for a three-month bill. The Treasury bill yield is the yield on a three-month Treasury bill, and the term spread is the difference between the yield on a ten-year Treasury bond and three-month Treasury bill. Table 1 reports mean and standard deviation of the aforementioned variables of each country. The mean excess stock return for the U.S., Hong Kong, and Singapore is 4.4, 4.9, and 4.8 percent respectively, while the mean excess stock return for Korea is the lowest at -2.5 percent. On the other hand, the mean excess bond return for Korea is the highest at 2.5 percent. The mean excess Treasury bond return for the U.S., Hong Kong, and Singapore is 2.0, 2.0, and 1.9 percent respectively. The mean and standard deviation of three predictors of the forecasting model are also reported in Table 1. The T-Bill yield for each country has negative mean value. The log dividend yield for Korea is the lowest at 0.42, and the term spread for Korea has the only negative value at -0.04 of the four countries analyzed.

Table 1. Descriptive Statistics

	USA, 1963.12-2016.02	Korea, 1991.01-2016.02
Log T-Bill real return	0.973(1.162)	3.872(1.808)
Log excess stock return	4.398(14.968)	-2.538(28.562)
Log excess T-Bond return	2.006(8.046)	2.453(5.806)
T-Bill yield	-0.0003(0.0104)	-0.0036(0.0196)
Log dividend yield	1.015(0.408)	0.420(0.306)
Term spread	0.016(0.013)	-0.044(0.073)
	HK, 1993.06-2016.01	**SG, 1988.01-2016.02**
Log T-Bill real return	0.501(2.884)	-0.234(1.534)
Log excess stock return	4.909(25.892)	4.804(21.729)
Log excess T-Bond return	2.003(6.079)	1.865(3.813)
T-Bill yield	-0.0007(0.0097)	-0.0004(0.0066)
Log dividend yield	1.104(0.2005)	0.713(0.368)
Term spread	0.010(0.026)	0.003(0.023)

Notes: The descriptive statistics for the U.S., Korea, Hong Kong, and Singapore are shown in the table. The mean (standard deviation) of the three risky assets (the log T-Bill real return, the log excess stock return, and the log excess T-Bond return) and three predictor variables (the T-Bill yield, log dividend yield, and term spread) are reported.

2. Optimal Portfolio for Domestic Assets

We report the total, myopic, and hedging demand for stocks, bonds, and bills as domestic assets in the U.S., Korea, Hong Kong, and Singapore in Table 2. For each country, we take $\psi = 1$, along with different γ values to calculate the CCV optimal consumption.[2] Campbell et al. (2003) employ a wide range of CRRA values of 1, 2, 5, 20, and 2000 and Rapach and Wohar (2009) use the CRRA values of 4, 7, and 10. The most important point that we would like to prove is how total demand for risky assets is composed of myopic demand and intertemporal hedging demand regardless of CRRA values. After we find that the intertemporal hedging demand for risky assets takes higher portion in total demand than myopic demand, we would like to show that portfolio weights on risky assets naturally decline as we have higher CRRA values. The CRRA values of 4, 7 and 10 are, in that sense, quite arbitrary. The parametric bootstrap procedure is used for the 90 percent confidence band reported in Table 2.

Table 2. Optimal Portfolio Choice for Domestic Assets

		USA		
		$\gamma = 4$	$\gamma = 7$	$\gamma = 10$
Stock	Total	94.60 [50,174]	62.14 [31,121]	47.79 [25,97]
	Myopic	58.40 [-51,204]	33.24 [15,42]	23.17 [11,30]
	Hedging	36.20 [-261,51]	28.90 [10,85]	24.62 [6,69]
Bond	Total	69.02 [27,74]	35.58 [-34,113]	22.74 [-28,77]
	Myopic	86.03 [-37,202]	48.82 [-22,115]	33.94 [-16,81]
	Hedging	-17.01 [-171,79]	-13.24 [-25,12]	-11.19 [-22,7]
Bill	Total	-63.62 [9,102]	2.28 [-110,82]	29.47 [-54,90]
	Myopic	-44.43 [-35,18]	17.94 [-54,88]	42.89 [-8,92]
	Hedging	-19.19 [-110,11]	-15.67 [-90,3]	-13.42 [-74,2]

[2] The GAUSS codes obtained from Rapach and Wohar (2009) are used to solve the CCV model. We thank D.E. Rapach for providing us with the GAUSS code.

Table 2. Continued

		Korea		
		$\gamma = 4$	$\gamma = 7$	$\gamma = 10$
Stock	Total	7.97 [-36,56]	5.74 [-18,36]	4.79 [-12,26]
	Myopic	2.12 [-29,50]	1.34 [-17,28]	1.02 [-11,20]
	Hedging	5.84 [-7,17]	4.40 [-3,13]	3.77 [-3,10]
Bond	Total	170.79 [-58,375]	100.04 [-35,205]	72.93 [-23,144]
	Myopic	220.92 [-85,476]	125.32 [-51,270]	87.09 [-36,188]
	Hedging	-50.13 [-121,26]	-25.28 [-69,22]	-14.16 [-50,17]
Bill	Total	-78.75 [-295,158]	-5.78 [-122,133]	22.28 [-64,114]
	Myopic	-123.04 [-467,109]	-26.66 [-223,106]	11.89 [-125,105]
	Hedging	44.29 [-26,112]	20.88 [-20,68]	10.39 [-22,44]

