What Explains Current Account Surplus in Korea?*

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Abstract

Since the currency crisis in 1998, Korea has experienced continuous current account surpluses. Recently, the current account surplus increased more rapidly—amounting to 7.7 percent of GDP in 2015. In this paper, we investigate the underlying reasons for the widening of Korea's current account surpluses. We find that the upward trend in Korea's current account surpluses is largely explained by its demographical changes. Other economic variables are only helpful when explaining short run fluctuations in current account balances. Moreover, we show that Korea's current account surplus is expected to disappear by 2042 as it becomes one of the most aged economies in the world. Demographic changes are so powerful that they explain, quite successfully, the current account balance trends of other economies with highly aged populations such as Japan, Germany, Italy, Finland, and Greece. When we add the real exchange rate as an additional explanatory variable, it is statistically significant with the right sign, but the magnitude explained by it is quite limited. For example, to reduce the current account surplus by 1 percentage point, a 12 percent depreciation is needed. If Korea's current exchange rate is undervalued 4 to 12 percent less than the level consistent with fundamentals, it is impossible to reduce Korea's current account surplus to a reasonable level by adjusting the exchange rate alone. Another way to reduce current account surplus is to expand fiscal policies. We find, however, that the impact of fiscal adjustments in reducing current account surplus is even more limited. According to our estimates, reducing the current account surplus by 1 percentage point requires an increase in budget deficits (as a ratio to GDP) of 5 to 6 percentage points. If we allow endogenous movements of exchange rate and fiscal policy, the impact of exchange rate adjustment increases by 1.6 times but that of fiscal policy decreases that it is no longer statistically significant.

* We appreciate the helpful comments of Sung-Chun Jung, Doo Yong Yang, Jae Ryang Lee, Jong-Wha Lee and Deok Ryong Yoon at the KIEP-IMF conference. We also thank Jimin Oh and Sul Wi Shin for their excellent research assistance and KIEP for financial support. Research by Han was financially supported by Korea University (K1710071). An earlier version of this paper is available as KIEP Working Paper No. 16-15.

Asian Economic Papers 17:2
doi:10.1162/ASEP_a_00610

1. Introduction

A perpetual and large current account balance surplus is not desirable for any country or its neighboring countries as a group.[1] Nevertheless, some countries have persistent current account surpluses, contributing to global imbalances up to a level that is worrisome. For example, Germany has been continuously experiencing current account surpluses since 2002, amounting for 8.4 percent of GDP in 2015.[2] China has never experienced current account deficits since 1997, the year that data are first available. Japan's record is even longer; its consecutive current account surplus started from 1981. Recently, Korea joined this large current-account surplus club: Since the currency crisis in 1997, Korea's current account balance has been continuously in the black, expanding even more in recent years.

So why do these countries enjoy current account surpluses for such prolonged periods of time? In this paper, we will present an empirical methodology that explains how current account balances are determined and, by implementing it, attempt to diagnose factors that account for Korea's current account surplus. In fact, the IMF has introduced a methodology, the External Balance Assessment (EBA) (Phillips et al. 2013), to assess exchange rate and current account gaps that are defined as the difference between current levels and those consistent with fundamentals. For example, the 2016 External Sector Report, by utilizing this methodology, demonstrates that Korea's real effective exchange rate in 2015 was 4 to 12 percent undervalued relative to the level consistent with fundamentals.

Although the IMF's EBA approach incorporates major studies in the literature, we feel that it has some limitations when analyzing the movements of Korea's current account balances. First, although the EBA methodology states that demographic changes are one of the most crucial factors in explaining the movement of current account balances, neither the old dependency nor youth dependency ratio is significant in its estimation. We believe that the old dependency and/or youth dependency ratio is limited in fully representing all demographic changes, and that the impact of aging on current account balances is better captured by tracking down changes in the entire age distribution instead. The reason is that, as shown by Lee and Shin (2017), in some cases the working population share can rise even when the dependency ratio increases if the youth ratio is rapidly shrinking.

Secondly, the IMF's EBA methodology includes a dummy variable for oil-exporting countries as an explanatory variable in the current account estimation, which recognizes that oil-exporting countries tend to have current account surpluses. A positive coefficient for the dummy variable is justified because these countries need to accumulate current

1 See, for example, Blanchard and Milesi-Ferretti (2011) for reasons why current account balances should be reduced.

2 Current account data in this paper are obtained from IMF's World Economic Outlook Database.

account surpluses to prepare for the future when oil reserves will be depleted. Nonetheless, as will be illustrated in the next section, a number of oil-exporting countries experienced current account deficits in 2015 because of a drop in oil prices. In contrast, oil-importing countries such as Korea are experiencing an increase in current account surpluses. Hence, the dummy variable does not adequately explain the recent movements of current account balances of oil-exporting versus oil-importing countries. In this paper, we will instead utilize information on both oil exports and imports of individual countries as well as oil price changes in the current account estimation. This way, an increase in the current account surplus of oil-importing countries can be attributable to declines in oil prices.

Lastly, as will be shown in the next section, exchange rate movements cannot explain the recent increase in Korea's current account surplus. By calculating the exchange rate gap, the IMF's EBA methodology suggests that adjusting the exchange rate will decrease current account surpluses. There are a number of other factors that explain current account balances, however, and in Korea's case, the exchange rate movement does not seem to contribute much to reducing the recent increase in current account surplus.

The remainder of the paper is organized as follows. In Section 2, we explain the latest trend in global imbalances and how Korea's current account surplus contributes to them. Section 3 introduces our empirical methodology and describes the data used for it. In Section 4, by utilizing the empirical methodology, we decompose Korea's current account surplus into portions explained by main factors. Section 5 draws policy implications from the analyses and Section 6 concludes.

2. Korea and global imbalances

Global current account imbalances narrowed significantly after the global financial crisis (GFC) broke out in 2008 and then have more or less stabilized since 2009. If, however, we focus on the current account balances of the United States and China, the two largest deficit and surplus countries in the world, we notice some worrisome movements in the most recent years. These two countries were the main contributors to the decrease in global imbalances from 2006 to 2012.[3] The U.S.'s deficit surged to −5.8 percent of its GDP in 2006, shrunk to −2.7 percent in 2009, and then further waned to −2.2 percent in 2013. China's surplus shows a similar path but in a symmetric way: It peaked at 9.9 percent of GDP in 2007 and decreased to 1.5 percent in 2013. However, the U.S.'s deficit and China's surplus bounced back to −2.6 percent and 3.0 percent of GDP, respectively, in 2015. Although

3 Oil exporters' current account surplus decreased from 1.1 percent of the world GDP in 2006 to −0.1 percent in 2015, is another important contributor to the shrink of global imbalances. On the other hand, the current account surplus of Europe surplus countries actually expanded from 2.8 percent of the world GDP in 2006 to 3.1 percent in 2015. These figures are based on the World Economic Outlook Database and see Table 1 in the working paper version of this paper for details.

China's current account surplus as a percentage of its own GDP decreased compared with that of 2007, the rapid growth China experienced results in its surplus in terms of the world GDP to be almost identical to that of 2006 (0.45 percent).[4]

Whether global imbalances will expand again in the future is an open question. IMF's (2014) World Economic Outlook finds that global current account imbalances have significantly narrowed after the GFC mainly as a result of demand depression in deficit countries and the faster recovery of emerging countries. The contraction of global imbalances is expected to last as long as the decrease in output due to diminished demand in deficit countries is matched by lower potential output. If potential output is not permanently reduced, however, there still remains the risk that global imbalances will widen again.[5] IMF (2016) also finds that global imbalances increased moderately in 2015, reflecting the uneven strength of recovery in advanced countries. Another concern is oil prices; if they increase again, this may lead to the expansion of the current account surpluses of oil exporting countries, worsening global imbalances.

