Macroeconomic Measurement 3: The Accumulation of Value

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So far we discussed how a country creates value in a given interval of time. In this lecture we will discuss how value gets accumulated over time creating assets (or liabilities). In particular we will be describing the accumulation of assets of private households vis-vis the government and of a country as whole vis-a-vis the rest of the world.

Assets and savings

Before we start it's useful to review the distinction between stocks and flows. A stock is a quantity measured at a point in time (like the end of month balance in your credit card) and a flow is a quantity that is measured over a period of time (like your purchases and payments during the month). The evolution of a stock variable usually depends on past flows plus other conditions. For example your credit card balance at the end of the month depends on the payments and purchases made during the month plus the interest rate charged on the past stock. In the previous lecture we have seen an example of stock and flow with capital and investment.

Government Saving and Deficit

Account 4 reported in figure 1 (from NIPA) shows the sources of revenues and current expenditures of the US Government in 2009. The US government, like most governments, receives most of its resources through taxation and most of its current expenditures are public consumption (like paying government employees or military expenses), transfers (like social security or welfare) and interest payments on outstanding government debt. We thus define government net saving S_G as government revenues (Taxes) less government consumption (C_G) less transfers less interest payments on government debt, which we denote by $r \cdot B^g$

$$S_G = \text{Taxes-Transfers} - C_G - r \cdot B^g \tag{1}$$

In 2009 net saving of the US government was -1271 billion dollars (around 8.5% of GDP). The fact that saving is negative means the the US government needs to issue new debt to finance current expenditure. Note though that the issue of new debt has also to be used to finance investment spending, which is not included in current expenditures. The total financing needs of a government are called government deficit (surplus) and lead to an increase (or decrease if the deficit is negative) of government debt. More formally

$$\text{Government Deficit} = B^g_{t+1} - B^g_t = I_G - S_G \tag{2}$$

Sometimes economists also distinguish between total deficit and the Primary deficit which is just the deficit less interest payments on government debt i.e.

$$\text{Primary Deficit} = I_G - S_G - r \cdot B^g = I_G + C_G + \text{Transfers} - \text{Taxes} \tag{3}$$

Now combining equation (2) with equation (3) one gets the following

$$B^g_{t+1} = B^g_t(1+r) + \text{Primary Deficit}_t$$

which shows the two key forces that drive up government debt, i.e. high primary deficits and high interest rates. Sometimes it is useful to divide both sides of the equation above by Y_t GDP to get

$$\frac{B^g_{t+1}}{Y_t} = \frac{B^g_t(1+r)}{Y_t} + \frac{\text{Primary Deficit}_t}{Y_t}$$

then multiply and divide the left hand side by Y_{t+1}

$$\frac{B^g_{t+1}Y_{t+1}}{Y_{t+1}Y_t} = \frac{B^g_t(1+r)}{Y_t} + \frac{\text{Primary Deficit}_t}{Y_t}$$

$$b_{t+1} = b_t\frac{1+r}{1+g} + \frac{1}{1+g}\frac{\text{Primary Deficit}_t}{Y_t} \tag{4}$$

$$\text{where we define } b_t \equiv \frac{B_t}{Y_t},$$

$$1+g \equiv \frac{Y_{t+1}}{Y_t} \tag{5}$$

Equation 4 determines the evolution of a more relevant fiscal indicator, i.e. the debt to GDP ratio. It shows that the key factor that determines the stability of government debt to output ratio is really $\frac{1+r}{1+g}$,(or alternatively the term $r-g$). If $r-g>0$ then $\frac{1+r}{1+g} > 1$ and even a constant negative primary deficit to output ratio might not be

