

Meaningful Measures of the Current Account

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Abstract

Since the conventional current account uses cash-flow accounting, it is potentially devoid of economic meaning. Assessing foreign assets at market values and including expected transfers from abroad, this paper reports two measures of the external surplus that are grounded in economic theory. The first measure is the aggregate generational current account, annual differences in the sum of net foreign assets across all current and future generations. The second measure is the generational profile of net foreign assets in a benchmark year. These ideas are implemented with data from Korea.

1. Introduction

By now it is well known that the conventional government deficit is flawed. There are two major criticisms. First, Eisner (1989) emphasizes that it does not account for changes in the value of the stocks of central government assets and liabilities. Second, Auerbach and Kotlikoff (1987) and Auerbach et al. (1994) argue convincingly that changes in the conventional measure of the government deficit are not related in any meaningful way to changes in agents' utilities. Fisher (1995) showed that their logic carries over to the open economy.

Why do we economists compile and analyze macroeconomic statistics? Any thoughtful answer will eventually appeal to a notion of human welfare. Economic statistics, however, are typically compiled in calendar time, and they may not be measured in a way that relates them directly to the agents in an economy. Since capital markets allow agents to smooth consumption, anticipated future transfers may affect agents as much as current payments. Kotlikoff (1993) emphasizes that the real effects of such transfers ought to be part of any proper measure of the government deficit, and he argues that changes in government policy can only be understood within the framework of generational accounts.¹

The current account includes transfers too. Thus all the criticisms leveled against conventional government deficit are also true for it. Unilateral transfers are not a small part of the external account; net military transfers and net unilateral transfers have accounted for about 15% of the US current account deficit in the last decade.² Since international capital markets also allow agents to borrow in anticipation of future receipts, there is no simple relationship between current transfers and the utility of domestic and foreign agents.

Using this simple observation, Fisher (1995) showed that the conventional current

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account is not well defined. In particular, for any description of countries' unilateral transfers, there is an implementation of these transfers such that any country's conventional current account satisfies any exogenous constraint. The intuition is that a country can always delay unilateral transfers to abroad and make its conventional current account surplus as large as necessary. Since agents can borrow against anticipated future transfers, delaying a transfer will not affect an agent's consumption choices if future receipts maintain his real income in every state of the world. But then the real effects of international economic policy are fully reflected only by expected transfers from abroad.

This argument is true for the government deficit as well. Since Auerbach et al. (1991) are interested in how government deficits transfer resources between generations and between agents in the same generation, they construct measures for representative males and females in different cohorts. Of course, external deficits matter for a different reason. The international economist studies how fiscal policy affects aggregate trade flows between countries.

Thus our first measure, called the *aggregate generational current account*, keeps track of the sum of expected net transfers to abroad, and it does not take explicit intergenerational transfers into account. Hence, this measure is easier to construct than Auerbach, Gokhale, and Kotlikoff's generational accounts because it is not designed to keep track of transfers between males and females or between those alive and those not yet born. If countries can tax only their own citizens, then a worsening of the aggregate generational current account indicates that some domestic agent (alive or not yet born) will suffer decreased utility.

Our second measure, called the *generational profile of net foreign assets*, keeps track of private and public assets and allows for generational heterogeneity. Since different generations have different patterns of historical asset accumulation, changes in international economic conditions will affect cohorts disparately. The value of a generation's private assets is the market value of its own net international investment position, but we assume that public assets are shared between current and future generations. For example, the stock of central bank reserves generates a flow of income that is divided equally among current and future domestic residents. The stock of economic and military aid likewise generates a flow of income for all generations alive during the course of these expected transfers.

What are the properties of an ideal measure of the external surplus? A good measure ought to reflect accurately the change in the real value of net foreign assets. It should possess four properties. First, it should be invariant with respect to proportional changes in all the prices in the world economy. Second, it ought to be related transparently to agents' utilities. Third, it should incorporate foreseeable changes in net foreign assets. Fourth, it ought to be independent of transfers among the agents in the domestic economy.

Constructing any ideal measure is a part of the theory of index numbers, and dealing in depth with issues of aggregation and proper price indices is beyond the scope of our work. Still, the conventional current account surplus is reported in current prices, and it is thus not very informative in an inflationary environment. Fisher's (1995) aggregate generational current account deflates the stock of net foreign assets by nominal interest rates that include both a real discount factor and a realized inflation rate, and thus it deals in part with the effects of inflation.

Any measure of the external surplus that is related to the well-being of domestic residents must take into account changes in the market values of foreign assets. Both of our measures do so, and an increase in the aggregate generational current account

shows that some domestic resident has higher wealth abroad. Moreover, the generational profile of net foreign assets shows exactly which domestic cohort has higher foreign wealth.

Since our measures also incorporate an estimate of the present value of expected public transfers from abroad, they actually include foreseeable changes in the value of net foreign assets. Finally, our measures are independent of transfers among domestic residents. Only if these transfers change the conventional trade surplus will they appear in either measure. Thus our standards have several of the properties of an ideal measure.