Korea's current account surplus has greatly contributed to global imbalances in recent years.[6] Korea's current account surplus was 0.4 percent of GDP in 2006 and remained small until 2011 at 1.6 percent (not shown). Since then, it has continuously increased, to reach 7.7 percent of GDP in 2015. Although Korea did not appear in the list of the top ten current account surplus countries in 2006, Korea's current account surplus accounted for 0.14 percent of the world GDP in 2015, making it the fourth largest surplus country, just after China (first), Germany (second) and Japan (third). IMF (2016) also points out that Germany and Korea are two countries with excessively persistent current account surpluses that remain substantially stronger than fundamentals.

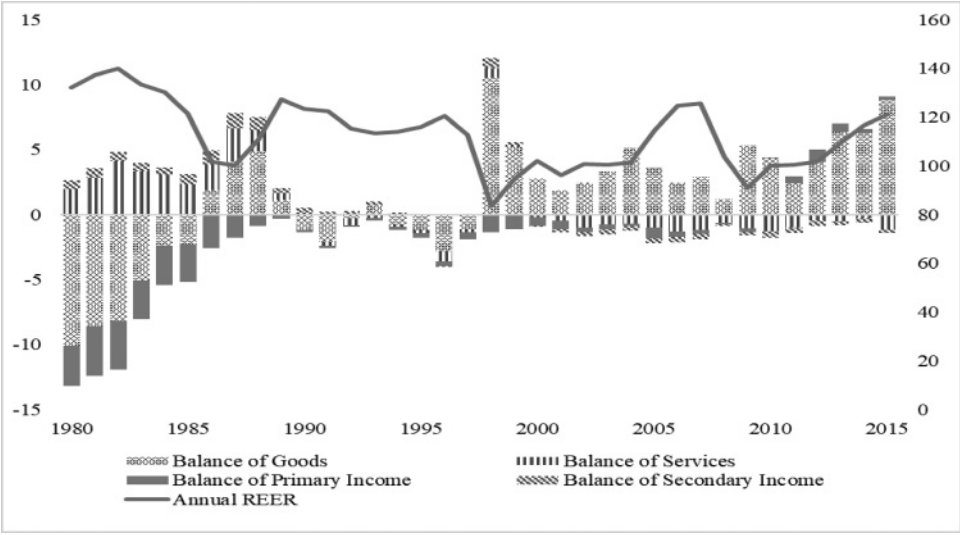
Korea's rapid increase in current account surplus in these years constitutes the background of high pressure on Korea. Three criteria were adopted in determining so-called "unfair" currency practices—that is, whether a trade partner (1) has a significant bilateral trade surplus with the United States; (2) has a material current account surplus; and (3) is engaged in persistent one-sided intervention in the foreign exchange market (U.S. Department of Treasury 2016a). In the April 2016 report, the U.S. Department of Treasury selected five countries that met two of the three criteria: China, Japan, Korea, Taiwan, and Germany. According to the report, China, Japan, Germany, and Korea satisfied the first two criteria, and Taiwan satisfied the last two criteria, but no country met all three. In the second report,

4 They differ only at three decimal places.

5 See Lu (2017), for example, for the prospect of China's economic growth.

6 The figures are based on the World Economic Outlook Database and see the working paper version of the paper for details.

Figure 1. Korea's current account balances and the real effective exchange rate



Source: *Current account balance data are collected from the Bank of Korea; the real effective exchange rate is from the Bank for International Settlements.*

Note: *The solid line, measured by the right axis, is the real effective exchange rate (REER). The current account balances as percentage of GDP, measured by the left axis, are divided into balances of goods, services, primary income, and secondary income.*

disclosed in October 2016 (U.S. Department of Treasury 2016b), the U.S. Department of Treasury included, in addition to these five countries, one more country (Switzerland) to the monitoring list.

The reports implicitly assume that the current account surpluses of these countries will be substantially reduced by exchange rate adjustments—but the current account surpluses of these countries cannot be explained by the exchange rate alone. This can be seen, for example, when looking at Korea's current account balances and the real effective exchange rate from 1980 to 2015, shown in Figure 1. The correlation between the two is clearly negative until 2007 (its value being −0.80), implying that depreciation of the real effective exchange rate is in line with currency account surplus. It becomes positive after the GFC (its value being 0.67). After the GFC, despite a rapid appreciation of the real effective exchange rate, Korea's current account surplus has been continuously increasing.

Therefore, it is important to explain what other factors are responsible for the large surplus of Korea's current account balance these years. In the next section we explain the empirical methodology and the data used in our analyses.

3. Data and methodology

The methodology we use in this paper is the comparison of Korea's experience with those of other OECD countries. For this, we take the strategy of fitting a model for current account balance using an OECD panel data set that excludes Korea, and then predicting Korea's current account balance based on the fitted model and Korea's predictor variables.

Important predictors include population distribution, variables that measure economic structure, and those for business cycles. Population distribution enters the equation in a restricted way following Fair and Dominguez (1991) and Higgins (1998), who characterize the demographic characteristics in terms of three quantities.[7] Specifically, let p_j be the fraction of the jth age group to the total population, for $j = 1, \ldots, J$. Note that $\sum_{j=1}^{J} p_j = 1$ and thus using all the densities as explanatory variables cause perfect collinearity with the constant term, and thus a restriction should be imposed. When the effect of age distribution is modeled as $\sum_{j=1}^{J} \alpha_j p_j$, these studies impose a further restriction that the population coefficient, α_j, is a cubic function of j—that is, $\alpha_j = \sum_{k=0}^{3} \gamma_k j^k$—which implies that[8]

$$\sum_{j=1}^{J} \alpha_j p_j = \sum_{j=1}^{J} \left(\sum_{k=0}^{3} \gamma_k j^k \right) p_j = \sum_{k=0}^{3} \gamma_k \left(\sum_{j=1}^{J} j^k p_j \right) = \gamma_0 + \sum_{k=1}^{3} \gamma_k \left(\sum_{j=1}^{J} j^k p_j \right). \tag{1}$$

The perfect collinearity issue remains even after these cubic restrictions are imposed. Higgins (1998) solves this issue by normalizing the population coefficients by

$$\sum_{j=1}^{J} \alpha_j = 0, \text{ i.e., } \sum_{j=1}^{J} \left(\sum_{k=0}^{3} \gamma_k j^k \right) = 0,$$

which implies that

$$\gamma_0 = -\sum_{k=1}^{3} \gamma_k \frac{1}{J} \sum_{j=1}^{J} j^k.$$

Substituting this for equation (1) yields

$$\sum_{j=1}^{J} \alpha_j p_j = \sum_{k=1}^{3} \gamma_k D_k, \text{ where } D_k = \sum_{j=1}^{J} j^k p_j - \frac{1}{J} \sum_{k=1}^{3} j^k. \tag{2}$$

7 The Fair and Dominguez (1991) approach has been widely adopted to analyze the impact of demographical changes on current account balances in Korea. See, among others, Kwon (2014) and Shin, Han, and Park (2016).

8 For a more general approach of nonparametric estimation that does not impose any restrictions on population coefficients, see Park, Shin, and Whang (2010).