		Hong Kong		
		$\gamma = 4$	$\gamma = 7$	$\gamma = 10$
Stock	Total	67.05 [16,114]	48.73 [12,80]	38.60 [10,64]
	Myopic	25.56 [5,52]	15.17 [3,30]	11.01 [2,21]
	Hedging	41.48 [11,71]	33.56 [8,58]	27.59 [6,48]
Bond	Total	127.50 [-50,300]	73.13 [-35,171]	51.22 [-19,126]
	Myopic	124.57 [-52,305]	69.21 [-32,174]	47.07 [-35,111]
	Hedging	2.92 [-28,38]	3.91 [-20,32]	4.16 [-16,27]
Bill	Total	-94.54 [-272,86]	-21.86 [-134,75]	10.18 [-64,86]
	Myopic	-50.14 [-232,112]	15.62 [-71,126]	41.92 [-20,119]
	Hedging	-44.40 [-98,-0.2]	-37.47 [-77,2]	-31.74 [-64,2]

Table 2. Continued

		Singapore		
		$\gamma = 4$	$\gamma = 7$	$\gamma = 10$
Stock	Total	53.77 [-3,114]	31.61 [-5,72]	21.61 [-5,53]
	Myopic	37.74 [4,63]	21.39 [2,36]	14.84 [2,25]
	Hedging	16.03 [-11,62]	10.22 [-13,39]	6.77 [-10,30]
Bond	Total	358.39 [127,614]	207.59 [77,361]	146.47 [54,255]
	Myopic	344.43 [127,583]	198.16 [73,334]	139.66 [51,233]
	Hedging	13.97 [-37,71]	9.43 [-23,52]	6.81 [-19,37]
Bill	Total	-312.17 [-568,-74]	-139.20 [-290,2]	-68.07 [-177,31]
	Myopic	-282.17 [-491,-36]	-119.55 [-239,20]	-54.50 [-140,41]
	Hedging	-29.99 [-105,39]	-19.65 [-78,23]	-13.57 [-63,15]

Notes: The table reports the total, myopic, and hedging demand for domestic stocks, bonds, and bills. The 90 percent confidence intervals are in square brackets. The optimal portfolio selection problems are solved with $\psi = 1$, and $\gamma = 4, 7,$ and 10. The numbers are portfolio weights and in percentage units. For each value of γ, the portfolio weights on domestic stocks, bonds, and bills sum to one hundred.

According to Table 2, the investors in the U.S. put 94.6% of the investable wealth on domestic stocks, 69.0% on domestic bonds, and -63.6% on domestic bills. For each value of γ, the portfolio weights on domestic stocks, bonds, and bills sum to one hundred. The portfolio weight of 94.6% on domestic stocks consists of 58.4% of myopic demand and 36.2% of intertemporal hedging demand. All types of portfolio weights on the U.S. stocks decrease as the degree of relative risk aversion increases. While the portfolio weights on domestic bonds for the U.S. investors are the same pattern as portfolio weights on domestic stocks, those on bills are the opposite. The total demand for bills are negative for all investors in each country, meaning that investors short bills except the case where the investors in the U.S. have the value of $\gamma = 7{,}10$ and the investors in Korea and Hong Kong have the value of $\gamma = 10$.

The investors in Korea have overwhelmingly smaller portfolio weights on domestic stocks compared to the investors in other countries. While they put from 8.0% to 4.8%

of investable wealth on domestic stocks, they invest from 170.8% to 72.9% of the wealth on domestic bonds depending on the value of γ. The intertemporal hedging demand for domestic stocks is the smallest of the four countries.

The third panel of Table 2 shows portfolio demand for the investors in Hong Kong. The results are similar to those in the U.S., however, the intertemporal hedging demand for domestic stocks are larger than the myopic demand for domestic stocks. For the U.S., the myopic demand for domestic stocks has the higher portfolio weight than that on the intertemporal hedging demand. The investors in Hong Kong also short bills in order to invest in the risky assets, stocks and bonds except the case where we assume the highest relative risk aversion coefficient of $\gamma = 10$.

The allocation of portfolio demand for the investors in Singapore is presented in the last panel of Table 2. For all values of relative risk aversion coefficients, the investors in Singapore short bills from 3.12 to 0.68 times of investable wealth. The investors in Singapore invest 53.8% of the investable wealth on domestic stocks, 358.4% on domestic bonds, and -312.2% on domestic bills. The total demand for bills is overwhelmingly large in negative numbers, meaning that they borrow a great amount of cash to increase the portfolio weight on domestic stocks and bonds.

From the empirical results discussed in Table 2, we can conclude that the dynamic asset allocation strategy for optimal portfolio selection leads investors in Korea, Hong Kong, and Singapore to allocate more resources to domestic bonds than to domestic stocks. However, investors in the U.S. invest more wealth in domestic stocks than in domestic bonds. Also, investors in all countries short bills (borrow funds) to invest more wealth in domestic risky assets with a varying degree of relative risk aversion coefficients.

We can interpret the results reported in Table 2 that the investors can maximize the expected lifetime utility by shorting 3-month government bill and investing in domestic stock and domestic bond without overseas investment opportunities. For the intertemporal hedging demand for risky assets, the intertemporal hedging demand for the U.S., Hong Kong, and Singapore stands out. For Korea, the myopic demand for domestic stocks and domestic bonds far outweighs the intertemporal hedging demand. We do not analyze the sources of strong intertemporal hedging demand for the stock markets in the aforementioned countries in this paper. However, it is clear that the total demand for risky assets have higher portion of myopic demand than intertemporal hedging demand for the investors in Korea. The investors in other countries can increase the expected lifetime utility more by dynamically allocating assets compared to the investors in Korea.

We repeat the analysis of portfolio selection for domestic assets using the CCV model with varying ψ values and report the results in Table 3. The optimal portfolio results in the fourth column of each country panel are the same as the results in Table 2, because we assume the elasticity of intertemporal substitution as 1.0 when we analyze dynamic asset allocation strategy in Table 2. We duplicate the results in Table 3 for comparison.