In the next section we describe our two measures from a theoretical perspective, and then we implement them in the third section with data from Korea. That country serves as a good example for two reasons. First, the Korean economy is one of the most rapidly growing economies in the world. Hence, it is interesting to examine the extent to which constraints on the external account have hampered Korea's growth. Second, the Korean economy has received unilateral aid transfers for a considerable time. Indeed, the existence of foreign aid institutions and programs over a long period, especially during and after the Korean war, enables us to predict aid flows and to calculate the expected time of their duration, taking economic, social and political considerations into account.

2. A Simple Economy

Consider a world economy with uncertainty, and with a slight abuse of notation let $S = \{0, 1, \dots, S\}$ be the set of states of nature. We will identify the initial element of S with the current period, and its other elements are an exhaustive description of an uncertain future. For simplicity we will analyze an exchange economy, but it will become apparent that the force of our arguments still applies to an economy with production. Let the index set of consumers be $I = D \cup F$, with $D \cap F = \emptyset$; then $i \in D$ is a *domestic resident* and $i \in F$ is a *foreigner*. In each $s \in S$ there are L physical commodities. Finally, the agents trade K assets in state 0. Following Radner (1982), we shall assume that an asset is a title to receive r_{sk} units of good 1 in state $s \in S - \{0\}$. The price of asset k is q_k . Radner's framework allows for a simple description of a wide class of economies, even those with incomplete asset markets.

As usual, $x_s^i = (x_{s1}^i, \dots, x_{sL}^i)$ and $\omega_s^i = (\omega_{s1}^i, \dots, \omega_{sL}^i)$ denote the demands and endowments respectively of consumer i in state s . Then agent i 's consumption set is $X^i \subset \mathfrak{R}^{L(S+1)}$, and her consumption plan is $x^i = (x_0^i, \dots, x_s^i) \in X^i$. An agent's preferences are summarized by a utility function $U^i: X^i \rightarrow \mathfrak{R}$.³ Likewise, an agent's portfolio plan is $z^i = (z_1^i, \dots, z_K^i) \in \mathfrak{R}^K$, where we are explicitly allowing unlimited short sales. Now let $p_s = (p_{s1}, \dots, p_{sL}) \in \mathfrak{R}_+^L$ be the vector of spot prices for the L commodities in state s , and $q = (q_1, \dots, q_K) \in \mathfrak{R}_+^K$ be that of asset prices in state 0.

We shall assume that the domestic government levies lump-sum taxes and transfers on all the agents in the world economy. These taxes are state-contingent, and those that accrue to agent i in state s are denoted by τ_s^i . If $\tau_s^i < 0$ for some $i \in F$, then a foreigner receives transfers from the domestic government. The government finances its fiscal policy with the portfolio $z^g \in \mathfrak{R}^K$.

An *equilibrium* is a list of prices $p = \{p_s\}_{s \in S}$ and q and corresponding consumption plans $x^* = \{x^{*i}\}_{i \in I}$ and portfolio plans $z^* = \{z^{*i}\}_{i \in I}$ such that:

$$(i) \quad x^{*i} \in X^i \quad \text{and} \quad z^{*i} \in \mathfrak{R}^K \quad \text{maximizes} \quad U^i(x^i)$$

subject to

- (a) $p_0 \cdot x_0^i + q \cdot z_k^i \leq p_0 \cdot \omega_0^i - \tau_0^i$ and
- (b) $p_s \cdot x_s^i \leq p_s \cdot \omega_k^i - \tau_s^i + \sum_k p_{s1} z_k^i r_{sk}$ for $s \in S - \{0\}$;
- (ii) $q \cdot z^g \leq \sum_i \tau_0^i$ and $0 \leq \sum_i \tau_s^i + \sum_k p_{s1} z_k^g r_{sk}$ for $s \in S - \{0\}$;
- (iii) $\sum_i z^{*i} + z^g \leq 0$ and
- (iv) $\sum_i x^{*i} \leq \sum_i \omega^i$.

This definition requires materials balances in each state of nature, and it states that no asset is in positive net supply in the initial period of the economy. It also requires that the government's budget be balanced in every state of nature. Further, it allows agents to trade assets and thus transfer purchasing power across states of nature, but it does not assume that asset markets are complete.

Now let prices (p, q) and the corresponding plans (x^*, z^*) be an equilibrium. Then the *conventional current account at time 0* is:

$$p_0 \cdot \sum_{i \in D} (\omega_0^i - x_0^{*i}) + \sum_{i \in F} \tau_0^i. \quad (1)$$

Equation (1) states that the conventional external surplus is the sum of the trade balance and net unilateral transfers.

Consider a tax in the amount $\tau_0^i = q_1$ levied by the domestic government on some $i \in F$. Assume further that this tax is fully offset by a corresponding subsidy of $\tau_s^i = -r_{s1} p_{s1}$ in each state in the next period. This tax increases the conventional current account surplus at time 0; in essence, it is an exogenous increase in the excess demand for foreign assets. Of course, the offsetting future transfer increases the current account deficit in the next period by the amount $p_{s1} r_{sk}$. But the scheme of taxes and transfers is chosen so that it leaves goods and asset prices and each agent's equilibrium allocations unchanged. Also, as long as $r_{s1} \geq 0$ and agent i 's marginal utility of income is well-defined in each state, we can choose prices so that

$$q_1 = \sum_{s \in S - \{0\}} p_{s1} r_{s1} \mu_s^i,$$

where μ_s^i is the shadow value associated with consumer i 's budget constraint in state s . Thus the rescheduling of transfers satisfies the government's budget constraint.