Table 1. Sources of data

Data source	Variables
World Economic Outlook Database World Development Indicators	Current account balance (% of GDP), fuel imports and exports (% of merchandise imports and exports), merchandise imports and exports (current US$), GDP (current US$, LCU), broad money (% of GDP), net foreign asset (current LCU), real growth rate, cash surplus/deficit
United Nations	Population
Penn World Table	PPP-adjusted GDP
Global Economic Monitor	Crude oil price
Bank for International Settlement	Real effective exchange rates
IMF's Direction of Trade Statistics	Bilateral exports and imports
Korean Labor and Income Panel Study	Average propensity to consume by age group
Statistics Korea	Future age distribution up to 2060

This way, the population distribution is characterized by the three quantities D_1, D_2, and D_3.[9] See Higgins (1998) for more details on this restricted specification.

We follow Chinn and Prasad (2003) in using other possible predictors that include GDP gaps (ratio to GDP), GDP level (relative to the United States), growth, crude oil price interacted with fuel imports (ratio to GDP), trade openness (trade volume as percentage of GDP), net foreign assets (ratio to GDP), and government budget surplus (cash surplus/deficit as a percentage of GDP).[10] We also consider real effective exchange rates, though it is more likely to be endogenously determined together with the dependent variable. The explained and explanatory variables are obtained from various sources. Table 1 summarizes the data sources. The final data set consists of 34 OECD countries for the period 1980–2015.

It is not easy to set up a model that is not subject to potential problems of omitted important variables and endogeneity. Hence, we consider as many cases as possible including the following three basic models:

Model 1: The first model explains the current account to GDP ratio (CA) only by the age distribution measured by D1, D2, and D3. The purpose of fitting this model is to examine the extent to which demographic changes are able to explain the evolution of CA in Korea as well as other OECD countries. As shown in the next section, experiences in other OECD countries summarized by fixed effects regression predicts the long-run trend of Korea's CA quite well. Demographic changes, however, do not provide information on the

9 Alternatively, one can describe the demographic characteristics by youth and old dependency ratios. This approach, however, imposes even more restrictive assumptions that population distribution affects current account balances only through youth and old dependency ratios.

10 Chinn and Prasad (2003) also considered financial deepening (money to GDP ratio), and volatility of terms of trade index. But these are not used in our analyses because of the limitation of data availability.

Table 2. The three basic models: Dependent variable: CA (current account balance to GDP, percent)

Model	Explanatory variables
1	Age distribution (D1, D2, D3)
2	Age distribution (D1, D2, D3), GDP gap ratio, trade partners' average GDP gap ratio, crude oil price, fuel exports (% of GDP), fuel imports (% of GDP), relative GDP (PPP, USA = 1), real growth rate, openness, net foreign asset (ratio to GDP), government budget surplus (% of GDP)
3	Age distribution (D1, D2, D3), real effective exchange rate, cash surplus/deficit

cross-country differences in the levels of CA—that is, different age distributions across countries hardly remove the fixed effects in the estimation.

Model 2: A more detailed model is considered that includes economic variables such as business cycles (GDP gap ratios, percentage of GDP), crude oil price (interacted with fuel imports to GDP ratio), trade openness (percentage of GDP), real GDP growth (percentage), net foreign assets (percentage of GDP), government budget surplus (percentage of GDP), and relative income level (to the United States), as well as age distribution (D1–D3). For business cycle considerations, we include the country's GDP gap ratio and the trading partners' average GDP gap ratio weighted by exports volumes, where GDP gaps are measured by the cyclical deviations from its trend obtained by the Hodrick-Prescott filter.[11] The purpose of considering this detailed model is to examine the effects of various economic conditions together with demographic changes.

Model 3: We examine Model 1 again with policy variable(s)—a model with either the real effective exchange rate (Model 3a), or government budget surplus (Model 3b), or both (Model 3c). By fitting the model with the real effective exchange rate (Model 3a), for example, we aim to estimate the total effect of the exchange rate on CA—that includes the indirect effects of exchange rate through other control variables—in search of evidence on how much an exchange rate market intervention, if it existed, would influence current account balance to the greatest degree. In the same manner, we also estimate the total effect of government fiscal policy on current account surplus by adding government budget surplus as an additional explanatory variable (Model 3b). Model 3c considers both. We are interested in total effects, rather than partial effects that assume other control variables in Model 2 to be fixed. In Model 3, by controlling for the age distribution only (while suppressing other economic variables), we allow for the possibilities that those covariates also change as the exchange rate is adjusted.[12]

The three basic models are summarized in Table 2. We estimate each model by fixed-effects panel regression. The fixed-effects estimation method allows for arbitrary differences in

11 GDP data are obtained from real GDP indexes constructed from WDI's real GDP growth rates.

12 The 2016 External Sector Report claims that Korea's real effective exchange rate in 2015 was 4 to 12 percent undervalued to the level consistent with fundamentals. We will examine how much CA difference there can be by a 12 percent devaluation.

the levels of the dependent variable and the predictor variables. Thus, it detects the patterns that are found in the variation of the variables over time within each of the sample countries, while, by contrast, the pooled ordinary least squares estimator finds a weighted average of the functional relationships that are evident across countries within each of the periods. The fact that the models are fitted by the fixed-effects method means that Korea's change over time is compared with the benchmark behavior of other OECD countries' changes over time. Technically, it means that fixed effects are controlled for.

Another important feature of this paper is that Korean data are excluded from the analysis when fitting the models. The purpose of this is to prevent the model from being over-fitted in favor of Korean data. We estimate the rule of how CA is related to predictors (such as demographic changes) in other OECD countries, and then apply the same rule to Korean data to see if it applies to Korea as well. This method is common in the prediction literature (see James et al. [2015] for an introduction), and can address the potential problem that demographic changes over-explain Korea's current account surplus. In this way, we also implicitly assume that the parameters governing the behavior of other OECD countries are the same as those of Korea. In other words, we try to explain Korea's current account surplus as much as possible solely based on the experiences of other OECD countries without introducing any behavior unique to Korea. In the next section, we will present estimation results and the implications for Korea's CA.

4. Decomposition of Korea's current account surplus

The fixed-effects regression results for Models 1–3 are presented in Table 3. Results for Model 1 suggest the following relationship between current account balance (ratio to GDP) and the age distribution:

$$\begin{aligned} \mathrm{CA} &= \text{fixed effects} - 0.851^{***}D_1 + 0.121^{**}D_2 - 0.0048^{**}D_3, \\ &\quad (0.296)\ \ (0.048)\ \ (0.0021), \end{aligned} \tag{3}$$

where the numbers in the parentheses are cluster-robust standard errors, and the triple and double asterisks represent statistical significance at the 1 percent and 5 percent levels, respectively. From these estimates, we can recover the estimates of α_j using the formula $\alpha_j = \sum_{k=0}^{3} \gamma_k j^k$, with γ_0 chosen such that the sum of the α_j estimates is zero. The resulting estimates are presented in Figure 2. Not surprisingly, CA is higher when the fraction of the working age group is higher, but lower when the economy has a higher population of young and old people.[13]

13 This particular cubic form of population coefficients in estimating current account balances is also found in Kwon (2014) and Shin, Han, and Park (2016).