Account 4. Government Receipts and Expenditures Account

Line			Line		
1	Consumption expenditures (1–30)	2,411.5	14	Current tax receipts	2,409.3
2	Current transfer payments	2,164.9	15	Personal current taxes (3–1)	1,140.0
3	Government social benefits	2,112.3	16	Taxes on production and imports (1–6)	1,024.7
4	To persons (3–23)	2,096.8	17	Taxes on corporate income (2–13)	231.4
5	To the rest of the world (5–18)	15.5	18	Taxes from the rest of the world (5–18)	13.2
6	Other current transfer payments to the rest of the world (net) (5–18)	52.7	19	Contributions for government social insurance (3–25 and 5–18)	975.1
7	Interest payments (3–20)	362.0	20	Income receipts on assets	162.2
8	Subsidies (1–7)	60.3	21	Interest and miscellaneous receipts (2–2 and 3–20)	140.8
9	*Less:* Wage accruals less disbursements (1–4)	0.0	22	Dividends (3–21)	21.5
10	Net government saving (6–14)	–1,271.9	23	Current transfer receipts	193.5
11	Federal	–1,251.7	24	From business (net) (2–7)	98.5
12	State and local	–20.1	25	From persons (3–6)	95.0
			26	Current surplus of government enterprises (1–10)	–13.2
13	**GOVERNMENT CURRENT EXPENDITURES AND NET SAVING**	**3,726.9**	27	**GOVERNMENT CURRENT RECEIPTS**	**3,726.9**

Figure 1: Net Savings of US Government

enough to stabilize the debt to output ratio (why is this the case?); on the contrary if $r - g < 0$ debt to output ratio can stabilize even with a positive constant primary deficit.

Figure 2 shows the pattern of US federal government surplus and government debt from 1962 plus the Congressional Budget Office (CBO) forecasts for the next 10 years. Notice that when surplus is very negative (i.e. it is a big deficit) like in 2008-2009 debt tends to increase. To give you a perspective on how large the current US debt is Figure 2 shows a very long run series of the US Debt to GDP ratio (notice the impact of wars) together with some CBO prediction for its future evolution.

In later classes we will discuss more the long term perspectives on the US Budget and the causes and consequences of large government debts. If you'd like to read more about this please check the CBO website and in particular the recent study on long run budget outlooks. The CBO website is also a very good source for more disaggregated data (for example defense v/s non defense, on v/s off budget, federal v/s state) on government budget. The IMF follows quite closely the fiscal evolution of many countries in the world, and if interested in chacing the fiscal stance of a particular country you can consult the IMF fiscal monitor. Figure 4, for example, shows government debt (Gross which is total and Net which is net of financial assets of the government) in a number of countries in the world.

Foreign assets

Nowadays international capital markets are relatively open and national households can buy foreign assets (and foreign households can buy domestic assets). Let's denote by A the stock of foreign assets held by US nationals (this includes, for example, the villa on the French Riviera owned by Lance Armstrong) and by L the stock of US domestic assets held by foreigners (this includes for example the US Treasury Bonds