How should one interpret the rescheduling of these unilateral transfers to abroad? If the domestic country has a fiat asset that is valued in every state of nature, then the government improves the conventional current account simply by delaying payments to abroad and promising foreigners repayment of principal and interest in the next period. If domestic economy has no such asset, then the timing of transfers is a rescheduling of sovereign debt that leaves the present value of debt service unchanged in every state of the world. This "infusion of foreign official capital" leaves the present value of the equity of any international creditor unchanged, but it allows the conventional current account of the debtor country to be anything.

None of our arguments depends upon the number of goods, countries, or assets available in the world economy. Also, it is clear that these ideas are still true in an economy with production, as long as firms' investment decisions are described carefully in an environment of incomplete markets. Thus we have established that the

conventional current account in all but the final period is arbitrary, and the natural generalization to an economy with infinitely many periods is also true: *the conventional current account is not well defined at any time!* The force and generality of the argument stems from the fact that conventional macroeconomic statistics are often only cash-flow accounting conventions that may have very little to do with economic well-being.

What are meaningful measures of a country's external surplus? In this paper, we propose two measures. The first is annual changes in the stock

$$q \cdot \left(\sum_{i \in D} z^{*i} + z^g \right) + \sum_{i \in F} \sum_{s \in S - \{0\}} \pi(s|0) \tau_s^i, \quad (2)$$

where $\pi(s|0)$ is the conditional probability that state $s \in S - \{0\}$ occurs. This measure is the *aggregate generational current account*, and it incorporates changes in both the market value of a country's net international investment position and in expected unilateral transfers from abroad.⁴

The second measure captures the full generational heterogeneity inherent in an actual economy. Consider a partition of the index set D into $D_1 \cup \dots \cup D_n$; one can now define the stocks

$$b_j(0) = q \cdot \sum_{i \in D_j} z^{*i} + (\# D_j)^{-1} \left(q \cdot z^g + \sum_{i \in F} \sum_{s \in S - \{0\}} \pi(s|0) \tau_s^i \right) \quad \text{for } j \in \{1, \dots, n\}.$$

If this partition corresponds to age cohorts, then the list

$$\{b_j(0)\}_{j=1}^n \quad (3)$$

is the full *generational profile of net foreign assets* given the information set in state 0. We have assumed that expected transfers from abroad are shared equally by agents in each generation, perhaps even by those not yet born, but the ownership of private net foreign assets is determined by individual investment decisions.

Consider a change in the exogenous variables or stochastic process describing expectations such that (2) or some element of (3) increases. Such a change has at least three interpretations. First, there has been a capital gain in the value of net foreign assets. Second, real interest rates have changed. Third, the domestic currency has experienced a real depreciation. The crucial point is that each of these phenomena must affect the utility of some or all agents in the domestic economy, unlike changes in the conventional current account.

Here is the essence of the paradox. On the one hand, cash flow accounts are measured quite precisely, but robust theoretical arguments show that they are potentially devoid of economic meaning. On the other hand, generational accounts and our definitions of the external surplus are measured imprecisely, but they do have sound foundations in economic theory. So one is caught between Scylla and Charybdis. Is it more useful to accept an accurate measurement of a meaningless number or to attempt a rough measure of a useful economic concept? Recognizing the need for some heroic assumptions, we turn our attention to the latter endeavor.

3. Implementing these Measures

The actual derivation of the aggregate generational current account consists of two main parts: (1) computing the market value of a country's net international investment

position; and (2) calculating the present value of the net expected transfer payment from abroad. In essence, the aggregate generational current account treats expected transfers from abroad as assets and capitalizes them. Of course, such transfers have been a main source of financing imports into Korea, but there has been a secular change in the composition of the source of financing of international transactions. During the first two decades after World War II, the main source of financing imports was foreign aid intermediated by international institutions. However, after 1965, the United States of America became the primary contributor of the aid to Korea and committed implicitly to providing long-term loans as a means of continuing support.⁵

Military aid has been closely related to the US military policy on the Korean peninsula since World War II. The major changes in this policy in general can be classified into four periods: (1) post-war relief from 1946 to 1948; (2) the Marshall Plan from 1949 to 1952; (3) the Mutual Security Act from 1953 to 1961; and (4) the Foreign Assistance Act from 1962 until now. The flow of military aid increased continuously during and after the Korean War and reached its peak during the Vietnam War. Since 1956, the value of military aid has exceeded that of economic aid. Although most of this aid was used for the build-up of Korea's defense capability, it has been quite important in the development process. It has declined since 1971, following changes in the military policies of the United States of America.⁶

Appendix 1 gives a detailed description of the data that we discuss in the next four subsections. It is important that the reader keep in mind that almost all of our data are assembled from information not reported directly in Korea's balance of payments. For example, the data on private assets and liabilities held in won are derived from surveys of the domestic financial sector, and the data on expected economic and military transfers come from idiosyncratic sources, not from the line in the balance of payments that reports unrequited transfers. The market value of foreign direct investment is calculated using country-specific stock market indices. As the reader shall see below, our measure of the aggregate generational current account is highly correlated with the historical values of the conventional measure of the current account. This fact is reassuring, and it lends confidence to our empirical analysis.