We report the total, myopic, and intertemporal hedging demand for stocks, bonds, and bills as domestic investable assets in the U.S., Korea, Hong Kong, and Singapore in Table 3. For each country, we set $\gamma = 7$, along with different ψ values to calculate the CCV optimal consumption.

Table 3. Optimal Portfolio Choice for Domestic Assets with Varying ψ Values

		USA		
		$\psi = 0.5$	$\psi = 1$	$\psi = 1.5$
Stock	Total	58.73	62.14	67.39
	Myopic	33.24	33.24	33.24
	Hedging	25.49	28.90	34.15
Bond	Total	35.05	35.58	36.47
	Myopic	48.82	48.82	48.82
	Hedging	-13.77	-13.24	-12.35
Bill	Total	6.23	2.28	-3.85
	Myopic	17.94	17.94	17.94
	Hedging	-11.71	-15.67	-21.80

		Korea		
		$\psi = 0.5$	$\psi = 1$	$\psi = 1.5$
Stock	Total	5.47	5.74	6.08
	Myopic	1.34	1.34	1.34
	Hedging	4.14	4.40	4.74
Bond	Total	97.68	100.04	103.41
	Myopic	125.32	125.32	125.32
	Hedging	-27.64	-25.28	-21.91
Bill	Total	-3.16	-5.78	-9.49
	Myopic	-26.66	-26.66	-26.66
	Hedging	23.51	20.88	17.17

Table 3. Continued

		Hong Kong		
		$\psi = 0.5$	$\psi = 1$	$\psi = 1.5$
Stock	Total	47.62	48.73	49.91
	Myopic	15.17	15.17	15.17
	Hedging	32.45	33.56	34.74
Bond	Total	72.95	73.13	73.32
	Myopic	69.21	69.21	69.21
	Hedging	3.74	3.91	4.11
Bill	Total	-20.57	-21.86	-23.23
	Myopic	15.62	15.62	15.62
	Hedging	-36.19	-37.47	-38.85

		Singapore		
		$\psi = 0.5$	$\psi = 1$	$\psi = 1.5$
Stock	Total	31.11	31.61	32.17
	Myopic	21.39	21.39	21.39
	Hedging	9.73	10.22	10.78
Bond	Total	207.19	207.59	208.06
	Myopic	198.16	198.16	198.16
	Hedging	9.02	9.43	9.89
Bill	Total	-138.30	-139.20	-140.23
	Myopic	-119.55	-119.55	-119.55
	Hedging	-18.75	-19.65	-20.68

Notes: The table reports the total, myopic, and hedging demand for domestic stocks, bonds, and bills. The optimal portfolio selection problems are solved with $\gamma = 7$, and $\psi = 0.5, 1.0, \text{and } 1.5$. The numbers are portfolio weights and in percentage units. For each value of ψ, the portfolio weights on domestic stocks, bonds, and bills sum to one hundred.

From the empirical results reported in Table 3, we find that the dynamic asset allocation strategy for optimal portfolio selection leads investors in Korea, Hong Kong, and Singapore to allocate more resources to domestic bonds than to domestic stocks. However, investors in the U.S. allocate more wealth to domestic stocks than in domestic bonds. Also, investors in Korea, Hong Kong, and Singapore short bills (borrow funds) to invest more wealth in domestic risky assets with a varying coefficients of elasticity of intertemporal substitution. The optimal portfolio weights on total, myopic, and hedging demand for domestic stocks increase as the degree of elasticity of intertemporal substitution increases. While the portfolio weights on domestic bonds increase with increasing ψ values, those on bills move in the opposite direction. The total demand for bills are negative except for the two cases in the U.S, meaning that investors short bills (borrow money) to allocate more wealth to risky assets, stocks and bonds. Compared to the model that focuses on the myopic demand for risky assets, we find that the investors can increase the expected lifetime utility by expanding the investment opportunities intertemporally. The effect of intertemporal hedging demand on the expected lifetime utility can be gleaned from the increase in the intertemporal hedging demand with increasing values of ψ.

3. Optimal Portfolio Demand for Domestic and Foreign Assets

In this section, we analyze dynamic asset allocation for optimal consumption for the investors in Korea. We assume that the investors in Korea allocate investors resources not only to domestic stocks, bonds, and bills but also to foreign stocks and bonds. When the investors in Korea allocate their wealth to domestic stocks, bonds, and bills, they simultaneously have the option to allocate their resources to stocks and bonds from the other three countries, the U.S., Hong Kong, and Singapore. The optimal portfolio demands for domestic and foreign assets are reported in Tables 4 and 5.

While we still use the data on domestic stocks, bonds, and bills for Korean assets defined in the previous section, we convert the data on foreign stocks and bonds in foreign currency units to the data on foreign stocks, bonds, and bills in Korean won units using exchange rates. From the perspective of Korean investors, for example, we calculate the log return on the foreign stock index by converting the foreign stock index return (Hong Kong stock index return) to Korean won return using exchange rates. The log excess foreign stock index return is the difference between the log Korean won return on a total return index for Hong Kong stock and the log return on a total return index for a three-month Korean government bill. Likewise, the log excess return on a Hong Kong government bond is the difference between the log Korean won return on a total return index for a ten-year Hong Kong government bond and the log return on a total return index for a three-month Korean government bill.

We report the total, myopic, and hedging demand of an investor in Korea for foreign stocks, and bonds as well as domestic stocks, bonds, and bills in Table 4. For the analysis, we set $\psi = 1$, along with different γ values to calculate the CCV optimal consumption. The U.S., Hong Kong, and Singapore serve as the foreign country one at a time. Due to a different time span of the data, we use the sample period from June, 1993 to January, 2016 in the analysis.

