Definitions

1. Trade account:a record of the value of transactions undertaken between economic units of different countries for goods and services.

2. The current account includes along with trade account transactions the value of international transactions for a special type of service called **net factor payments from abroad**. These are, loosely speaking, payments to factors of production that are located in one country but owned by a citizens of another country. These factor payments include such things as interest payments from borrowers in one country to lenders in another, repatriations of profits earned in one country by foreign firms, and repatriated labor earnings earned by foreign workers.

3. The news frequently expresses concern over the magnitude of the trade account or current account **deficit**. The trade account is in deficit when the value of imports of goods and services exceeds the value of exports. It is in **surplus** when the value of exports exceeds the value of imports. It is in **balance** when the value of exports equals the value of imports. For the United States, for the year 2005 the trade **deficit** was approximately 717 billion dollars, and the current account **deficit** was approximately 705 billion dollars. SEE FIGURE

4. To gain perspective on these magnitudes, for the United States, for the year 1980 the trade account **deficit** was approximately 21 billion dollars, and the current account **deficit** was approximately 28 billion dollars. Of course, over these twenty-five years from 1980 to 2005, the size of the U.S. economy increased and the purchasing power of a dollar decreased. A better measure of the magnitude of the changes in these trade and current account numbers is found by looking at the trade balance/GDP and current account/GDP ratios for these two years. In 1980, U.S. GDP was $2789.5 billion, while in 2005 it was $12,730 billion. Thus the trade balance-GDP ratio went from about -.7% in 1980 to about -5.6% in 2005, while the current account-GDP ratio went from about -1% to about -5.5%.

5. The concerns raised about such deficits are, among others, how long they can continue before a "correction" takes place, and whether the deficits represent lost domestic jobs.

6. These concerns are not fleeting because, for most countries at most times, trade account and current account balances are not zero. Thus, a model useful for analysis of most relevant real world situations must be capable of analyzing trade and current account deficits and surpluses.

Accounting!

Country	Citizens and representatives
USA	A(lex), B(obby), G(overnment)
Great Britain	C(harley)
ROW	P(at)

1. To fix ideas, think of Alex as an economics professor who has written a book. Alex regularly sells copies of this book to Pat in ROW. Let Q_1 denote the quantity of books sold (perhaps 100, or 200, or any positive number), and P_1 the dollar price of a book, e.g., \$2.99/book. The value of these books measured in dollars is the amount Q_1P_1 which we will symbolize as $XP_P^A(t)$. The superscript denotes the person or economic unit selling the good or service and generating a **receipt**, while the subscript denotes the economic unit purchasing the good or service (generating an **expenditure** for them, of course). The number in parenthesis that follows tells us the time period in which the transaction took place. We will consistently use $XP_j^i(t)$ to symbolize the value of a sale of a good or service from individual i to individual j during period t, and the use of "XP" is a mnemonic device to remind us that the sale of some good or service by individual i can be thought of as an "e**xp**ort" by i.

2. To orient ourselves to our earlier discussion of budget constraints, note that "XP" can always be broken down (as we did) into the price per unit of the good or service times the number of units sold. For example, in our model of an endowment economy, the sale of an individual's endowment of, say, coffee, would be worth (measured in units of a currency) $P_C \times \overline{C}_i$. In the notation introduced here, this would be equal to XP_j^i:

$$P_C \times \overline{C}_i = XP_j^i$$

3. Assume Alex also *purchases* goods from Pat in ROW. Imagine, for example, that he purchases beer in amount Q_2 at dollar price P_2. The value measured in units of dollars of this beer purchase is thus $Q_2 \times P_2$, which we denote as $M_P^A(t)$. Again, the superscripts and subscripts denote that this is a purchase by Alex from Pat, and the "(t)" denotes the time period during which the transaction takes place. We will consistently symbolize purchases by individual i from individual j during period t by $M_j^i(t)$. The choice of "M" is a mnemonic device to remind us that the purchase of a good or service by individual i is an "i**m**port" for i.

4. Now consider transactions in which Alex buys or sells assets. Imagine that Alex takes out a loan, i.e., borrows, an amount of money, from an economic entity in a foreign country, during period t. To be concrete, imagine that Alex borrows money from Charley. We will denote the value of this borrowing as $BF_C^A(t)$, where "BF" is a mnemonic device that signifies "borrowings from." Such a borrowing is thought of as a sale by Alex of an asset, namely an IOU, and thus generates a "payment" this year to Alex from Charley.