The Net International Investment Position

The first big step is to calculate Korea's net international investment position. We followed Ulan and Dewald's (1989) technique of evaluating foreign assets at market value. Calculating Korea's net international investment position is accomplished in three steps. First, we used the table in the Bank of Korea's *Economic Statistics Yearbook* reporting the assets of the central bank to determine the annual stocks of official reserve assets. We did not exclude the value of gold holdings because they were indeed an international asset for Korea, especially under the Bretton Woods System.

Second, we determined Korea's private foreign assets and private foreign liabilities from the two tables in the *Economic Statistics Yearbook* entitled "Monetary Survey" and "Foreign Exchange Assets and Liabilities (Summary)." The former reports private assets and liabilities that are intermediated by the Korean banking system, and the latter reports private assets and liabilities that are held in foreign currencies. The first table reports the flow of funds for the domestic financial sector in won, and the second table reports the dollar values of Korea's assets and liabilities denominated in foreign currencies. We used end-of-year market exchange rates as reported by the Interna-

tional Monetary Fund in *International Financial Statistics* to convert the domestic flow-of-funds data from won into current dollars.

Third, we used the balance-of-payments data on long-term capital transactions from *Economic Statistics Yearbook* to determine the annual flows of both foreign direct investment into Korea and Korean foreign direct investment abroad. Again following Ulan and Dewald, we used stock market indices reported by the IMF in *International Financial Statistics* to convert these flows into stocks of the market values of both inward and outward foreign direct investment.⁷ The data on outward direct foreign investment are reported by region in *Economic Statistics Yearbook*. These data are broken down into the following areas: Southeast Asia, Mid-Asia, North America, Latin America, Europe, Africa, and Oceania. We used stock market indices for Australia, the United States of America, Japan, and Germany to determine the market value of Korean outward foreign direct investment and GDP deflators to determine the market value of Korean investment in Saudi Arabia, Liberia, and Panama.⁸ The book value of Korean inward foreign direct investment was marked to market using an exchange rate index and the Korean stock market index reported in *Economic Statistics Yearbook*. Summing the calculations from these three steps gives Korea's net international investment position, taking public and private assets into account.

The Capitalized Value of Expected Unilateral Transfers

The second step entails capitalizing expected net transfers from abroad. We analyzed two kinds of unilateral transfers: military aid and economic aid. The data on economic aid come primarily from the Bank of Korea's *Economic Statistics Yearbook*, and those on military aid are derived from Hwang et al. (1990). Because much of the information related to the military policy is classified, we may not have captured all military transfers into Korea. Still, we have included a large part of expected unilateral military transfers.

We assumed throughout that Korea had no long-term commitments to pay unilateral transfers to any other country. Hence, we are capitalizing only an expected inflow of military and economic transfers from abroad. Also, our calculations for military aid assume that such aid is provided entirely by the United States of America.

We did not simply capitalize transfers from abroad by assuming that they would continue into perpetuity. Instead, we determined the expected durations for the two kinds of unilateral payments for the different periods of post-war Korean history. Because it is an *expected* unilateral transfer payment, the duration of aid flow should be based on the social, political and economic situations involved around the announcement of the aid program. We classify the *expected duration of the aid flow* into five categories, with durations of 1 year, 5 years, 10 years, 15 years, and perpetuity. Once we have postulated the duration of an aid flow, we capitalize its value using market (dollar) interest rates during the years of its duration. Hence, a grant of \$1 million with an expected duration of five years has a capitalized value of $\sum_{s=t}^{t+4} ({}_t\delta_s)$ millions, where ${}_t\delta_s = \prod_{j=t+1}^s (1 + i_j)^{-1}$ is the market discount factor from period t to s , $1 + i_j$ is the gross nominal interest rate from period j to $j + 1$, and ${}_t\delta_t = 1$. The art of constructing expected unilateral transfers consists in positing the duration of transfers from abroad, and we used the accounts of Korean economic development in Kim (1970) and Kwon (1990) to form our judgments about the expected duration of economic aid flows. We make explicit our assumptions about the duration of both kinds of aid flows in Appendix 2.

Changes in Net Foreign Assets Broadly Defined

The penultimate step in computing the aggregate generational current account is to add the capitalized value of expected unilateral transfers to the net international investment position. Then one takes first differences to arrive at the final numbers. Table 1 presents our computations for these historical data.