Table 3. Fixed effects regression results for the three basic models

Dependent variable: Current account as percentage of GDP	Model 1	Model 2	Model 3a	Model 3b	Model 3c
D1	−0.851***	−0.837***	−0.759**	−0.894***	−0.852***
	(0.296)	(0.116)	(0.325)	(0.265)	(0.267)
D2	0.121**	0.116***	0.113**	0.128***	0.122**
	(0.048)	(0.031)	(0.053)	(0.044)	(0.047)
D3	−0.0048**	−0.0045***	−0.0046*	−0.0051**	−0.0049**
	(0.0021)	(0.0015)	(0.0023)	(0.0020)	(0.0021)
GDP gap ratio (% of GDP)		−0.781***			
		(0.189)			
Trading partner's GDP gap ratio (weighted by exports)		0.195			
		(0.192)			
log(crude oil price, Dubai)		−1.699*			
		(0.851)			
Fuel exports (% of GDP)		1.298***			
		(0.387)			
Fuel imports (% of GDP)		−0.577			
		(0.913)			
log(Dubai)*Fuel exports		−0.078			
		(0.091)			
log(Dubai)*Fuel imports		0.067			
		(0.201)			
log(relative income, USA = 100)		0.799			
		(3.679)			
Real growth rate		0.016			
		(0.084)			
Openness (trade to GDP ratio, %)		0.052*			
		(0.026)			
Net foreign asset (% of GDP)		4.956***			
		(1.391)			
Budget surplus (% of GDP)		0.134**		0.189**	0.181
		(0.062)		(0.085)	(0.107)
log(real effective exchange rate)			−8.095**		−8.347**
			(3.000)		(3.462)
Intercept	2.579*	−0.544	40.33***	3.114**	42.13**
	(1.347)	(15.24)	(13.95)	(1.392)	(16.06)
Total observations	974	803	674	853	586
Number of countries	33	33	22	33	22
Average T	29.5	24.3	27.2	25.8	26.6
R^2 within	0.1041	0.3469	0.1790	0.1260	0.2250

Source: *Authors' calculation.*

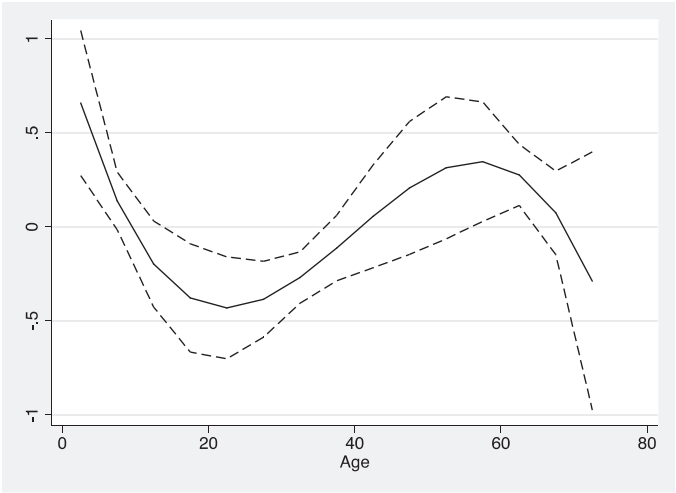
Note: *Cluster-robust standard errors are presented in parentheses.* ***Statistically significant at the 1 percent level;* **statistically significant at the 5 percent level;* *statistically significant at the 10 percent level. Korea's data are not used for estimation.*

The results in equation (3) can be used to predict Korea's CA using forecasts of Korea's demographic changes. Figure 3a exhibits Korea's actual CA, the trend of the prediction (labeled as "Linear prediction") by

$$2.579 - 0.851 \times D_1 + 0.121 \times D_2 - 0.0048 \times D_3,$$

and its adjustment by an estimated fixed effect (labeled as $Xb + u[i]$). The "linear prediction," which ignores the fixed effects, rather understates the actual CA overall, but it traces the recent upward trend well. This is a natural phenomenon because the fixed-effects regression fits over-time variation while leaving out the level difference across countries. To visualize better how the predictor performs in Korea, Figure 3a also displays the CA

Figure 2. Population coefficients in Model 1



Source: *Authors' calculation.*

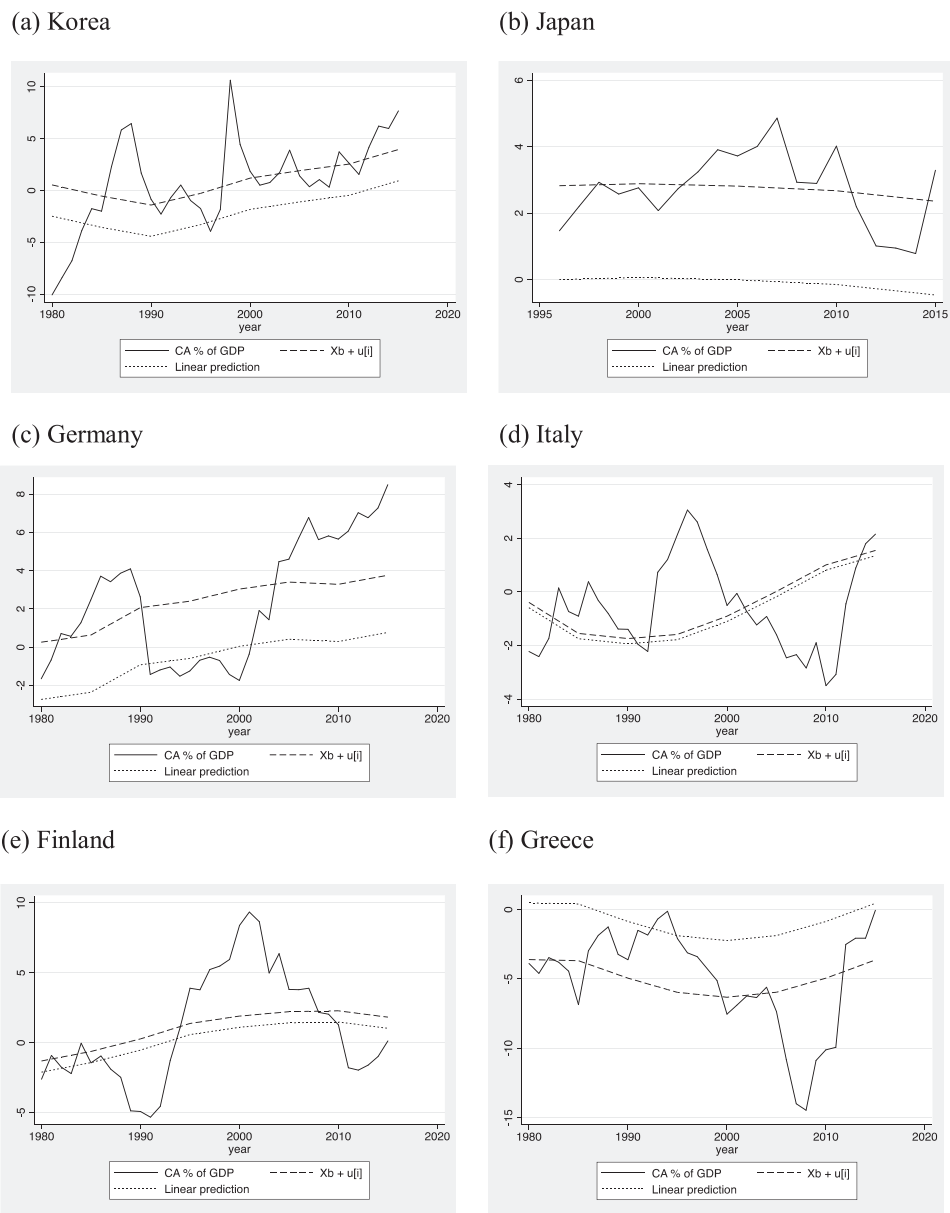
Note: *The solid line represents a cubic from of the population coefficients estimated from Model 1 and the dashed lines represent the 95 percent confidence band.*