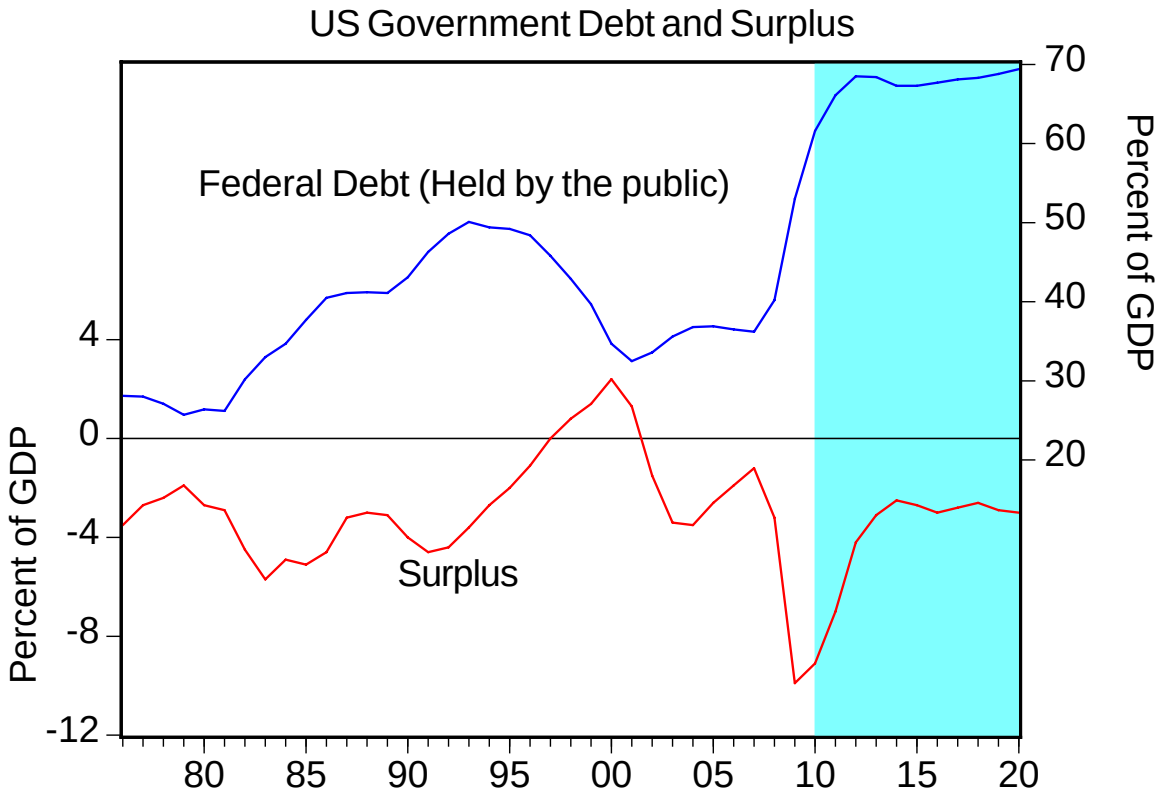
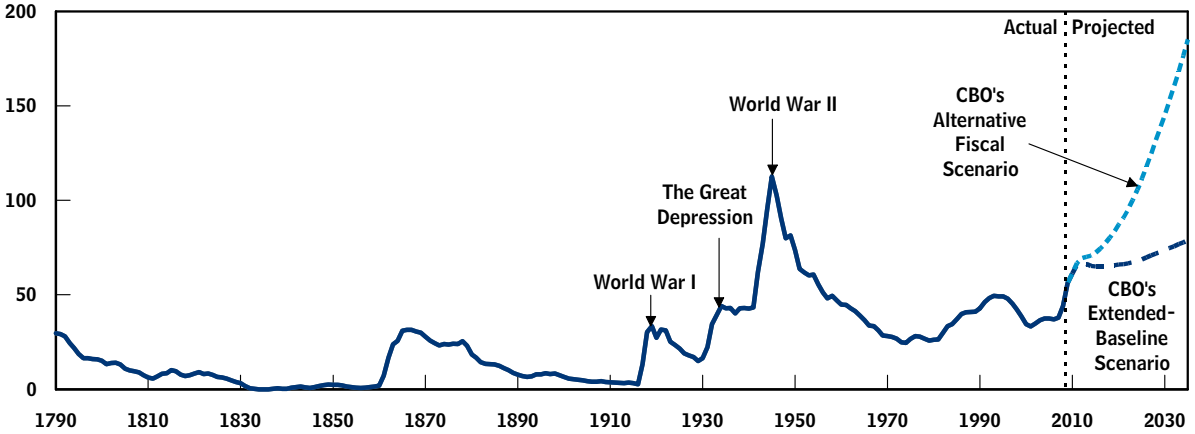


Figure 2: US Government Deficit and Debt

Federal Debt Held by the Public, 1790 to 2035

(Percentage of gross domestic product)



Source: Congressional Budget Office, *The Long-Term Budget Outlook* (June 2010); *Historical Data on Federal Debt Held by the Public* (July 2010).