Figure 1 presents historical data contrasting the aggregate generational current account with the conventional current account. Notice that the aggregate generational current account showed several large surpluses during the 1950s. This fact reflects the large capitalized value of aid flows that occurred during and after the Korean War. Also, the sharp deterioration of the aggregate generational current account in 1961 reflects the reduction in expected transfers from abroad owing to worsening diplomatic relations with the United States of America in the wake of the military *coup* of that year. Since expected aid flows were largely curtailed by the last decade, the sharp surpluses in the late 1980s reflects the rise in the dollar value of Korean assets, owing to the rapid appreciation of the yen and other currencies against the dollar in those years. The aggregate generational current account shows generally smaller deficits than the conventional current account in most of these years because expected transfers from abroad have been an important element of the external balance for Korea.

The two measures of the current account are highly correlated, although the aggregate general current account is more volatile than the conventional current account, just as the price of a common stock is more volatile than its underlying stream of dividends. The mean value of the aggregate generation current account is higher than that of the conventional current account during this period, but, using the Procrustean assumptions of normality and independence of the two processes, one cannot reject the null hypothesis that the two measures are drawn from distributions with the same first moments. Finally, the aggregate generational current account is more frequently in

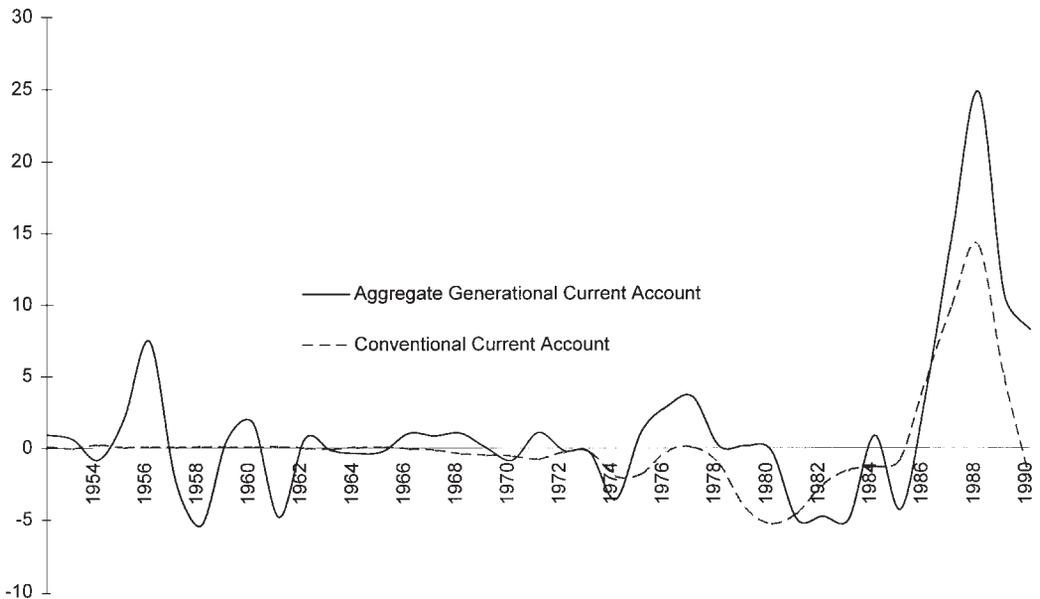


Figure 1. Korea's Aggregate Generational Current Account (billions of dollars)

Table 1. Components of the Aggregate Generational Current Account (thousands of dollars)

<i>Year</i>	<i>Public and private net foreign assets</i>	<i>Market value of net foreign direct investment</i>	<i>Capitalized economic aid</i>	<i>Capitalized military aid</i>	<i>Aggregate generational current account</i>
1950	27,087	0	1,161,034	91,398	NA
1951	39,192	0	2,051,962	113,298	924,007
1952	85,364	0	3,024,723	31,609	939,462
1953	130,142	0	3,546,959	68,155	602,142
1954	130,133	0	2,724,846	62,775	-827,554
1955	119,476	0	4,064,281	757,369	1,992,804
1956	149,572	0	4,895,313	7,654,434	7,423,584
1957	182,565	0	3,849,911	6,315,190	-2,317,028
1958	245,082	0	3,081,516	1,369,697	-5,397,473
1959	248,250	0	2,356,504	2,746,356	560,382
1960	128,208	0	2,494,729	4,614,654	1,741,482
1961	367,968	0	713,906	1,013,108	-4,824,043
1962	280,594	0	761,137	1,705,627	652,377
1963	205,522	-4,800	966,325	1,397,149	-183,161
1964	207,690	-3,860	704,030	1,258,714	-397,622
1965	223,355	-9,145	564,156	1,126,607	-261,600
1966	436,144	-22,828	505,827	1,994,633	1,008,803
1967	944,909	-50,935	233,672	2,620,900	834,770
1968	1,092,124	-74,173	220,081	3,529,528	1,019,013
1969	1,455,497	-97,575	142,984	3,255,374	-11,280
1970	1,579,691	-161,444	92,749	2,391,696	-853,588
1971	1,239,768	-221,034	77,304	3,882,987	1,076,334
1972	1,480,493	-169,948	22,192	3,450,075	-196,213
1973	2,671,079	-369,820	9,304	2,139,591	-332,658
1974	617,540	-395,840	4,249	624,881	-3,599,326
1975	1,982,184	-584,916	4,991	543,159	1,094,589
1976	5,093,013	-682,662	7,444	410,312	2,882,690
1977	9,254,919	-899,660	3,968	17,228	3,548,347
1978	10,093,466	-1,593,258	169	10,251	134,174
1979	9,428,043	-852,243	224	80,718	146,114
1980	8,199,895	-494,223	361	786,080	-164,630
1981	4,021,354	-612,037	236	100,855	-4,981,704
1982	-878,817	-508,577	61	131,619	-4,766,121
1983	-5,960,666	-295,166	30	1,619	-4,998,470
1984	-4,979,512	-412,801	0	1,766	863,637
1985	-9,319,275	-352,944	0	1,955	-4,279,717
1986	-4,736,841	-1,041,461	0	1,816	3,893,778
1987	12,551,677	-3,310,140	0	2,003	15,020,025
1988	44,083,689	-10,043,641	0	1,652	24,798,160
1989	55,790,314	-11,087,326	0	1,652	10,662,941
1990	59,679,067	-6,745,809	0	1,652	8,230,269