Table 4. Optimal Portfolio Demand for Domestic and Foreign Assets for Korean Investors

		Foreign Country: USA		
		$\gamma = 4$	$\gamma = 7$	$\gamma = 10$
Domestic Stock	Total	20.65	13.70	10.49
	Myopic	7.33	4.44	3.28
	Hedging	13.32	9.26	7.21
Domestic Bond	Total	196.98	113.09	80.70
	Myopic	250.77	142.93	99.79
	Hedging	-53.79	-29.84	-19.10
Foreign Stock	Total	63.71	43.27	33.64
	Myopic	41.17	23.37	16.25
	Hedging	22.54	19.90	17.39
Foreign Bond	Total	22.82	7.06	1.40
	Myopic	32.30	19.29	14.08
	Hedging	-9.48	-12.23	-12.68
Domestic Bill	Total	-204.16	-77.11	-26.24
	Myopic	-231.57	-90.02	-33.40
	Hedging	27.41	12.91	7.17

		Foreign Country: Hong Kong		
		$\gamma = 4$	$\gamma = 7$	$\gamma = 10$
Domestic Stock	Total	1.08	0.23	-0.10
	Myopic	-1.77	-0.76	-0.35
	Hedging	2.85	0.99	0.26
Domestic Bond	Total	184.65	108.47	78.47
	Myopic	218.06	124.29	86.78
	Hedging	-33.40	-15.81	-8.31
Foreign Stock	Total	74.16	54.23	43.71
	Myopic	28.04	15.95	11.11
	Hedging	46.12	38.28	32.60
Foreign Bond	Total	-9.77	-15.40	-16.38
	Myopic	16.95	10.49	7.91
	Hedging	-26.72	-25.89	-24.29
Domestic Bill	Total	-150.13	-47.54	-5.71
	Myopic	-161.28	-49.97	-5.45
	Hedging	11.15	2.43	-0.26

Table 4. Continued

		Foreign Country: Singapore		
		$\gamma = 4$	$\gamma = 7$	$\gamma = 10$
Domestic Stock	Total	11.18	5.98	3.83
	Myopic	6.18	3.76	2.79
	Hedging	5.00	2.22	1.04
Domestic Bond	Total	177.61	98.03	66.66
	Myopic	212.43	121.09	84.56
	Hedging	-34.81	-23.06	-17.90
Foreign Stock	Total	49.22	28.56	18.69
	Myopic	21.04	11.78	8.08
	Hedging	28.18	16.78	10.62
Foreign Bond	Total	-20.79	-12.18	-8.05
	Myopic	-0.88	0.53	1.09
	Hedging	-19.91	-12.71	-9.15
Domestic Bill	Total	-117.22	-20.38	18.87
	Myopic	-138.77	-37.16	3.48
	Hedging	49.08	16.78	15.38

Notes: The table reports the total, myopic, and hedging demand for domestic stocks, bonds, and bills as well as for foreign stocks and bonds. The optimal portfolio selection problems are solved with $\psi = 1$, and $\gamma = 4, 7,$ and 10. The numbers are portfolio weights and in percentage units. For each value of γ, the portfolio weights on domestic stocks, bonds, bills, foreign stocks, and bonds sum to one hundred.

According to Table 4, when an investment opportunity to allocate an investor's wealth to foreign assets is given to a Korean investor, the investor increases hedging demands for foreign stocks in the U.S. and Singapore compared to the case where the investor can only invest in domestic stocks. An investor in Korea puts 20.7% of investable resources on domestic stocks, 197.0% on domestic bonds, and -204.2% on domestic bills. On the other hand, the investor allocates 63.7% of the funds to stocks and 22.8% to bonds in the U.S. The total demand for domestic bills is negative, thus investors in Korea short bills in all cases. The investors in Korea have the smallest portfolio weights on domestic stocks when their foreign investment opportunity is in the Hong Kong market. While they put from 1.1% to -0.1% of investable wealth on domestic stocks, they invest from 74.2% to 43.7% of the wealth on foreign stocks in Hong Kong depending on the value of γ. The intertemporal hedging demand for domestic stocks grows larger when Korean investors can choose foreign stocks in the U.S. market. The investors in Korea short bills in order to invest in the risky assets, stocks and bonds except the case where the investment opportunity in foreign assets is in Singapore and we assume the highest relative risk aversion coefficient of $\gamma = 10$.

The allocation of portfolio demand for the investors in Korea with the alternative investment opportunity in the Singapore market is presented in the last panel of Table 4. For all values of relative risk aversion coefficients, the investors in Korea short bills from 1.17 to 0.20 times of investable wealth. The investors in Korea invest 11.2% of the investable wealth on domestic stocks, 117.6% on domestic bonds, 49.2% on foreign stocks, and -20.8% on foreign bonds in Singapore market. The total demand for bills is large negative numbers, meaning that they borrow a great amount of cash to increase the portfolio weight on stocks and bonds in Singapore market as well as in domestic market.

When domestic investors in Korea have access to stock and bond markets in the U.S., Hong Kong, and Singapore, the dynamic asset allocation strategy for optimal portfolio demand leads investors in Korea to allocate most resources to domestic bonds and foreign stocks in order. The portfolio weights on foreign bonds and domestic stocks do not show the same pattern. Depending on foreign assets in hand, domestic investors in Korea put more weight on foreign bonds than on domestic stocks, or vice versa. Also, investors in Korea short domestic bills (borrow funds) to invest more wealth in risky assets with a varying degree of relative risk aversion coefficients with one exception ($\gamma = 1$, Singapore case).