Note: The extended-baseline scenario adheres closely to current law, following CBO's 10-year baseline budget projections through 2020 (with adjustments for the recently enacted health care legislation) and then extending the baseline concept for the rest of the long-term projection period. The alternative fiscal scenario incorporates several changes to current law that are widely expected to occur or that would modify some provisions that might be difficult to sustain for a long period.

Figure 3: Long term evolution of US Debt

Table 5. General Government Debt, 2008–13
(Percent of GDP)

					Projections		Difference from September 2011 *Fiscal Monitor*		
	2008	2009	2010	2011	2012	2013	2011	2012	2013
Gross debt									
Advanced economies	81.5	93.0	99.3	103.5	106.5	108.6	0.9	0.8	1.1
United States	76.1	89.9	98.5	102.9	106.6	110.2	2.9	1.6	1.2
Euro area	70.2	79.9	85.7	88.1	90.0	91.0	–0.7	–0.7	0.1
France	68.3	79.0	82.4	86.3	89.0	90.8	–0.6	–0.4	0.0
Germany	66.7	74.4	83.2	81.5	78.9	77.4	–1.1	–3.0	–3.5
Italy	105.8	116.1	118.7	120.1	123.4	123.8	–1.0	2.0	3.7
Spain	40.2	53.9	61.2	68.5	79.0	84.0	1.0	8.9	11.2
Japan	191.8	210.2	215.3	229.8	235.8	241.1	–3.3	–2.6	–1.8
United Kingdom	52.5	68.4	75.1	82.5	88.4	91.4	1.7	3.6	5.4
Canada	71.1	83.6	85.1	85.0	84.7	82.0	0.8	0.5	–0.3
Emerging economies	34.7	36.7	41.0	37.6	35.7	34.1	–0.1	0.1	0.4
Asia	35.2	35.7	43.5	38.1	35.6	33.6	0.0	0.7	1.3
China	17.0	17.7	33.5	25.8	22.0	19.4	–1.0	–0.2	0.9
India	74.7	75.0	69.4	68.1	67.6	66.8	3.1	3.4	3.6
ASEAN-5	37.0	39.5	37.8	36.3	36.1	35.5	–2.6	–2.1	–2.2
Europe	23.5	29.1	30.3	28.7	27.4	26.5	–1.4	–2.5	–3.3
Russia	7.9	11.0	11.7	9.6	8.4	7.9	–2.1	–3.7	–4.7
Latin America	49.2	51.7	49.4	49.1	48.0	46.9	0.7	0.3	0.3
Brazil	63.5	66.9	65.2	66.2	65.1	63.1	1.2	1.1	0.6
Mexico	43.1	44.6	42.9	43.8	42.9	42.9	0.9	–0.8	–0.6
Middle East and North Africa	48.0	48.2	49.4	52.3	53.8	56.4	0.5	–0.7	1.5
Low-income countries	39.1	41.3	38.6	38.2	39.5	38.5	–3.5	–1.8	–2.8
Oil producers	22.0	24.2	24.0	22.6	21.9	21.4	0.2	–0.7	–1.1
G-20 economies	66.0	72.8	77.9	77.7	77.5	77.1	0.6	0.4	0.6
Advanced	87.0	99.3	105.9	110.3	113.2	115.4	0.9	0.6	0.7
Emerging	34.7	35.9	41.0	37.0	34.7	32.9	0.1	0.2	0.6
Net debt									
Advanced economies	52.0	61.3	66.7	72.4	75.9	78.4	1.8	1.3	1.4
United States	53.7	65.9	73.1	80.3	83.7	86.7	7.7	5.3	4.6
Euro area	54.0	62.2	65.8	68.4	70.3	71.5	–2.4	–2.5	–1.9
France	62.3	72.0	76.6	80.4	83.2	84.9	–0.6	–0.4	0.0
Germany	50.0	56.6	56.8	56.1	54.1	53.4	–1.1	–2.9	–3.2
Italy	88.8	97.1	99.0	99.6	102.3	102.6	–0.9	1.6	3.0
Spain	30.8	42.5	49.7	56.9	67.0	71.8	0.9	8.3	10.4
Japan	95.3	106.2	112.8	126.6	135.2	142.7	–4.0	–3.8	–3.7
United Kingdom	46.0	60.9	71.1	78.3	84.2	87.2	5.4	7.3	9.1
Canada	22.6	28.3	30.4	33.3	35.4	36.9	–1.6	–1.4	–0.2
Emerging economies	23.4	27.1	28.0	27.0	25.3	23.7	–1.2	–1.7	–2.5
Asia	54.6	57.0	57.9	56.8	58.5	57.0	2.6	4.5	3.7
Europe	24.1	30.4	32.8	32.3	31.2	30.4	–0.7	–1.6	–1.8
Latin America	30.9	34.5	33.8	32.5	31.8	31.0	–2.8	–2.7	–2.9
G-20 economies	52.7	61.6	66.1	70.7	73.0	74.8	2.6	1.7	1.5
Advanced	57.3	67.5	73.0	79.0	82.3	84.8	3.2	2.3	2.2
Emerging	26.4	29.1	28.5	27.6	25.3	23.7	–0.3	–1.2	–2.1