surplus than the conventional current account, reflecting that the capitalized value of expected transfers from abroad has been significant for Korea.

The wide swings of the aggregate generational current account in the 1950s represent changes in the present value of expected military aid flows. The large drop in 1961 reflects the diplomatic uncertainties about receipts of foreign aid after the *coup* that brought Park Jeong Hee to power. As the present value of expected foreign aid has decreased, the aggregate generational current account follows the conventional measure quite closely. This fact confirms the validity of our approach because almost none of our data are drawn from traditional balance-of-payments statistics.

The Generational Profile of Net Foreign Assets

The aggregate generational current account provides the foundation for determining the generational profile of net foreign assets. Breaking down the ownership of assets by population cohort entails two steps. First, we keep track of the ownership of private net foreign assets. Second, we describe an explicit rule for allocating the ownership of public assets that include capitalized economic and military aid and the interest income from the central bank's stock of foreign exchange reserves.

We define a cohort to be all domestic residents born during the five-year period centered around its reference year; thus the generation labeled 1911 consists of all residents born between 1909 and 1913, who have survived until our population benchmark in 1993. Using the United Nations' estimates of the populations of each cohort, we assumed arbitrarily that 6% of each generation died in every quinquennium. For example, our oldest cohort was estimated to consist of 309 thousand souls in 1993, and we imposed that there were $309(1.06)^6$ thousand people in that generation in 1963.

The National Statistical Office's *Annual Report on the Family Income and Expenditure Survey* gives annual data on average household incomes and expenditures beginning in 1963; these data are broken down by the age of household head in a manner that corresponds to our generations. Using the contemporaneous population estimates, we imputed the share of national savings accruing to a cohort in each calendar year. Then we used these shares to allocate annual flows of private net foreign assets. We updated these estimated shares using our population estimates and subsequent data from the *Family Income and Expenditure Survey* for each quinquennium between 1968 and 1988. Since a household becomes economically active in these data when its head reaches 24 years of age, we were adding new generations every five years. Thus, by 1988, we are following 12 different economically active generations. Each has different vintages of net foreign assets, and thus every group is affected disparately by changes in the market value of private net foreign assets.

Public net foreign assets consist of economic and military aid and the assets of the central bank. We assumed that these assets are allocated equally among the agents alive during the course of the projected aid flows. Also, we assumed that the reserves of the central bank are a financial buffer held to smooth fluctuations in the future external balance, and thus we allocated an equal amount v of reserves per capita to all current and future domestic residents. Let V be the value of central bank reserves in the benchmark year; we allocated them according to the budget constraint

$$V = \sum_{t=0}^{\infty} v N_0 (1+g)^t / (1+i)^t,$$

Table 2. The Generational Profile of Net Foreign Assets (1990 dollars per capita)

Generation	Base case	Thirty percent Depreciation	Zero population growth
1911	45	123	69
1916	81	151	105
1921	88	155	112
1926	4	98	28
1931	-126	22	-102
1936	151	468	175
1941	131	441	154
1946	308	585	332
1951	460	742	484
1956	644	865	667
1961	630	799	654
1966	582	682	605
1971	112	112	136
1976	112	112	136
1981	112	112	136
1986	112	112	136
Later	112	112	136

where N_0 is the total population, g is the forecast population growth rate, and i is the nominal interest rate, all in 1990. We assumed that the population growth rate was 1.5% per annum, near its historical average in the last two decades.

Table 2 reports the results for the benchmark. Older generations were most active when Korea borrowed net foreign assets, and their generational profiles are smallest. Middle-aged residents have some positive net foreign assets because their peak savings years occurred when Korea began to increase outward investment. Also, younger residents and those not yet born have “accumulated” \$112 in net foreign assets, the per capita annuity implicit in the central bank’s foreign exchange reserves in 1990. At the beginning of this decade, projected economic and military aid flows were expected to last for only one year; thus the capitalized value of these flows for the unborn was zero.