prediction adjusted by a fixed effect. Note that the model is fitted by a fixed-effects method using data for 33 OECD countries excluding Korea. Because the fixed effect for Korea is not estimated, we calculated it by comparing the actual CA and the prediction averaged over the sample period so that the fixed-effects-adjusted predictor passes through the middle of the actual trend. In the graph, the estimated fixed effect calculated in this way is 3.0. We have also tried pooled ordinary least squares, random-effects, and between-group regressions, but the fixed effect is not fully explained by any regression, which means that there are some factors in Korea other than demographic factors that make its CA high on average. Performance somewhat differs depending on how long-run is defined, but considering that the model was fitted using OECD countries excluding Korea, the prediction of Korea's long-run CA is surprisingly accurate.

Predictions are also drawn for five of the most aged countries such as Japan, Germany, Italy, Finland, and Greece in Figure 3 using the same regression results. Quite accurate predictions are obtained for these countries as well.

Forecasts of future age distribution up to 2060 is provided by Statistics Korea. We have constructed the D1–D3 variables by using these forecasts and constructed an outlook of future CA. The results are presented in Figure 4. It is forecast that Korea's demographic

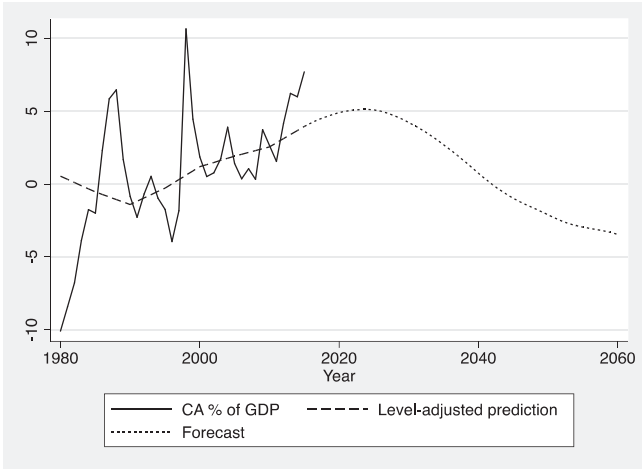
Figure 3. Prediction of current account by Model 1



Source: *Authors' calculation.*

Note: *The solid and dotted lines illustrate actual current account (as percentage of GDP) and its predictive values from Model 1 and the dashed line is predicted current account derived by adding an estimated country fixed effect.*

Figure 4. Future trend forecast of Korea's current account by demographic changes (Model 1)



Source: *Authors' calculation.*

Note: *The solid line represents Korea's actual current account balances (as percentage of GDP) from 1980 to 2015 and the dashed line is their future trend forecast from Model 1 based on forecasts of future age distribution up to 2060 provided by Statistics Korea.*

changes will cause its CA to increase until 2024 and then fall continuously until CA turns negative in 2042 if Korea follows the experience of the rest of the OECD countries.[14]

Getting back to the prediction of CA until 2015, although Korea's long-run trend is well predicted, the recent large increase in surplus is not fully explained by demographic changes. Table 4 contains the actual CA, the prediction by Model 1 (the linear prediction and the fixed effect), and the unexplained part (the residuals). CA amounts to a total of 7.7 percentage points in 2015 and although the model and the fixed effect explain 3.9 percentage points, 3.7 percentage points are left unexplained.

We next examine the possibility of explaining this recent behavior by Model 2. The fixed-effects regression results are presented in the Model 2 column of Table 3. The coefficients on D1, D2, and D3 are similar to those of Model 1. The country's own GDP gap ratio is strongly negatively correlated with CA holding other regressors fixed. Trading partners' GDP gap ratio has a positive correlation with CA but is statistically insignificant. Within a country, more open years are associated with higher CA, though the effect is small. Net

14 Kwon (2014) also points out that Korea's current account surplus is expected to increase until 2015 and then decrease as demographical changes start to act adversely. The fact that the current account is expected to decrease as aging progresses is consistent with other studies, including Kim and Lee (2007) on the impact of aging on current account.

Table 4. Trend in Korea's current account and its prediction by Models 1 and 2

		Model 1		Model 2	
Year	CA	Prediction	Residual	Prediction	Residual
2011	1.6	2.8	−1.3	3.5	−1.9
2012	4.2	3.1	1.0	4.4	−0.2
2013	6.2	3.4	2.8	4.3	1.9
2014	6.0	3.7	2.3	4.0	2.0
2015	7.7	3.9	3.7	4.8	2.9

Source: *Authors' calculation.*

Note: *Prediction columns include Korea's fixed effect, which is calculated so that the average over 1980–2015 is the same for the actual and the predicted. The discrepancy between the actual CA (as percentage of GDP) and the sum of Prediction and Residual is due to rounding.*

foreign assets (percentage of GDP) shows a significant positive association, as does government budget surplus.[15]

The CA trend predicted using the predictors in Model 2 is presented in Figure 5a for Korea. The long-run trend of Korea's CA is again well predicted by the functional relationship found in other OECD countries, as shown in Figure 5a. The rest of the panels of Figure 5 present the prediction for the five most aged countries (Japan, Germany, Italy, Finland, and Greece). We observe reasonable predicting power for all countries except for Greece.