Table 5. Optimal Portfolio Demand for Domestic and Foreign Assets for Korean Investors with Varying ψ Values

		Foreign Country: USA		
		$\psi = 0.5$	$\psi = 0.8$	$\psi = 1.1$
Domestic Stock	Total	12.81	13.27	13.96
	Myopic	4.44	4.44	4.44
	Hedging	8.37	8.83	9.53
Domestic Bond	Total	109.39	111.22	114.27
	Myopic	142.93	142.93	142.93
	Hedging	-33.54	-31.71	-28.66
Foreign Stock	Total	34.96	38.92	46.16
	Myopic	23.37	23.37	23.37
	Hedging	11.59	15.55	22.79
Foreign Bond	Total	15.20	11.09	4.54
	Myopic	19.29	19.29	19.29
	Hedging	-4.09	-8.20	-14.74
Domestic Bill	Total	-72.36	-74.49	-78.94
	Myopic	-90.02	-90.02	-90.02
	Hedging	17.66	15.53	11.08

Table 5. Continued

		Foreign Country: Hong Kong		
		$\psi = 0.5$	$\psi = 0.8$	$\psi = 1.1$
Domestic Stock	Total	0.94	0.62	-0.04
	Myopic	-0.76	-0.76	-0.76
	Hedging	1.70	1.38	0.72
Domestic Bond	Total	103.15	105.85	110.14
	Myopic	124.29	124.29	124.29
	Hedging	-21.14	-18.43	-14.15
Foreign Stock	Total	45.94	50.40	56.50
	Myopic	15.95	15.95	15.95
	Hedging	29.99	34.45	40.55
Foreign Bond	Total	-5.69	-10.81	-18.21
	Myopic	10.49	10.49	10.49
	Hedging	-16.18	-21.30	-28.70
Domestic Bill	Total	-44.34	-46.07	-48.40
	Myopic	-49.97	-49.97	-49.97
	Hedging	5.63	3.90	1.57

		Foreign Country: Singapore		
		$\psi = 0.5$	$\psi = 0.8$	$\psi = 1.1$
Domestic Stock	Total	6.19	6.06	5.95
	Myopic	3.76	3.76	3.76
	Hedging	2.43	2.30	2.19
Domestic Bond	Total	96.45	97.25	98.51
	Myopic	121.09	121.09	121.09
	Hedging	-24.64	-23.84	-22.58
Foreign Stock	Total	25.16	27.06	29.40
	Myopic	11.78	11.78	11.78
	Hedging	13.38	15.28	17.62
Foreign Bond	Total	-7.89	-10.31	-13.21
	Myopic	0.53	0.53	0.53
	Hedging	-8.42	-10.84	-13.74
Domestic Bill	Total	-19.90	-20.06	-20.65
	Myopic	-37.16	-37.16	-37.16
	Hedging	17.26	17.10	16.51

Notes: The table reports the total, myopic, and hedging demand for domestic stocks, bonds, and bills as well as for foreign stocks and bonds. The optimal portfolio selection problems are solved with $\gamma = 7$ and $\psi = 0.5, 0.8,$ and 1.1. The numbers are portfolio weights and in percentage units. For each value of ψ, the portfolio weights on domestic stocks, bonds, bills, foreign stocks, and bonds sum to one hundred.

We calculate dynamic asset allocation for optimal portfolio demand using the CCV model with varying ψ values when investors in Korea have access to foreign assets in the U.S., Hong Kong, and Singapore and report the results in Table 5. We report the total, myopic, and hedging demand for foreign stocks and bonds as well as domestic stocks, bonds, and bills in Korea. For each foreign country, we set $\gamma = 7$, along with different ψ values to calculate the CCV optimal consumption.

According to Table 5, the Korean investors, in general, have smaller portfolio weights on domestic stocks compared to the weights on foreign stocks. The optimal portfolio weights on total, myopic, and hedging demand for foreign stocks for the Korean investors increase as the degree of elasticity of intertemporal substitution increases, however, portfolio weights on domestic stocks decreases when overseas investment opportunities are in the Hong Kong and Singapore market (panel 2, 3 of Table 5). This means that the investors in Korea increase portfolio weights on foreign stocks instead of domestic stocks when the degree of elasticity of intertemporal substitution increases. While the portfolio weights on domestic bonds for Korean investors increase with increasing ψ values, those on bills move in the opposite direction. The total demand for bills is negative, meaning that investors short bills (borrow money) to allocate more wealth to risky assets, stocks and bonds, especially more funds to foreign stocks.

The first panel of Table 5 shows how Korean investors optimally allocate their funds between the U.S. and Korean markets. The intertemporal hedging demand for domestic stocks are larger than the myopic demand for domestic stocks. For the U.S. stock market, however, the myopic demand has a higher portfolio weight than the intertemporal hedging demand. For this investment opportunity, Korean investors short bills in order to invest in domestic and foreign risky assets for all values of ψ.

From the empirical results reported in Table 5, we can conclude that the dynamic asset allocation strategy for optimal portfolio demand leads Korean investors to allocate more resources to foreign stocks than to domestic stocks. Also, Korean investors short bills (borrow funds) to put more wealth on domestic bonds and foreign stocks than on domestic stocks and foreign bonds with a varying coefficients of elasticity of intertemporal substitution.

We analyze dynamic asset allocation for optimal consumption for the investors in the U.S., Hong Kong, and Singapore when they have access to Korean stock and bond markets as overseas investment opportunities and report the results in Table 6 and Table 7. We assume that the investors in the three countries allocate funds not only to domestic stocks, bonds, and bills but also to Korean stocks and bonds. When the investors allocate their wealth to domestic stocks, bonds, and bills, they simultaneously have the option to allocate their resources to stocks and bonds in the Korean market.