Table 2 also explores two policy scenarios. The first involves a 30% depreciation of the won; it is modeled as a capital loss in the value of private liabilities to foreigners owed by domestic residents. This depreciation is thus a real loss for foreigners, and the third column of Table 2 shows that it Pareto-dominates the benchmark for domestic residents. The second scenario is one of projected zero population growth. Now the same amount of reserves can be spread among fewer current and future residents. This situation represents again a Pareto improvement over the benchmark for the domestic residents.⁹ Note also that one cannot Pareto-rank the first and second scenarios; agents who owe liabilities to foreigners prefer the depreciation, but generations who are not yet economically active prefer zero population growth since they are granted a larger share of the central bank’s reserves.

4. Conclusion

We have constructed the first measures of an external deficit that are fundamentally related to human welfare. A worsening of the conventional current account need not

indicate that a domestic resident will experience decreased utility. But a deterioration of the aggregate generational current account indicates an expectation of precisely that fact. For example, the military *coup* in 1961 entailed that Korea experienced a real constraint on its external accounts because of the anticipation of curtailed aid inflows. Also, the aggregate generational current account shows that the conventionally measured Korean external deficits of the 1960s and 1970s were not as profound as one might have thought.

Our constructions are benchmarks. As we have emphasized, these measures have meaning only when compared with alternative economic and military policies. The current spate of research on generational accounts has led the US Office of Management and Budget recently to report the federal budget deficit using both the conventional measure and generational accounts. We hope our own work on a generational measure of the external deficit will spur further empirical research into macroeconomic statistics based on economic fact, not accounting fiction.

Appendix 1: Description of the Data

The data on the net foreign assets of Korea were constructed from the Bank of Korea's *Economic Statistics Yearbook*. Table 4 is entitled "Monetary Survey" and reports foreign assets and foreign liabilities denominated in won. We used the end-of-period market exchange rate from the International Monetary Fund's *International Financial Statistics* to convert these values into current dollars; we took into account the monetary reform in the early 1960s that changed the currency from hwan into won. The data on foreign assets and liabilities denominated in foreign currencies are reported in Table 118 of the Bank of Korea's *Economic Statistics Yearbook*; these data are already reported in dollars. The value of the assets of the central bank are also included in the net international investment position of Korea; these data include the value of the Bank of Korea's gold stocks, and they are reported in dollars in Table 116 of the *Economic Statistics Yearbook*.

Aggregate data on inward and outward foreign direct investment are reported in dollars in the balance of payments table under the category "long-term capital." They are found in Table 106 of the *Economic Statistics Yearbook*. The data are reported in dollars and are disaggregated by host country for outward Korean foreign direct investment; they are found in Table 119 of the *Economic Statistics Yearbook*. We used disaggregated data on Southeast Asia, Oceania, Europe, North America, Latin America, Mid-Asia, and Africa for Korean outward foreign direct investment. The data were adjusted for changes in the market value of assets using stock market indices (or GDP deflators) and nominal exchange rates available in *International Financial Statistics*. We used data from Japan for Southeast Asian investment, those from the United States of America for North American investment, those from Germany for European investment, and those from Australia for investment in Oceania. We used the Saudi Arabian GDP deflator for Mid-Asian investment because Saudi Arabia has no stock market. We used GDP deflators from Liberia to construct direct investment in Africa and data on Panama to construct direct investment in Latin America for the same reason. Data on inward foreign direct investment were adjusted for changes in the Korean stock market using data from *Economic Statistics Yearbook*.

Since all data are expressed in dollars, we used the long-term Treasury Bill rate in the United States of America, as reported in *International Financial Statistics*, for the present-value calculations. For the present-value calculations that extend beyond 1994, we assumed that nominal American interest rates are constant into the indefinite

future. The data on Korea's conventional current account are from the balance-of-payments tables in various issues of *Economic Statistics Yearbook*.

The data on economic aid to Korea are reported in Table 152 in the Bank of Korea's *Economic Statistics Yearbook*. They are reported in dollars, and we capitalized the values that are reported in the first column of that table. In order to avoid double counting, we subtracted the value of current aid received in a given year because we assumed that shows up as foreign exchange assets in that year. The data on military aid came from the table on page 31 of Hwang et al. (1990). We summed the three columns labeled MAP (Military Assistance Program), MASF (Military Assistance Service Fund), and IMET (International Military Education and Training) for the subcategory covering aid accruing only to Korea.

The data used to construct the savings rates for each cohort were drawn from the Republic of Korea's National Statistical Office's *Annual Report on the Family Income and Expenditure Survey*. We used the difference between columns entitled "Income" and "Expenditures" to determine savings for a cohort. Estimates of the 1993 populations of each cohort are reported in the United Nations' *Statistical Yearbook for Asia and the Pacific* for 1994.

Appendix 2: The Expected Duration of Aid Flows

Here are our assumptions about the duration of *economic aid*. For the years 1950 through 1956 inclusive, we assumed that aid flows were expected to last forever. For the years 1957 through 1960 inclusive, we assumed that aid economic aid flows would last for 15 years. We made these assumptions because until 1958, economic aid increased steadily except during the Korean War and trade, aid and exchange rate policies exhibited a high degree of continuity (Krueger, 1979, p. 41). Also, economic aid was a main source of import financing, and the share of aid in GNP rose from roughly 7% in 1953 to 14% in 1957. Several institutions gave continuous unilateral transfers during these years. These included GARIOA (Government Appropriations for Relief in Occupied Areas), the Economic Cooperation Administration, UNKRA (United Nations Korea Reconstruction Agency), and CRIK (Civil Relief in Korea). Still, foreign economic aid started to decrease in the late 1950s, and that is why we assumed that its expected duration was only 15 years during the latter part of the decade.