Assume Alex also took out a loan, i.e., borrowed, from Charley last year, and must repay that loan with interest this year. We denote the value of this expenditure as $[1 + r_{t-1}]BF_C^A(t-1)$ The r_{t-1} identifies the interest rate that applies to the loan, with the subscript "$t-1$" indicating that the rate was set when the loan was taken out last year, and the number "$t-1$" in parentheses following BF_C^A identifies the year in which the loan was incurred. The interest component of this expenditure, $r_{t-1} \times BF_C^A(t-1)$, can be thought of as a purchase of the "service" of having the use of the loan from one period to the next. The "repayment of principal" component of this expenditure, $BF_C^A(t-1)$, can be thought of as the purchase of an asset, namely Alex's previously-issued "IOU."

Imagine Alex also makes a loan to Bobby this year (year t). The value of this *expenditure* by Alex is denoted by $LT_B^A(t)$, where "LT" stands for "loan to." Such a loan can be thought of as a purchase of an asset, namely Bobby's IOU.

Alex also receives a repayment of a loan made the previous year to Bobby. This value of this receipt (for Alex) of principle and interest is denoted by $(1 + r_{t-1})LT_B^A(t-1)$. Again, this transaction can be broken into two parts: the interest component which represents sale of the "service" of the use of the money for a year; and the repayment of principal which can be thought of as the sale of an asset, namely Bobby's IOU.

Again, for simplicity assume these two transactions constitute all of Alex's purchases or sales of assets during period t.

Alex's transactions

Description	Symbolic representation
Book sale to Pat	$X_P^A(t)$
Beer purchase from P	$M_P^A(t)$
Food purchase from B	$M_B^A(t)$
Taxes paid to gov't.	T_G^A
Borrowings from C at $t-1$	$BF_C^A(t-1)$
Repay of principle to C at t	$BF_C^A(t-1)$
Borrowings from C at t	$BF_C^A(t)$
Interest paid to C	$r_{t-1}BF_C^A(t-1)$
Loans to Bob at $t-1$	$LT_B^A(t-1)$
Repay of principle to B at t	$LT_B^A(t-1)$
Loans to Bob at t	$LT_B^A(t)$,
Interest collected from B	$r_{t-1}LT_B^A(t-1)$

Receipts	Payments
$XP_P^A(t)$	$M_P^A(t)$
$(1+r_{t-1})LT_B^A(t-1)$	$M_B^A(t)$
$BF_C^A(t)$	$[1+r_{t-1}]BF_C^A(t-1)$
	$LT_B^A(t)$
	T_G^A

These are all of Alex's transactions for the year t. Because we have faithfully recorded all of Alex's transactions, and we have made sure that we attributed a purchase to every payment, it must be that his expenditures (payments made for purchases or taxes) equals his receipts (payments *received* from sales). Symbolically, for the stipulated transactions, this is:

$$\overbrace{XP_P^A(t)+(1+r_{t-1})LT_B^A(t-1)+BF_C^A(t)}^{receipts}$$
$$=\overbrace{M_P^A(t)+M_B^A(t)+T_G^A(t)+[1+r_{t-1}]BF_C^A(t-1)+LT_B^A(t)}^{payments}$$

As a historical record, this is an accounting *identity*: it is true by virtue of definition. We could also have interpreted this as a *planned* budget: in this case, the equality between receipts and payments would reflect that a planned budget makes no sense if planned expenditures don't equal planned receipts.

With a little algebra, we can rearrange Alex's budget constraint to highlight these categories:

$$\overbrace{XP_P^A(t) - M_P^A(t) - M_B^A(t) - T_G^A}^{TBS_t^A}$$

$$+\overbrace{r_{t-1} \times LT_B^A(t-1) - r_{t-1} \times BF_C^A(t-1)}^{NFPFO_t^A}$$

$$=\overbrace{[LT_B^A(t) - LT_B^A(t-1)] - [BF_C^A(t) - BF_C^A(t-1)]}^{\Delta NA_A(t)}.$$

The symbol TBS_t^A stands for "Alex's trade balance surplus for period t," the symbol $NFPFO_t^A$ stands for "*net* factor payments from others at period t," and the symbol $\Delta NA_A(t)$ stands for "the change in Alex's *net* assets from $t-1$ to t." Thus, in words, we would express Alex's accounting statement as:

> Alex's trade balance surplus (sometimes called *net exports*) plus Alex's net factor payments from others equals the change in Alex's net assets.