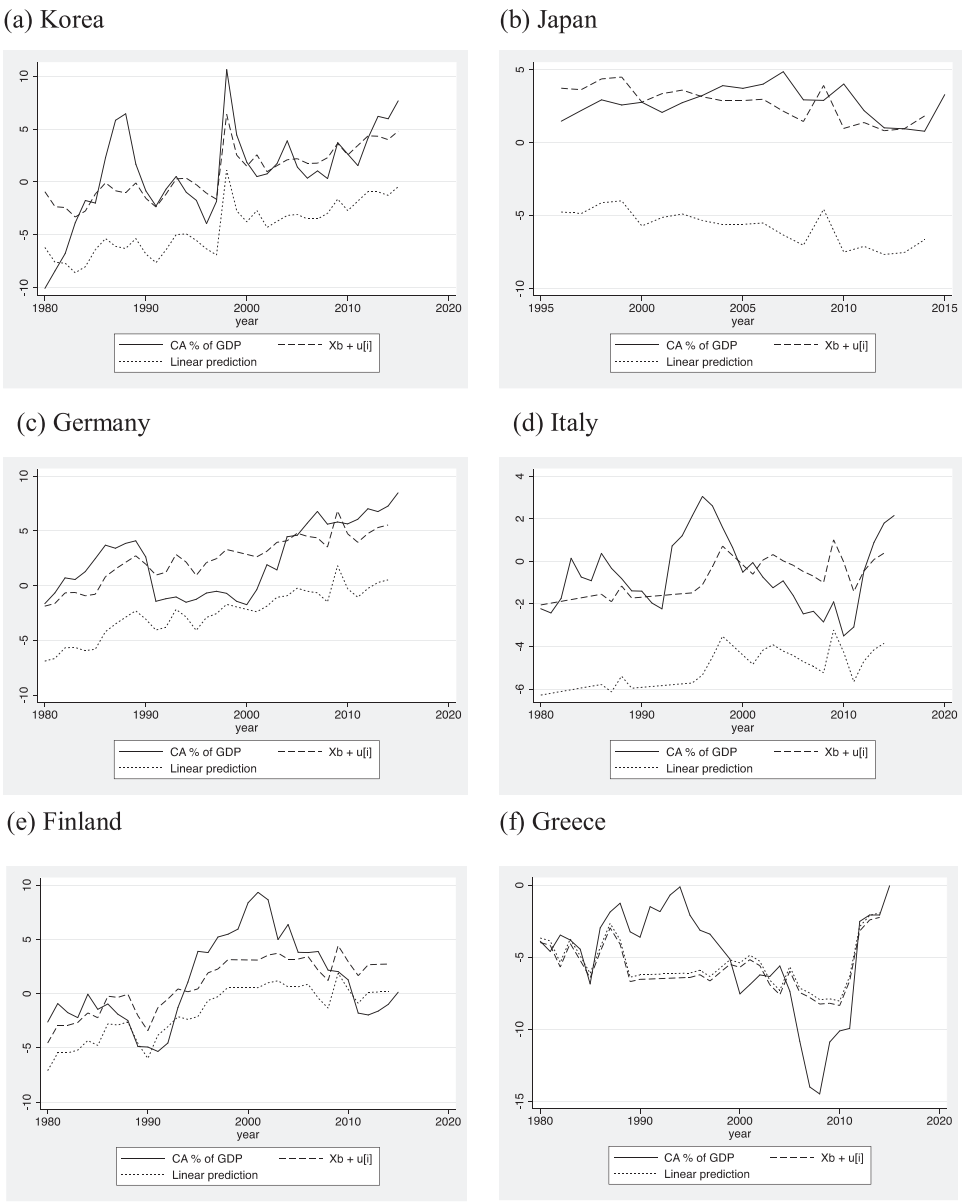
For Model 2, Korea's fixed effect is a large 5.3 percentage points, which remains unexplained by the explanatory variables in Model 2. We tried fitting (using random effects regression) various models including variables such as short-term interest rate difference (based on money market rates), financial deepening, and so forth, but could not obtain significantly different results.

The predicted CA by Model 2 is presented in the Model 2 column of Table 4. More is explained by the model (4.8 points of the 7.7 points).[16] Table 5 decomposes the changes in Korea's CA into the contributions of demographic changes and economic factors. In 2015, of the 7.5 percentage point deviation of Korea's CA from its average during 1980–2010, 2.8 percentage points are explained by demographic factors, and 1.7 percentage points by economic factors. This again shows that the upward trend is mostly explained by demographical changes. The remaining 3.0 percentage points, however, remain unexplained.

15 A meaningfully different result is obtained when a lagged dependent variable is included on the right-hand side. But a lagged dependent variable already contains fixed effects, and it is natural that fixed effects are well predicted by past dependent variables.

16 No data are available for Korea's relative income and fuel exports/imports in 2015. We assumed that they remain the same as 2014.

Figure 5. Prediction of current account by Model 2



Source: *Authors' calculation.*

Note: *The solid and dotted lines illustrate each country's actual current account (as percentage of GDP) and its predictive values from Model 2 and the dashed line is predicted current accounts derived by adding an estimated country fixed effect.*

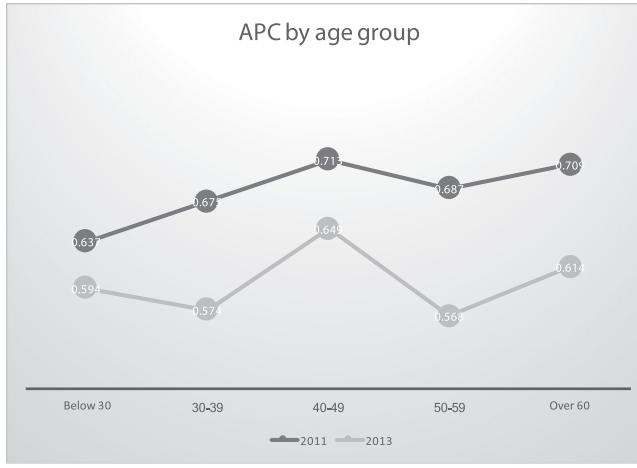
Table 5. Decomposition of Korea's current account change in comparison with 1980–2010 average

Year	CA	Change from 1980–2010 average (A)	Prediction			Residual (A − B)
			Change from 1980–2010 average (B)	Demographic factors	Other economic factors	
2011	1.6	1.4	3.2	1.7	1.5	−1.8
2012	4.2	4.0	4.1	2.0	2.1	−0.1
2013	6.2	6.1	4.0	2.2	1.8	2.0
2014	6.0	5.8	3.7	2.5	1.2	2.1
2015	7.7	7.5	4.5	2.8	1.7	3.0

Source: *Authors' calculation.*

Note: *Numbers may not add up due to rounding.*

Figure 6. Average propensity to consume by age group in Korea in 2011 and 2013



Source: *Authors' calculation based on The Survey of Household Finances and Living Conditions.*

The comparison of Model 2's estimation results (Figure 5) with those of Model 1 (Figure 3) generally indicates that other control variables introduced in Model 2 are only helpful in explaining short-run fluctuations without much improvement in explaining neither the trend nor the fixed effects. Especially the recent increase in Korea's CA seems not fully explained even by the factors considered in Model 2, which means that the recent changes are unique to Korea.

A feature of Korea that is not captured in the models, but is worth considering, is the fall in consumption propensity. For example, Figure 6 shows a decline in the average propensity to consume (APC) for different age groups from 2011 to 2013. In all age groups, the APC fell, with sharper declines in older age groups. The resulting higher saving rate seemed to have led to the recent higher CA, not explained by the model.

Figure 6 shows the possibility that the population coefficients may vary as time passes. In particular, as aging progresses, the same age group may change their behavior. For example, as the old dependency ratio increases, the burden of the young generation increases, causing changes in their saving behavior. To empirically examine this possibility, we now allow the coefficients of D1–D3 to change as the economy ages by introducing interaction terms between D1–D3 and the old age dependency ratio.

The regression results for the models with modified regressor sets are presented in Table 6. The fitted line from the modified Model 2 along with the actual CA is illustrated in Figure 7. The recent increases (at least from 2014 to 2015) of Korea's CA are better explained by this modification, as Figure 7 suggests. Specifically, an additional 0.6 percentage point is explained by the modified model. Nonetheless, a significant portion of the recent increase in CA remains unexplained. It may be possible to identify other factors that would explain recent behavioral changes in Korea. Candidates would include variables related with social security, country risks, household debts, credit risks, and so forth. But accounting for the recent changes based on the experiences of other countries seems difficult, if not impossible, because identifying and observing the relevant factors for other countries to explain this changing saving behavior will be challenging. This important issue is left for future research.

5. Policy implications

Korea's current level of current account surplus is quite large. Political pressures to appreciate the Korean won may escalate in the near future. IMF (2016) also recommends that, as a measure of correcting global imbalances, surplus countries that have enough fiscal space such as Korea need to play a greater role by expanding fiscal expenditures. In this section we assess how much Korea's current account surplus can be reduced by adjusting the exchange rate and/or fiscal policies.

To partially address these issues, we fit Model 3. The results are presented in the last three columns of Table 3. The coefficients on the real effective exchange rate in logarithm suggest that a 10 percent currency appreciation is associated with a decline in CA surplus of around 0.8 percentage points. This association is statistically significant at the 5 percent significance level, but the magnitude is not large enough to reduce Korea's large CA surplus in recent years.