We convert the data on foreign stocks and bonds from foreign currency units to domestic currency units using exchange rates. From the perspective of the U.S. investors, for example, we calculate the log return on the foreign stock index by converting the foreign stock index return (KOSPI return) to U.S. dollar return using exchange rates. The log excess foreign stock index return is the difference between the log U.S. dollar return on a total return index for Korean stock and the log return on a total return index for a three-month U.S. Treasury bill. Likewise, the log excess return on a Korean government bond is the difference between the log U.S. dollar return on a total return index for a ten-year Korean government bond and the log return on a total return index for a three-month U.S. Treasury bill.

Table 6. Optimal Portfolio Demand for Domestic and Foreign Assets When Foreign Investment Opportunities are in Korean Market

		Domestic Country: USA		
		$\gamma = 4$	$\gamma = 7$	$\gamma = 10$
Domestic Stock	Total	210.92	152.04	119.98
	Myopic	102.91	58.64	40.94
	Hedging	108.01	93.40	79.04
Domestic Bond	Total	269.37	167.66	122.31
	Myopic	196.57	111.58	77.58
	Hedging	72.80	56.08	44.73
Foreign Stock	Total	-10.82	-5.53	-3.60
	Myopic	-14.70	-8.33	-5.78
	Hedging	3.89	2.80	2.18
Foreign Bond	Total	39.16	22.86	16.65
	Myopic	37.19	21.36	15.03
	Hedging	1.97	1.50	1.62
Domestic Bill	Total	-408.63	-237.03	-155.34
	Myopic	-221.96	-83.25	-27.77
	Hedging	-186.67	-153.78	-127.58

Table 6. Continued

		Domestic Country: Hong Kong		
		$\gamma = 4$	$\gamma = 7$	$\gamma = 10$
Domestic Stock	Total	66.10	47.49	37.43
	Myopic	31.61	18.76	13.61
	Hedging	34.49	28.73	23.81
Domestic Bond	Total	106.83	60.14	42.58
	Myopic	133.96	74.62	50.89
	Hedging	-27.13	-14.48	-8.30
Foreign Stock	Total	-17.63	-11.64	-8.56
	Myopic	-5.99	-3.55	-2.57
	Hedging	-11.64	-8.09	-5.99
Foreign Bond	Total	83.57	49.39	35.43
	Myopic	75.84	44.27	31.64
	Hedging	7.72	5.11	3.78
Domestic Bill	Total	-138.87	-45.38	-6.88
	Myopic	-135.42	-34.10	6.43
	Hedging	-3.45	-11.28	-13.31

		Domestic Country: Singapore		
		$\gamma = 4$	$\gamma = 7$	$\gamma = 10$
Domestic Stock	Total	73.07	46.82	34.03
	Myopic	31.56	17.79	12.28
	Hedging	41.51	29.03	21.75
Domestic Bond	Total	310.31	184.83	132.44
	Myopic	269.20	155.14	109.51
	Hedging	41.10	29.69	22.92
Foreign Stock	Total	-1.44	-1.42	-1.12
	Myopic	-0.44	-0.27	-0.20
	Hedging	-1.00	-1.15	-0.92
Foreign Bond	Total	42.57	22.40	14.97
	Myopic	61.92	34.95	24.16
	Hedging	-19.35	-12.55	-9.20
Domestic Bill	Total	-324.51	-152.63	-80.31
	Myopic	-262.25	-107.61	-45.76
	Hedging	-62.26	-45.02	-34.56

Note: The table reports the total, myopic, and hedging demand for domestic stocks, bonds, and bills as well as for foreign stocks and bonds. The optimal portfolio demand problems are solved with $\psi = 1$, and $\gamma = 4, 7,$ and 10. The numbers are portfolio weights and in percentage units. For each value of γ, the portfolio weights on domestic stocks, bonds, bills, foreign stocks, and bonds sum to one hundred.

We report the total, myopic, and hedging demand of an investor in the U.S., Hong Kong, and Singapore for foreign stocks, and bonds as well as domestic stocks, bonds, and bills in Table 6. For the analysis, we set $\psi = 1$, along with different γ values to calculate the CCV optimal consumption. The U.S., Hong Kong, and Singapore serve as the domestic country respectively. Due to a different time span of the data, we use the sample period from June, 1993 to January, 2016 in the analysis.

According to Table 6, although overseas investment opportunities are given to the investors in the U.S., Hong Kong, and Singapore, none of them put a positive portfolio weight on the Korean stock market. While an investor in the U.S., for example, puts 210.9% of the funds on domestic stocks, 269.4% on domestic bonds, and -408.6% on domestic bills, the investor allocates -10.8% of the funds to stocks and 39.2% to bonds in the Korean market. The total demand for domestic bills are negative, thus investors in the U.S. short bills in all cases.

The dynamic portfolio demands of an investor in Hong Kong and Singapore are similar to those of an investor in the U.S. Compared to the results reported in Table 2, the investors in the U.S. and Singapore increase the portfolio weights on domestic stocks in spite of the overseas investment opportunities in the Korean stock and bond markets. A dramatic increase in short selling of Treasury bills is conspicuous in the U.S. market. The investors in the U.S., Hong Kong, and Singapore short domestic bills (borrow funds) to invest more than their initial funds in risky assets with a varying degree of relative risk aversion coefficients without exception.