Note the distinction between "net" and "gross:" Alex has two "gross" components for net factor payments, namely a payment from Bobby and a payment to Charley. The difference is defined as the "net" factor payments from others. The same is true concerning Alex's net foreign assets: there is a "gross" change in loans made to others, and a "gross" change in borrowings from others, and the difference is defined as the net change. This means that "net" values can be either positive or negative.

We can also display Alex's transactions in tabular form, as in the following chart by transaction partner and by category. The category "G&S" refers to "goods and services per unit of time," the category "NFPFO" refers to "net factor payments from others," the category "ΔNA" refers to "The change in net assets," and the category "Bi. TBS" refers to "bilateral trade balance surplus," and the category "Bi. CAS" refers to "bilateral current account surplus. The bottom row simply aggregates over all transactions within a category. This means the last row entry under "Bi. TBS" and under "Bi. CAS" are, obviously, not bilateral entities, but the overall aggregate for Alex.

	G & S	NFPFO	ΔNA	Bi. TBS	Bi. CAS
B	M_B^A	$r_{t-1}LT_B^A(t-1)$	ΔLT_B^A	$-M_B^A$	$rLT_B^A - M_B^A$
C		$-r_{t-1}BF_C^A(t-1)$	ΔBF_C^A	0	$-rBF_C^A$
G	T_G^A			$-T_G^A$	$-T_G^A$
P	$XP_P^A,\ M_P^A$			$XP_P^A - M_P^A$	$XP_P^A - M_P^A$
Agg	$\overbrace{XP_P^A - T_G^A - M_B^A - M_P^A}^{TBS}$	$r_{t-1}(LT_B^A(t-1) - BF_C^A(t-1))$	$\Delta LT_B^A - \Delta BF_C^A$		$\overbrace{TBS + NFPFO}^{CAS}$

Alex's transactions

The tabular display also emphasizes that there is no reason to expect bilateral balances to be zero.

As with Alex, we list a description of all of Bobby's transactions along with the symbolic representation of each:

Bobby's transactions

Description	Symbolic representation
Sale of BBQ to Charley	$XP_C^B(t)$
Purchase beer from Charley	$M_C^B(t)$
Sale of BBQ to Pat	$XP_P^B(t)$
Sale of BBQ to Gov't.	$XP_G^B(t)$
Purchase new oven from Pat	$M_P^B(t)$
Taxes paid to gov't.	T_G^B
Sale of BBQ to Alex	$XP_A^B(t)$
Borrowings from Alex at $t-1$	$BF_A^B(t-1)$
Repayment of principle to Alex at t	$BF_A^B(t-1)$
Borrowings from Alex at t	$BF_A^B(t)$
Loans to Pat at $t-1$	$LT_P^B(t-1)$
Pat's repayment of principle to Alex at t	$LT_P^B(t-1)$
Loansto Pat at t	$LT_P^B(t)$
Interest paid to Alex	$-[r_{t-1}BF_A^B(t-1)]$
Interest collected from Pat	$r_{t-1}LT_P^B(t-1)$

Bobby's accounting statement for year t is thus:

$$\overbrace{XP_C^B(t) + XP_A^B(t) + XP_P^B(t) + XP_G^B(t) + BF_A^B(t) + (1 + r_{t-1}) \times LT_P^B(t-1)}^{receipts}$$

$$= \overbrace{M_C^B(t) + M_P^B(t) + M_G^B + LT_P^B(t) + [1 + r_{t-1}]BF_A^B(t-1)}^{payments}.$$

As with Alex's statement, Bobby's can be rearranged into a form that will prove more useful for our purposes:

$$\overbrace{XP_C^B(t) + XP_A^B(t) + XP_P^B(t) + XP_G^B(t) - M_G^B - M_P^B(t) - M_C^A(t)}^{TBS_t^B}$$
$$+ \overbrace{[r_{t-1} \times LT_C^B(t-1)] - [r_{t-1} \times BF_A^B(t-1)]}^{NFPFO_t^B}$$
$$= \overbrace{[LT_C^B(t) - LT_C^B(t-1)] - [BF_A^B(t) - BF_A^B(t-1)]}^{\Delta NA_t^B}.$$

And again as with Alex, we can display Bobby's transactions in tabular form.