Sources: IMF staff estimates and projections.

Note: All country averages are weighted by GDP at purchasing power parity using rolling weights, and calculated based on data availability. Projections are based on IMF staff assessment of current policies. ASEAN-5: Indonesia, Malaysia, the Philippines, Singapore, and Thailand; G-20: Group of Twenty.

Figure 4: Net and Gross Debt

held by the Bank of China). We denote $B^f = A - L$ as the net foreign asset position. When B^f is negative it signals that US nationals have a debt with foreigners. Let's now define net factor payments NFP as

$$NFP = r^f \cdot A - r^d \cdot L + NLP$$

this equation simply says that the factor payments from abroad are the net payments on assets (where r^f and r^d are the returns on assets earned by US residents and foreigners, respectively) and net payments to labor. As we did before for government debt we can study the evolution of B^f. The stock of foreign assets will go up if nationals spend less that what they earn and thus can accumulate a credit with the foreigners (foreign assets). If on the other hand nationals spend more than what they earn they will increase their debt with the rest of the world. The difference between what nationals earn and what they spend is called the **current account.** Formally the earnings of the nationals of a country are given by GNP while their expenditures are given by C, I and G so we can write the current account as

$$\begin{aligned} CA &= GNP - C - G - I \\ &= GDP + r^f \cdot A - r^d \cdot L + NLP - C - G - I \end{aligned}$$

using the fact that

$$GDP = C + I + G + NX$$

we have

$$CA = NX + NLP + r^f \cdot A - r^d \cdot L$$

Note that another way of looking at the the current account is the amount of money (or more in general financial assets) flowing into (if positive) or out of (if negative) a country.

This finally leads us to the evolution of the stock of net foreign assets as

$$B^f_{t+1} = B^f_t + CA_t$$

Figure 6 plots the evolution of the current account and of the net foreign asset position in US in the last 35 years. In the 70s the US was a creditor toward the rest of the world, now a prolonged string of negative current accounts has brought the US to accumulate quite a substantial amount of foreign debt (the US net foreign asset position in 2009 is around 20% of US GDP). The current account position of US in 2009 is reported in account 5 in figure 5.

Comparing figure 6 with the table in figure 5 you might notice that even though the US stock of liabilities is much bigger than the stock of US assets (i.e $A < L$) the income payments on the assets received by the US nationals exceed the income payments the US nationals make to the rest of the world (i.e. $r^f \cdot A > r^d \cdot L$). This means that return on US investment abroad is much higher than the return on foreign investment in US. Why do you think this is the case?