We assumed that economic aid had an expected duration of only five years during 1961 and 1962. The absolute amount of aid flow started to fall in the late 1950s, and diplomatic relations between the United States of America and Korea deteriorated after the *coup d'état* in 1961. For the years from 1963 through 1966 inclusive, we assumed that the expected duration of aid was 10 years. The relationship between donor and recipient was predicated on the assumption that aid would continue to be phased out. This factor was crucial leading to the decision to embark upon an export-promotion strategy (Krueger, p. 112). Also, the absolute and relative importance of aid decreased, and by 1965, aid financed less than one-third of flow of imports. Finally, Korea's export orientation succeeded in attracting foreign capital, so aid was no longer perceived as enduring.

We assumed that economic aid during the period from 1967 through 1977 inclusive would have a duration of five years. The flow of economic aid kept decreasing throughout this period, and the United States was no longer the sole provider of aid. Most of its aid switched from grants to loans. Also, the Korean economy experienced dramatic

growth owing to the success of its five-year plans. Finally, we assumed that the duration of economic aid was one year for the period from 1978 to the present.

Here are our assumptions about the duration of *military aid*. For the period from 1950 through 1960 inclusive, we assumed that military aid would last forever. This assumption follows from the facts that the Korean War broke out in 1950, the United States of America and Korea signed their Mutual Defense Treaty in 1953, the United States of America had a permanent strategic interest in the Korean peninsula during the Cold War, and American troops were present in Korea along the Demilitarized Zone.

For the year 1961, we assumed that military aid would endure for only five years because diplomatic relations were strained between the United States and Korea owing to the military *coup* of that year. For the years from 1962 through 1968 inclusive, we assumed that the duration of military aid was 15 years. This was the period of the American troop buildup in Vietnam and Korea sent forces there as an ally of the Americans. The Brown Memorandum was issued in 1966, and the United States of America–South Korean Status of Forces Agreement came into effect in 1966.

For the years from 1969 through 1980 inclusive, we assumed that the expected duration of military aid flow was 10 years: The Nixon Doctrine was promulgated in 1969, and there was less emphasis on military assistance. This period saw a call for big reductions in defense spending in the United States of America, and there was a plan for partial withdrawal of American forces from Korea. Indeed, the reduction plan entailed cutting American forces in Korea from 62,000 to 10,000 soldiers. The Carter Administration maintained a withdrawal plan in spite of the Pueblo incident.

From 1981 to the present, the expected duration of military aid is one year. The United States of America has called on Korea to increase its share of expenses for America forces in Korea, and the Nunn–Warner Resolution has led to a reassessment of the role of American forces in Asia and the Pacific region.

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Notes

1. There is a subtlety here: the absolute level of a generational account is not meaningful, as Kotlikoff recognizes. A generational account, based upon current government policy and assumptions about the future behavior of the economy, can serve only as a benchmark against which one measures the effects of alternative government policies. Just as a utility function is defined only up to a class of monotonic functions, so are changes in generational accounts meaningful only as a measure of changes in policy, since only differences in individual utilities can be identified with different government policies.
2. Net military transfers have entered the United States of America external accounts on the balance of goods and services since 1960.
3. These preferences are quite general and not restricted to those satisfying the axioms of expected utility.
4. Of course, in our simple economy, there is only one period before the resolution of uncertainty, and thus there is no distinction between this stock and its first difference. Fisher (1995) actually defines the aggregate generational current account to be the present value of these first differences, but most macroeconomic statistics are reported in current dollars and we follow that convention here.
5. See Sakong (1993) and Krueger (1979) for a thorough discussion of these issues.
6. The important changes were the Nixon Doctrine in 1969 and the Carter Administration's troop withdrawal plan in 1977.
7. The dollar value of Korean direct foreign investment abroad in country i at the end of year t is $K_{i,t} = K_{i,t-1} \left(\frac{S_{i,t} F_{i,t}}{S_{i,t-1} F_{i,t-1}} \right) + I_{i,t}$, where $K_{i,t}$ is the dollar value of the stock of Korean net foreign assets; $S_{i,t}$ is the stock market index of country i at the end of time t , $F_{i,t}$ is the dollar price of currency i at the end of time t , and $I_{i,t}$ is the dollar value of the flow of Korean outward foreign direct investment in country i during year t . Data on inward foreign direct investment are available only from 1962, and those on outward foreign direct investment are reported starting only in 1968. We assumed that each $K_{i,t}$ was zero before the relevant data were reported.
8. These countries are Korea's major trading partners in the broad regions reported in the data on outward foreign direct investment in the Bank of Korea's *Economic Statistics Yearbook*.
9. Here we use the not implausible assumption that the agents not yet conceived are indifferent about the possibility of their eventual birth.