	G &S	NFPFO	ΔNA_B	Bi. TBS	Bi. CAS
A	XP_A^B	rBF_A^B	ΔBF_A^B	XP_A^B	$-rBF_A^B + XP_A^B$
C	$XP_C^B,\ M_C^B$			$XP_C^B - M_C^B$	$-rBF_C^A + TBS_C^B$
G	$X_G^B,\ M_G^B$			$XP_G^B - M_G^B$	$XP_G^B - M_G^B$
P	$XP_P^B,\ M_P^B$	rLT_P^B	ΔLT_P^B	XP_P^B	XP_P^B
Agg	$\overbrace{XP_A^B + XP_C^B + XP_P^B + XP_G^B(t) - M_G^B - M_P^B(t) - M_C^B}^{TBS}$	$rLT_P^B - rBF_A^B$	$\Delta LT_P^B - \Delta BF_A^B$		$\overbrace{TBS + NFPFO}^{CAS}$

Bobby's transactions

Again, the tabular display emphasizes that we should not expect bilateral balances to be zero.

The Government's record of transactions

In reality, the government collects taxes from many sources and buys tanks, planes, paper clips and the like. It also sells bonds to many and varied economic agents. We now record the government's transactions in our simplified world.

Government purchases or sales of goods and/or services

In our simplified world, though, we assume the government collects taxes from Alex and Bobby and purchases barbecue sauce from Bobby. For the governments records, the dollar value of the tax collections are denoted by $T_A^G(t)$ and $T_B^G(t)$, respectively, and the value of the purchase of barbecue sauce from Bobby is denoted as $M_B^G(t)$.

Government purchases or sales of assets, and net factor payments

In our simplified scenario, we will assume the government borrows money this period from Pat. The dollar value of the government borrowing from Pat this period is denoted as $BF_P^G(t)$.

We also assume the government has borrowed money in the past period from Pat in amount $BF_P^G(t-1)$. Thus, the repayment to Pat of the principle and interest of the loan from last period is denoted by $[1+r_{t-1}]BF_P^G(t-1)$.

Summing up: **the government's transaction record as a budget constraint**

The government's accounting statement for year t is thus:

$$\overbrace{T_A^G(t)+T_B^G(t)+BF_P^G(t)}^{receipts}=\overbrace{M_B^G(t)+[1+r_{t-1}]BF_P^G(t-1)}^{payments}.$$

As with Alex and Bobby, we can rearrange this as

$$\overbrace{T_A^G(t)+T_B^G(t)-M_B^G(t)}^{TBS_G}+\overbrace{[-r_{t-1}BF_P^G(t-1)]}^{NFPFO_G}=\overbrace{-[BF_P^G(t)-BF_P^G(t-1)]}^{\Delta NA_G}.$$

National or economy-wide budget constraints

For each individual economic unit, all this might seem obvious. The virtue of going into this much detail is only seen when we use these individual budget constraints to construct the national transactions record. This is done by adding up all the expenditures of the economic units of Alex and Bobby and the government, the only three members of this hypothetical United States, and setting them equal to the sum of the receipts of these three economic units. The *nations's* transaction record is thus:

$$\begin{aligned}
&XP_C^A(t)+(1+r_{t-1})LT_B^A(t)+BF_C^A(t)+\\
&XP_C^B(t)+XP_A^B(t)+XP_P^B(t)+BF_A^B(t)+(1+r_{t-1})\times LT_P^B(t-1)\\
&+T_A^G(t)+T_B^G(t)+BF_P^G(t)\\
=\ &M_C^A(t)+M_B^A(t)+T_G^A(t)+M_C^A(t)+M_G^B(t)+M_P^B(t)+M_B^G(t)+T_G^B+LT_P^B(t)+LT_B^A(t)\\
&+[1+r_{t-1}]BF_A^B(t-1)+[1+r_{t-1}]BF_C^A(t-1)\\
&+[1+r_{t-1}]BF_P^G(t-1)
\end{aligned}$$