The government budget surplus is also associated with a CA surplus with statistical significance. An extra 10 percentage point budget surplus (as a ratio to GDP) is associated with, approximately, an additional 2 percentage point CA surplus. Considering that the standard deviation of Korea's budget surplus is less than 2 (percentage points) in the period

Table 6. Fixed effects regression results for modified models

Dependent variable: Current account as percentage of GDP	Model 1	Model 2
D1	−0.638**	−0.759***
	(0.281)	(0.230)
D2	0.0792	0.0823*
	(0.0500)	(0.0427)
D3	−0.0027	−0.0023
	(0.0024)	(0.0021)
Old dependency ratio	0.136	−0.392
	(0.494)	(0.462)
D1*(Old dependency ratio)	−0.103**	−0.038
	(0.044)	(0.044)
D2*(Old dependency ratio)	0.0146**	0.0044
	(0.0069)	(0.0065)
D3*(Old dependency ratio)	−0.00058*	−0.00015
	(0.00029)	(0.00027)
GDP gap ratio (% of GDP)		−0.800***
		(0.167)
Trading partner's GDP gap ratio (weighted by exports)		0.304
		(0.196)
log(crude oil price, Dubai)		−2.231**
		(0.934)
Fuel exports (% of GDP)		1.436***
		(0.405)
Fuel imports (% of GDP)		−0.405
		(0.895)
log(Dubai)*Fuel exports		−0.126
		(0.089)
log(Dubai)*Fuel imports		0.032
		(0.202)
log(relative income, USA = 100)		1.566
		(3.663)
Real growth rate		0.016
		(0.075)
Openness (trade to GDP ratio, %)		0.053**
		(0.023)
Net foreign asset (% of GDP)		4.350***
		(1.350)
Budget surplus (% of GDP)		0.134**
		(0.060)
Intercept	2.261	−0.806
	(1.733)	(15.48)
Total observations	974	803
Number of countries	33	33
Average T	29.5	24.3
R^2 within	0.1441	0.3672

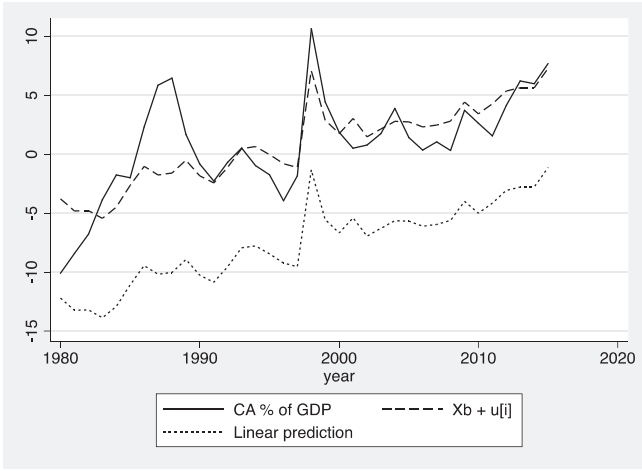
Source: *Authors' calculation.*

Note: *Old dependency ratio is the deviation of the old dependency ratio from its value (18.0 percentage points) for Korea in year 2015. Cluster-robust standard errors are presented in parentheses.* ***Statistically significant at the 1 percent level;* **statistically significant at the 5 percent level;* *statistically significant at the 10 percent level. Korea's data are not used for estimation.*

of 1970–2015, it is not likely that policy changes in budget surplus can lead to practically important changes in CA.

Overall, this section confirms that Korea's current account surplus cannot be reduced by adjusting the exchange rate and/or fiscal policies alone. On the other hand, a substantial portion of the current account surplus Korea is experiencing is due to the demographic

Figure 7. Prediction of current account by modified Model 2



Source: *Authors' calculation.*

Note: *In the modified specification, the coefficients on D1–D3 depend on old age dependency ratio. The solid and dotted lines illustrate Korea's actual current account (as percentage of GDP) and its predictive value from Model 2 and the dashed line is predicted current account derived by adding an estimated country fixed effect.*

changes, which will eventually act to reduce the surplus in the future. In other words, the current level of large current account surplus is primarily due to the savings of a large working population for the sake of their own future, which will naturally decline as Korea's population ages.

One important characteristic of real exchange rates is that they are endogenously determined together with CA. Thus, the fixed-effects estimator for Model 3 may suffer from endogeneity biases. As for the exchange rates, the direction of its causal effect on CA is negative, and the direction of the reverse causality is positive (an exchange rate rises when CA increases). We may thus rationally guess that the estimates on the exchange rate in Table 3 understate the true causal relationships. The case is different for budget surplus. The direction of its endogeneity bias seems to be the opposite. The reason budget surplus is endogenous is that governments facing a large CA surplus may be willing to reduce expenditure, which in turn will cause the surplus to increase. As the causal effect of budget surplus itself is positive, the endogeneity will reinforce the positive correlation between budget surplus and CA, and the estimates in Table 3 may overstate the causal effect. Thus, the true causal effect of budget surplus should be smaller than the one reported in Table 3.

To address this endogeneity issue and estimate the causal effect, we estimate a dynamic equation that includes a lagged CA and lagged explanatory variables together with D1–D3

on the right-hand side where, importantly, real exchange rate is specified to be contemporaneously endogenous. Technically, let y and X denote the explained and explanatory variables, respectively, where X contains D1–D3 and the log real effective exchange rate. The dynamic model is

$$y_{it} = \alpha_i + X_{it}\beta + \rho y_{it-1} + X_{it-1}\delta + u_{it}, \tag{4}$$

where β measures the expected effect of a change in X (by one unit) on y while holding y_{it-1} and X_{it-1} fixed. Here, some variables in X_{it} may be arbitrarily correlated with innovations, u_{it} contemporaneously, but past values are predetermined at a given time. Among the components of X, D1–D3 and their lagged variables are exogenous, whereas exchange rate and budget surplus are contemporaneously endogenous, and their lags are predetermined. Model (4) is best understood by rewriting it as

$$y_{it} = a_i + X_{it}\beta + u_{it} + \sum_{j=1}^{\infty} \rho^{j-1}\left(X_{it-j}\gamma + \rho u_{it-j}\right), \tag{5}$$

where $a_i = \alpha_i/(1-\rho)$ and $\gamma = \rho\beta + \delta$ by recursive backward substitution. Model (5) is interpreted as follows. The $X_{it}\beta$ term represents the contemporaneous effect of a change in the explanatory variable, and u_{it} comprises innovations due to other factors. The last term on the right-hand side of equation (5) signifies that past shocks in X and u have persistent influences on y. For example, shocks in exchange rates not only affect contemporaneous CA but can change economic agents' behaviors in a more persistent way. The ρ parameter summarizes the degrees of this persistence. In equation (5), the immediate contemporaneous effect is measured by β, and the aggregate persistent effect by $\sum_{j=1} \rho^{j-1}\gamma = (1-\rho)^{-1}\gamma = (1-\rho)^{-1}(\delta + \beta\rho)$. The total long-run effect is $\beta + (1-\rho)^{-1}(\delta + \beta\rho) = (1-\rho)^{-1}(\delta + \beta)$.