We calculate dynamic asset allocation for optimal portfolio demand using the CCV model with varying ψ values when investors in the U.S., Hong Kong, and Singapore have access to overseas investment opportunities in Korean asset markets and report the results in Table 7. We report the total, myopic, and hedging demand for Korean stocks and bonds as well as domestic stocks, bonds, and bills in each country. For each domestic country, we set $\gamma = 7$, along with different ψ values to numerically solve the CCV optimal consumption.

Table 7. Optimal Portfolio Demand for Domestic and Foreign Assets When Foreign Investment Opportunities are in Korean Market with Varying ψ Values

		Domestic Country: USA		
		$\psi = 0.5$	$\psi = 0.8$	$\psi = 1.1$
Domestic Stock	Total	105.88	128.30	167.52
	Myopic	58.64	58.64	58.64
	Hedging	47.23	69.65	108.88
Domestic Bond	Total	154.30	160.96	172.03
	Myopic	111.58	111.58	111.58
	Hedging	42.72	49.38	60.45
Foreign Stock	Total	-5.70	-5.66	-5.42
	Myopic	-8.33	-8.33	-8.33
	Hedging	2.63	2.67	2.92
Foreign Bond	Total	26.31	25.22	20.73
	Myopic	21.36	21.36	21.36
	Hedging	4.95	3.87	-0.63
Domestic Bill	Total	-180.79	-208.82	-254.87
	Myopic	-83.25	-83.25	-83.25
	Hedging	-97.54	-125.57	-171.62

		Domestic Country: Hong Kong		
		$\psi = 0.5$	$\psi = 0.8$	$\psi = 1.1$
Domestic Stock	Total	43.48	45.78	48.39
	Myopic	18.76	18.76	18.76
	Hedging	24.72	27.03	29.64
Domestic Bond	Total	60.39	60.25	60.08
	Myopic	74.62	74.62	74.62
	Hedging	-14.23	-14.37	-14.54
Foreign Stock	Total	-11.16	-11.43	-11.75
	Myopic	-3.55	-3.55	-3.55
	Hedging	-7.61	-7.88	-8.20
Foreign Bond	Total	49.40	49.39	49.38
	Myopic	44.27	44.27	44.27
	Hedging	5.13	5.12	5.11
Domestic Bill	Total	-42.11	-43.99	-46.11
	Myopic	-34.10	-34.10	-34.10
	Hedging	-8.01	-9.89	-12.01

Table 7. Continued

		Domestic Country: Singapore		
		$\psi = 0.5$	$\psi = 0.8$	$\psi = 1.1$
Domestic Stock	Total	43.10	45.18	47.73
	Myopic	17.79	17.79	17.79
	Hedging	25.31	27.40	29.94
Domestic Bond	Total	182.12	183.55	185.61
	Myopic	155.14	155.14	155.14
	Hedging	26.98	28.41	30.47
Foreign Stock	Total	-1.37	-1.42	-1.41
	Myopic	-0.27	-0.27	-0.27
	Hedging	-1.10	-1.15	-1.14
Foreign Bond	Total	23.52	22.92	22.10
	Myopic	34.95	34.95	34.95
	Hedging	-11.43	-12.03	-12.85
Domestic Bill	Total	-147.37	-150.23	-154.03
	Myopic	-107.61	-107.61	-107.61
	Hedging	-39.76	-42.62	-46.42

Note: The table reports the total, myopic, and hedging demand for domestic stocks, bonds, and bills as well as for foreign stocks and bonds. The optimal portfolio selection problems are solved with $\gamma = 7$ and $\psi = 0.5, 0.8,$ and 1.1. The numbers are portfolio weights and in percentage units. For each value of ψ, the portfolio weights on domestic stocks, bonds, bills, foreign stocks, and bonds sum to one hundred.

According to Table 7, the U.S. investors have overwhelmingly larger portfolio weights on domestic stocks compared to weights on foreign stocks. The optimal portfolio weights on total, myopic, and hedging demand for foreign stocks for the U.S. investors are all decreasing negative values as the degree of elasticity of intertemporal substitution increases. This means that although the U.S. investors are offered overseas investment opportunities in Korea, they increase portfolio weights on the U.S. stocks instead of on the Korean stocks when the degree of elasticity of intertemporal substitution increases. While the portfolio weights on domestic bonds for U.S. investors increase with increasing ψ values, those on bills move in the opposite direction. The total demand for bills are negative and decreasing, meaning that investors short bills (borrow money) to allocate more wealth to risky assets, stocks and bonds, especially domestic stocks.

The second panel of Table 7 shows how Hong Kong investors optimally allocate their funds between Hong Kong and Korean markets. The intertemporal hedging demand for domestic stocks are larger than the myopic demand for domestic stocks.

For the Korean stock market, Hong Kong investors short foreign stocks in order to invest in domestic assets for all values of ψ.

From the empirical results reported in Table 7, we can conclude that the dynamic asset allocation strategy for optimal portfolio demand leads foreign investors to allocate more resources to domestic stocks than to Korean stocks. They also short bills (borrow funds) to put more wealth on domestic bonds and stocks than on foreign stocks and bonds with a varying coefficient of elasticity of intertemporal substitution.

IV. Concluding Remarks

In this paper, we solve for the total, myopic, and intertemporal hedging demand for stocks, bonds, and bills using the CCV model. In relation to investment opportunities, we derive the following three conclusions.

First, the dynamic asset allocation strategy for optimal portfolio demand leads domestic investors in Korea, Hong Kong, and Singapore to allocate more funds to domestic bonds than to domestic stocks. However, domestic investors in the U.S. allocate more wealth to domestic stocks than to domestic bonds. The investors in all countries short bills (borrow funds) at a low level of risk aversion to invest more funds in domestic risky assets.