But some of these entries are the same number: *a transaction between two members of the same country is an expenditure for one but a receipt for the other*. In our example, this is reflected in following equalities:

$$(1+r_{t-1})LT_B^A(t-1)=[1+r_{t-1}]BF_A^B(t-1);$$

$$XP_A^B(t)=M_B^A(t);$$

$$BF_A^B(t)=LT_B^A(t);$$

$$T_A^G(t)=T_G^A(t);\ T_B^G(t)=T_G^B.$$

Making use of these equalities, we write the national budget constraint as:

$$\begin{aligned}
&XP_P^A(t)+BF_C^A(t)+XP_C^B(t)+XP_P^B(t)+(1+r_{t-1})\times LT_P^B(t-1)+BF_P^G(t)\\
=\ &M_P^A(t)+M_C^B(t)+M_P^B(t)+[1+r_{t-1}]BF_C^A(t-1)+LT_P^B(t)+[1+r_{t-1}]BF_P^G(t-1).
\end{aligned}$$

Note that the only transactions remaining are those between the economic units of different countries. This is a general feature of economy-wide budget constraints, no matter how many different economic units are involved and no matter how many transactions.

We can rearrange this in a slightly different and more memorable manner:

$$\overbrace{[XP_P^A(t) + XP_C^B(t) + XP_P^B(t)]}^{\text{exp}\,orts} - \overbrace{[M_P^A(t) + M_C^B(t)]}^{imports} +$$

$$\overbrace{[r_{t-1} \times LT_P^B(t-1)] - [r_{t-1} \times BF_C^A(t-1)] - [r_{t-1} \times BF_P^G(t-1)]}^{net\ \text{factor}\ payments}$$

$$= \overbrace{[LT_P^B(t) - LT_P^B(t-1)] - [BF_C^A(t) - BF_C^A(t-1)] - [BF_P^G(t) - BF_P^G(t-1)]}^{\Delta\ net\ foreign\ assets}.$$

In words, this says that the value of exports minus the value of imports plus interest payments made from foreigners to the citizens and government of the hypothetical U.S. economy (made up of Alex and Bobby and the government) minus interest payments made from U.S. citizens and the U.S. government to foreigners equals the the change in the value of aggregate United States citizens and government's holdings of foreign assets minus the change in foreigners' holdings of United States citizens andgovernment's assets. If these are planned transactions, we would refer to this as the economy-wide budget constraint.

To reiterate, we have special terminology for the three major components of this economy-wide budget constraint:

1. The value of exports minus the value of imports is known as the **trade balance surplus**. When this is a negative number, it is frequently referred to as the **trade deficit**. When this is a positive number, it is referred to as the **trade surplus**.

2. The trade balance surplus plus the *net* factor payments from abroad that arise from holdings of foreign assets such as bonds, or stocks, or ownership of companies, e.g., Nissan plant in Tennessee, is known as the **current account surplus**. When this is a negative number it is frequently referred to as the **current account deficit**. When this is a positive number, it is referred to as the **current account surplus**.

3. The national budget constraint identity says the current account surplus must equal the change in net foreign assets. This is also known as the **balance of payments** identity.

Note that the balances for the nation as a whole are sums of individual balances. This means, for example, that the change in net foreign assets is the *sum* of increases in loans from home-country residents (including governments) to foreigners *minus* the increase in the sum of loans from foreigners to domestic residents (including governments). The point here is that national accounts of the various categories are determined by *individual economic agents'* decisions. Keep this in mind whenever you read in the newspapers, for example, an article that treats any of these balances as if they are determined by the nation as a monolithic whole.

BOP meets NIPA

Consider again Alex's record of transactions:

Alex's Transactions

Receipts	Payments
$XP_P^A(t)$	$M_P^A(t)$
$(1+r_{t-1})LT_B^A(t-1)$	$M_B^A(t)$
$BF_C^A(t)$	$[1+r_{t-1}]BF_C^A(t-1)$
	$LT_B^A(t)$
	T_G^A

There is another way of classifying Alex's transactions: we can classify some of his receipts as *income*, some as taxes, some as consumption, some as purchases and/or sales of assets. To simplify, we note that repayments of principle of a previously-transacted borrowing can be thought of as a purchase of an asset. That is, if Alex borrowed from Charley last period, this can be thought of as a previous-period *sale* of an "Alex IOU" to Charley. Hence, when Alex repays the loan, this can be thought of as a repurchase of the IOU, i.e., a purchase from Charley of an asset. We display this classification in the following table.