The dynamic model (4) is estimated using the System GMM (Arellano and Bover 1995; Blundell and Bond 1998) for three different specifications of Model 3. The results for Model 3a in Table 7 reveals that the contemporaneous effect (estimate $= -7.281$) of a change in the real effective exchange rate is slightly smaller than what is implied by Table 3. But there is an additional indirect effect that amounts to $(5.441 - 7.281 \times 0.861)/(1 - 0.861) = -5.956$ in aggregation due to persistence. Thus, for every permanent 10 percent depreciation, CA improves by 1.3 percentage points in total, which is 1.6 times larger than what the fixed-effects estimation results (0.8 percentage point) in Table 3 imply. This is still too small to explain Korea's large CA surplus. Model 3c, which includes government budget surplus as an additional explanatory variable, suggests even smaller effects of the real effective exchange rate. The contemporaneous effect is measured as -6.641 in contrast to -7.281 of Model 3a, and the aggregate persistency effect is $(5.383 - 6.641 \times 0.863)/(1 - 0.863) = -2.541$.

Table 7. System GMM estimation of dynamic panel data models

Dependent variable: Current account (as percentage of GDP)	Model 3a	Model 3b	Model 3c
Lagged CA	0.861***	0.794***	0.863***
	(0.026)	(0.023)	(0.030)
D1	−0.821**	−0.920	−0.660
	(0.408)	(0.567)	(0.531)
D2	0.193***	0.151	0.154**
	(0.070)	(0.101)	(0.075)
D3	−0.0089***	−0.0064	−0.0074**
	(0.0034)	(0.0046)	(0.0031)
Lagged D1	0.593	0.673	0.409
	(0.400)	(0.564)	(0.576)
Lagged D2	−0.163*	−0.118	−0.121
	(0.063)	(0.096)	(0.077)
Lagged D3	0.0079*	0.0052	0.0063**
	(0.0030)	(0.0042)	(0.0030)
log(real effective exchange rate)	−7.281***		−6.641***
	(1.402)		(1.679)
Lagged log(real effective exchange rate)	5.441***		5.383***
	(1.495)		(1.948)
Budget surplus		0.066	0.022
		(0.075)	(0.086)
Lagged budget surplus		−0.125**	−0.047
		(0.058)	(0.057)
Total observations	666	828	570
Number of countries	22	33	22
Average T	30.3	25.1	25.9
Arellano-Bond AR(1)	−3.51 ($p = 0.0005$)	−3.01 ($p = 0.0026$)	−3.39 ($p = 0.0007$)
Arellano-Bond AR(2)	−1.59 ($p = 0.1111$)	−2.00 ($p = 0.0458$)	−1.66 ($p = 0.0964$)

Source: *Authors' calculation.*

Note: *The models are estimated by the one-step efficient System GMM using Stata's xtdpdsys command. Robust clustered standard errors are reported in parentheses. Log(exchange rate) and Surplus are specified as endogenous, and their lags as predetermined. The demographic variables (D1–D3 and their lags) are specified exogenous.*

The contemporaneous effect of government budget surplus is statistically insignificant and its size is practically negligible. According to the results for Model 3b in Table 7, a 10 percentage point budget deficit (ratio to GDP) is associated with a 0.0066 percentage point fall in CA, which is insignificant both statistically and practically. The results for Model 3c imply even smaller effects. However, it concerns us that the Arellano-Bond serial correlation test for order 2 rejects the null hypothesis for Model 3b.[17]

6. Conclusions

Korea experienced a currency crisis in 1998. Since then it has experienced continuous current account surpluses. The current account surpluses just after the crisis were extremely

17 To resolve this issue, we fit an AR(2) model $y_{it} = X_{it}\beta_0 + X_{it-1}\beta_1 + X_{it-2}\beta_2 + \rho_1 y_{it-1} + \rho_2 y_{it-2} + u_{it}$. The estimated coefficient of the budget surplus is 0.0715 (standard error = 0.0742), which is again insignificant both statistically and practically, and its two lags have coefficients −0.110 (se = 0.096) and 0.026 (se = 0.065), respectively, whereas the coefficients on the two lagged dependent variables are 0.825 (se = 0.0465) and −0.044 (se = 0.0553), respectively. The Arellano-Bond serial correlation tests for the AR(2) model indicates that it is a correct specification (the p-value for order 1 is 0.0013, and that for order 2 is 0.1911).

helpful for the economy to recover from the crisis. Managing a modest level of current account surpluses has also been beneficial for the economy in preventing future crises. Nevertheless, Korea's current account surplus in 2015 amounted to 7.7 percent of GDP, causing a concern that it may be too excessive. This exorbitant reliance on external demand can escalate political pressures from trading partners to allow the won to appreciate. It is also argued that maintaining more balanced demand sources by giving domestic demand a greater role is essential for a sustained growth path.

In this paper we investigated reasons underlying the widening of Korea's current account surpluses. We found that the upward trend in Korea's current account surpluses is essentially explained by demographic changes it is currently experiencing. Moreover, we show that because Korea's population is rapidly aging, its current account surplus is expected to disappear by 2042 as it becomes one of the most aged economies in the world. In fact, demographic changes are so powerful that they explain quite successfully the trend of current account balances of other aged economies such as Japan, Germany, Italy, Finland, and Greece as well. Demographics, however, do not explain cross-country differences in the level of current account balance—namely, the high level of Korea's current account surpluses is mainly explained by a country fixed effect.

When we add the real exchange rate as an additional explanatory variable, it is statistically significant with the right sign, but the magnitude it explains is quite limited. For example, to reduce current account surplus by 1 percentage point, a whopping 12 percent depreciation is needed. Because other economic variables are yet included as explanatory variables, this can be considered to be the maximum estimate of the effect of the exchange rate changes. If it is true that Korea's current exchange rate is 4 to 12 percent undervalued to the level consistent with fundamentals, it is impossible to reduce Korea's current account surplus to a reasonable level by adjusting the exchange rate alone. Another possibility to reduce current account surplus is expanding fiscal policies. We find, however, that the impact of fiscal adjustments on current account surplus is even more limited. According to our estimates, reducing current account surplus by 1 percentage point requires a 5–6 percentage point increase in budget deficits (as a ratio to GDP).

These impacts of exchange rate and fiscal policy adjustments are estimated without considering the endogeneity of these policy variables. If we allow endogenous movements of these variables, the impact of exchange rate adjustment is 1.6 times larger, whereas that of fiscal policy decreases so that it is no longer statistically significant.

When we add other fundamental variables such as GDP gap, oil prices, net foreign asset and so on, they contribute to explaining short-run fluctuations without much improvement in explaining the trend or country fixed effects. On the other hand, although the upward

trend in Korea's current account surplus since 1997 is mainly explained by demographical changes, the current level of current account surplus (i.e., 7.7 percent of GDP) is placed quite above the fitted line derived by the economically fundamental variables including demographical changes.

This idiosyncrasy of Korea's current account surplus seems to be related to the increased saving propensity of households especially among aged people. The current older generation is in a special situation in the sense that they suddenly realize that their increased life span may not be appropriately supported by any means. In the past, old people had relied on informal subsidies from their own children, which, as individualism became more prevalent, is no longer expected as much. The current pension scheme started as a fully funded system and the older population are not beneficiaries of the pension. Hence, they have to rely on themselves, needing to save for their own future. As people entitled to the pension grow older, this problem will disappear with the saving rate also expected to decrease again and the idiosyncratic current account surplus will be reduced. This is just one conjecture, however, and we will need further detailed analyses for more rigorous evidence to support this argument.

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