Account 5. Foreign Transactions Current Account

Line			Line		
1	Exports of goods and services (1–28)	1,578.4	9	Imports of goods and services (1–29)	1,964.7
2	Income receipts from the rest of the world	629.8	10	Income payments to the rest of the world	483.6
3	Wage and salary receipts (3–13)	2.9	11	Wage and salary payments (1–3)	10.8
4	Income receipts on assets	626.9	12	Income payments on assets	472.8
5	Interest (3–20)	146.3	13	Interest (3–20)	344.5
6	Dividends (2–22)	206.8	14	Dividends (2–3)	99.5
7	Reinvested earnings on U.S. direct investment abroad (2–23)	273.8	15	Reinvested earnings on foreign direct investment in the United States (2–4)	28.8
			16	Current taxes and transfer payments to the rest of the world (net)	139.5
			17	From persons (net) (3–7)	66.5
			18	From government (net) (3–25 plus 4–5 plus 4–6 less 4–18 less 4–19)	50.2
			19	From business (net) (2–8 plus 2–14)	22.9
			20	Balance on current account, national income and product accounts (7–1)	–379.7
8	**CURRENT RECEIPTS FROM THE REST OF THE WORLD**	**2,208.2**	21	**CURRENT PAYMENTS TO THE REST OF THE WORLD AND BALANCE ON CURRENT ACCOUNT**	**2,208.2**