Alex's transactions

Description	Net Income	Consumption	Δ assets (ΔA_A)
Book sale to Pat	$X_P^A(t)$		
Beer pur. from Pat		$M_P^A(t)$	
Food from B		$M_B^A(t)$	
Taxes	T_G^A		
Borrowings from			$[BF_C^A(t) - BF_C^A(t-1)]$
interest paid to	$[r_{t-1}BF_C^A(t-1)]$		
Loans to			$LT_B^A(t) - LT_B^A(t-1)$
interest collected from	$r_{t-1}LT_B^A(t-1)$		

Alex's net (after-tax) income over this period, denoted Y_A, is thus

$$Y_A = X_P^A(t) + r_{t-1}LT_B^A(t-1) - [r_{t-1}BF_C^A(t-1)] - T_G^A.$$

Alex's consumption, denoted C_A, is thus

$$C_A = M_P^A(t) + M_B^A(t).$$

Alex's savings this period, denoted S_A, is the difference between net income and consumption:

$$S_A = Y_A - C_A.$$

The budget constraint thus implies

$$S_A = \Delta A_A.$$

That is, Alex's savings equals the change in Alex's net worth, i.e., the increase (or decrease) in Alex's asset holdings.

We can do the same classification of transactions for Bobby:

Bobby's transactions

Description	Net Income	Consumption	Δ assets (ΔA_B)
Sale of BBQ	$XP_C^B(t)$		
Purchase beer		$M_C^B(t)$	
Sale of BBQ	$XP_P^B(t)$		
Sale of BBQ	$XP_G^B(t)$		
New Oven			$M_P^B(t) \equiv I_B$
Taxes	T_G^B		
Sale of BBQ	$XP_A^B(t)$		
Borrowings from			$[BF_A^B(t) - BF_A^B(t-1)]$
Loans to			$LT_P^B(t) - LT_P^B(t-1)$
interest paid to	$[r_{t-1}BF_A^B(t-1)]$		
interest collected from	$r_{t-1}LT_P^B(t-1)$		

Note that we have put Bobby's purchase of a new oven into the "Δ assets" category. This is because the oven is a physical asset. In macroeconomics terminology, this is viewed as *investment* (hence the new symbol I_B) because it is an addition to Bobby's physical capital stock.

Bobby's budget identity thus implies the followed reformulated identity:

$$Y_B - C_B = S_B = \Delta A_B.$$

We can do the same exercise with the government. The following table re-classifies the governments transactions as was done with Alex and Bobby:

Government's transactions

Description	Income	Consumption	Δ assets (ΔA_G)
BBQ purchase		$M_B^G(t)$	
Taxes from Andy	$T_A^G(t)$		
Taxes from Bob	$T_B^G(t)$		
Borrowings from			$[BF_P^G(t) - BF_P^G(t-1)]$
interest paid to	$[r_{t-1} BF_P^G(t-1)]$		

Thus, by the same logic, the government budget identity implies:

$$T - G = S_G = \Delta A_G.$$

where we have substituted the traditional macroeconomics symbols "G" for M_B^G and "T" for the sum of taxes collected by the government, which is just $T_A^G(t) + T_B^G(t)$ in our simple example.

We can now add up these reformulated budget identities over all members of our economy–namely Andy, Bob, and the government–and get a reformulated national budget identity:

$$S_A + S_B + S_G = \Delta A_A + \Delta A_B + \Delta A_G.$$

Macroeconomics breaks this identity down by making use of the fact that transactions between economic entities within the same country cancel out in the aggregate. In particular, we have

$$[r_{t-1} \times BF_A^B(t-1)] = r_{t-1} \times LT_B^A(t-1);$$
$$LT_B^A(t) - LT_B^A(t-1) = [BF_A^B(t) - BF_A^B(t-1)];$$

Making use of this, we can write the national budget identity as

$$S - I = \Delta NFA,$$

where *national savings,* denoted by S, is the sum of *private savings*, denoted by S_P, which is just $S_A + S_B$ in our example, and I symbolizes additions to the capital stock, and is just I_A in our example. As before, ΔNFA symbolizes the change in net foreign assets.

Miller time

Previously, we showed that the current account surplus equals the change in net foreign assets:

$$CAS = \Delta NFA.$$

Now we know that it also must be true that national savings minus investment must equal the change in net foreign assets. This implies that savings minus investment must equal the current account surplus:

$$S - I = CAS.$$

The general principle is that the present discounted value of exports plus the value of inherited wealth must equal the present discounted value of imports.