Second, we investigate the dynamic asset allocation strategy when domestic investors in Korea have access to stock and bond markets in the U.S., Hong Kong, and Singapore. The dynamic asset allocation strategy for optimal portfolio demand leads investors in Korea to allocate most resources to domestic bonds and foreign stocks. On the other hand, the portfolio weights on foreign bonds and domestic stocks are relatively low. Investors in Korea also short domestic bills (borrow funds) to invest more wealth in risky assets with a varying degree of relative risk aversion coefficients.

Third, we analyze the dynamic asset allocation for optimal consumption for the investors in the U.S., Hong Kong, and Singapore when they have access to Korean markets as overseas investment opportunities. When the investors allocate their wealth to domestic stocks, bonds, and bills, they simultaneously have the option to allocate their resources to stocks and bonds in the Korean markets. Compared to the results reported in the previous paragraph, the investors in the U.S. and Singapore increase the portfolio weights on domestic stocks in spite of the overseas investment opportunities in the Korean stock and bond markets. A dramatic increase in short selling of Treasury bills is conspicuous in the U.S. market. The investors in the U.S., Hong Kong, and Singapore short domestic bills (borrow funds) to invest more than their initial funds in risky assets with a varying degree of relative risk aversion coefficients without exception.

The investors can maximize the expected lifetime utility by shorting 3-month government bills and investing in stocks and bonds. For the intertemporal hedging demand for risky assets, the intertemporal hedging demand for the U.S., Hong Kong, and Singapore stand out. For Korea, however, the myopic demand for domestic stocks and domestic bonds far outweighs the intertemporal hedging demand. We do not analyze the sources of strong intertemporal hedging demand for domestic stocks in the U.S., Hong Kong, and Singapore in this paper. However, the total demand for domestic stocks have higher portion of myopic demand than intertemporal hedging demand only for the investors in Korea. The investors in other countries can increase the expected lifetime utility more by dynamically allocating assets compared to the investors in Korea.

REFERENCES

Balduzzi, P. and A. W. Lynch. 1999. “Transaction Costs and Predictability: Some Utility Cost Calculations,” *Journal of Financial Economics*, vol. 52, no. 1, pp. 42-78.

Barberis, N. C. 2000. “Investing for the Long Run When Returns Are Predictable,” *Journal of Finance,* vol. 55, no. 1, pp. 225-264.

Brennan, M. J., Schwartz, E. S. and R. Lagnado. 1997. “Strategic Asset Allocation,” *Journal of Economic Dynamics and Control*, vol. 21, no. 8-9, pp. 1377-1403.

Campbell, J. Y. and L. M. Viceira. 1999. “Consumption and Portfolio Decisions When Expected Returns Are Time Varying,” *Quarterly Journal of Economics,* vol. 114, no. 2, pp. 433-495.

Campbell, J. Y. and L. M. Viceira. 2001. “Who Should Buy Long-term Bonds?” *American Economic Review,* vol. 91, no. 1, pp. 99-127.

Campbell, J. Y. and L. M. Viceira. 2002. *Strategic Asset Allocation: Portfolio Choice for Long-term Investor.* Oxford: Oxford University Press.

Campbell, J. Y., Chan, Y. L. and L. M. Viceira. 2003. “A Multivariate Model of Strategic Asset Allocation,” *Journal of Financial Economics*, vol. 67, no. 1, pp. 41-80.

Epstein, L. G. and S. E. Zin. 1989. “Substitution, Risk Aversion, and the Temporal Behavior of Consumption and Asset Returns: A Theoretical Framework,” *Econometrica*, vol. 57, no. 4, pp. 937-969.

Epstein, L. G. and S. E. Zin. 1991. "Substitution, Risk Aversion, and the Temporal Behavior of Consumption and Asset Returns: An Empirical Analysis," *Journal of Political Economy,* vol. 99, no. 2, pp. 263-286.

Kim, T. S. and E. Omberg. 1996. "Dynamic Nonmyopic Portfolio Behavior," *Review of Financial Studies,* vol. 9, no. 1, pp. 141-161.

Lynch, A. W. 2000. Portfolio Choice with Many Risky Assets, Market Clearing, and Cash Flow Predictability. Available in SSRN. <https://ssrn.com/abstract=1295242> (accessed October 1, 2021)

________. 2001. "Portfolio Choice and Equity Characteristics: Characterizing the Hedging Demands Induced by Return Predictability," *Journal of Financial Economics*, vol. 62, no. 1, pp. 67-130.

Lynch, A. W. and P. Balduzzi. 2000. "Predictability and Transaction Costs: the Impact on Rebalancing Rules and Behavior," *Journal of Finance*, vol. 55, no. 5, pp. 2285-2310.

Lynch, A. W. and S. Tan. 2010. "Multiple Risky Assets, Transaction Costs and Return Predictability: Allocation Rules and Implications for U.S. Investors," *Journal of Financial and Quantitative Analysis,* vol. 45, no. 4, pp. 1015-1053.

Merton, R. C. 1969. "Lifetime Portfolio Selection under Uncertainty: The Continuous-time Case," *Review of Economics and Statistics,* vol. 51, no. 3, pp. 247-257.

________. 1971. "Optimum Consumption and Portfolio Rules in a Continuous-time Model," *Journal of Economic Theory,* vol. 3, no. 4, pp. 373-413.

Rapach, D. E. and M. E. Wohar. 2009. "Multi-period Portfolio Choice and the Intertemporal Hedging Demands for Stocks and Bonds: International Evidence," *Journal of International Money and Finance,* vol. 28, no. 3, pp. 427-453.

First version received on May 17, 2021
Peer-reviewed version received on July 12, 2021
Final version accepted on July 27, 2021