Figure 5: Current Account Balance in US in 2009

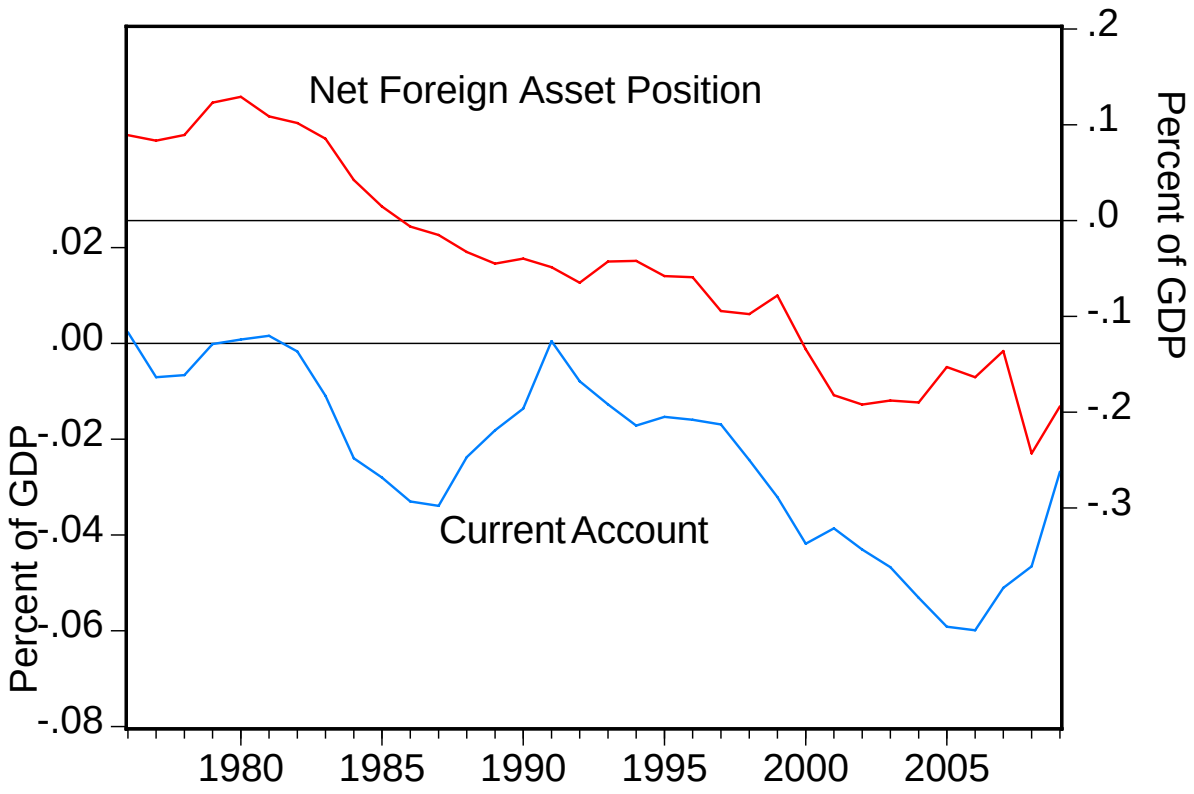


Figure 6: US Current Account and Net Foreign Asset Position, 1976-2009

Assets and investment

In this last section we will put together the definitions we have introduced so far to get to an accounting of the resources used to finance domestic investment. Let's start again from the definition of GDP

$$GDP = C_P + I_P + C_G + I_G + NX$$

where I_G and C_G denote public investment and public consumption while I_P and C_P are private investment and consumption. Using the definitions of NNP and GNP we get

$$\begin{aligned} GNP &= C_P + I_P + C_G + I_G + NX + NFP \\ NNP + Depreciation &= C_P + I_P + C_G + I_G + CA \\ NNP - C_P - C_G &= I_P + I_G - Depreciation + CA \end{aligned} \tag{6}$$

Now remember (equation 1) that government saving is equal to

$$S_G = \text{Taxes-Transfers} - C_G - r \cdot B^g$$

so

$$C_G = \text{Taxes-Transfers} - S_G - r \cdot B^g$$

substituting C_G into (6) yields

$$\underbrace{\underbrace{NNP - \text{Taxes}+\text{Transfers}+r \cdot B^g}_{\text{Private Disposable Income}} - C_P}_{\text{Private Saving} = S_P} + S_G = \underbrace{I_P + I_G - Depreciation}_{\text{Net Investment}} + CA$$

so that we can finally write

$$S_P + S_G = \text{Net Investment} + CA$$

This last equation tells us how the wealth of a nation evolves. A country adds to its capital stock by increasing its net investment (either privately through I_P or publicly through I_G). The investment can be either financed through national saving (either private or public) S_P, S_G, or through foreign borrowing CA. Account 6 in table 1 at the end summarizes the relation between investment, saving and the current account in the US at the end of 2009. In figure 7 we display the 4 terms in the equation above (as percent of GDP) for the US in the last 40 years (the raw data comes from table 5.1 of the NIPA accounts at the BEA. Note for example how the large CA deficit of