The specific simple example to illustrate this is a two-period model. In the first period, residents of a country may have existing assets or debts, the sums of which are denoted as LT_0 and BF_0, respectively. The budget constraint for the country in the first period, denoted as time $t = 1$, is thus:

$$\overbrace{[XP_1 - M_1] + r_0 \times [LT_0 - BF_0]}^{CAS} = \overbrace{LT_1 - LT_0 - [BF_1 - BF_0]}^{\Delta NFA}$$

where XP_t and M_t refer to the value of *aggregate* exports and imports in period t (period one(1) in this period), LT_t is the sum of the loans made from members of the home country to economic units of foreign countries in period t, and BF_t is the sum of the borrowings of members of the home country from members of foreign countries in period t. That is, $[LT_t - BF_t]$ is net foreign assets of the home country at period t, $t = 0, 1$.

Notice we can rearrange this:

$$[LT_1 - BF_1] = (XP_1 - M_1) + (1 + r_0)[LT_0 - BF_0].$$

Now we add some assumptions about behavior.

In the second period, interest payments and principle from first-period loans and borrowings must be repaid. Furthermore, because this is the last period of existence for the country (by assumption), no new loans or borrowings will occur. After all, if everyone is going to die, they wouldn't loan anything to other people, because they wouldn't be around to use the principle and interest that would be repaid, and they would be giving up current consumption.

And no one else would loan such a person anything, because they wouldn't get repaid. As one of the authors' favorite bumper stickers says, "He who dies in debt wins." Sentiments such as these keep prudent lenders from making loans to anyone in their last period of life.

Thus, the period-two budget constraint is given by:

$$XP_2 - M_2 + [(1 + r_1)LT_1 - (1 + r_1)BF_1] = 0.$$

We can rearrange this as:

$$[LT_1 - BF_1] = -\frac{XP_2 - M_2}{1 + r_1}$$

Equating the expression for $[LT_1 - BF_1]$ derived from the first period budget constraint to the expression for $[LT_1 - BF_1]$ derived from the second period budget constraint yields

$$(XP_1 - M_1) + (1 + r_0)[LT_0 - BF_0] = -\frac{XP_2 - M_2}{1 + r_1}.$$

Rearranging to separate exports from imports yields the **lifetime budget constraint**:

$$XP_1 + \frac{XP_2}{1+r_1} + (1+r_0)[LT_0 - BF_0] = M_1 + \frac{M_2}{1+r_1}.$$

We denote this the lifetime budge constraint because it can be interpreted as a statement that says:

> The present discounted value of lifetime receipts equals the present discounted value of lifetime imports.

Consider first the case in which $[LT_0 - BF_0] = 0$, that is, the case in which there is no legacy of net foreign assets. In this case, the lifetime budget constraint simply says that the present discounted value of exports equals the present discounted value of imports. In this sense we can say that "exports pay for imports" even though at any moment in time a nation's value of exports can be less than or greater than its value of imports.

Now let us consider the case in which we start with non-zero net foreign assets. Now, we must amend our description of the lifetime budget constraint to say "the present value of exports plus the value of inherited net foreign assets equals the present value of imports."

The logic of this exercise extends to as many time periods as we would like: three, four, five, two thousand, three gazillion, and more.

This exercise has two important purposes. First, it is important for our interpretation of the analysis of "real" trade, i.e., the POW model of trade within a period, because it lets us put in perspective the results about patterns, effects, and gains from trade that are derived from simple models in which the trade balance is always zero. The results are robust to real-world conditions of non-zero trade balances because we can reinterpret the simple models as applying to the "lifetime" of an economy.

Second, the exercise let's us think about current events. Let us see what the exercise implies about, for example, the U.S. situation in 2006. In 2006, the U.S. is in a situation in which inherited net foreign assets are negative, and in which the current value of exports is less than the current value of imports, i.e., both the trade balance and the current account balance are negative (in deficit). The logic of the lifetime budget constraint implies that at some point in the future the U.S. will run a trade balance surplus.

What, then, is all the fuss about concerning the U.S. trade balance and current account deficit? Why, for example, does the IMF stress that the U.S. "reliance on foreign capital" is a "big source of risk in the international economy and could prompt a disorderly decline in the dollar?"

To even begin answering this, we need some further assumptions about behavior (which we do not do in this class).