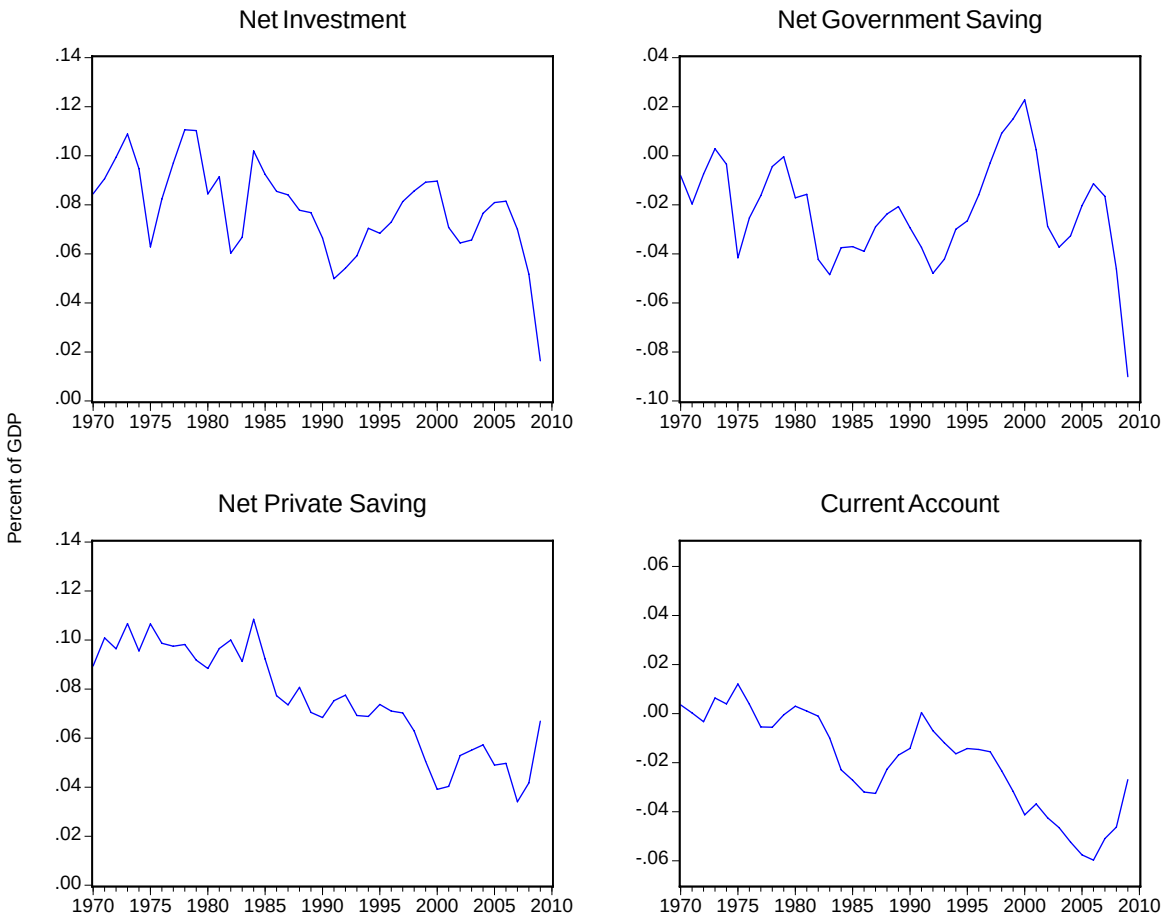


Figure 7: Investment, Savings and the Current Account in US, 1970-2009

the 1980s was associated with low government saving, while the one of the late 1990s with an investment boom. Note that the long run increase in the current account is clearly associated with a long run decline in private saving. Why do US households are now saving much less than they used too? and why international investors keep lending to them at very low interest rates? Notice also the effects of the 2008-1009 crisis: during the crisis net investment has collapsed to historical lows but at the same time government financing needs (i.e. negative government savings) have increased even more. So basically in 2009 private saving and foreign borrowing have financed government borrowing. In 2010 investment is picking up again and that suggest that at least one of these three things will have to happen: 1) foreign borrowing will have to increase, 2) private saving will have to increase, 3) government saving will have to increase. We will discuss these issues in this and in future classes.

Account 6. Domestic Capital Account

Line			Line		
1	Gross domestic investment	2,092.6	10	Net saving	–327.4
2	Private fixed investment (1–21)	1,716.4	11	Personal saving (3–8)	655.3
3	Government fixed investment (1–30)	503.4	12	Undistributed corporate profits with inventory valuation and capital consumption adjustments (2–17)	284.2
4	Change in private inventories (1–26)	–127.2	13	Wage accruals less disbursements (private) (1–4)	5.0
5	Capital account transactions (net) (7–2)	0.6	14	Net government saving (4–10)	–1,271.9
6	Transfer payments for catastrophic losses (net) (7–3)	0.0	15	*Plus:* Consumption of fixed capital (1–11)	1,861.1
7	Other capital account transactions (7–4)	0.6	16	Private	1,535.8
8	Net lending or net borrowing (–), national income and product accounts (7–5)	–380.3	17	Government	325.3
			18	General government	272.3
			19	Government enterprises	53.0
			20	*Equals:* Gross saving	1,533.8
			21	Statistical discrepancy (1–13)	179.1
9	**GROSS DOMESTIC INVESTMENT, CAPITAL ACCOUNT TRANSACTIONS (NET), AND NET LENDING**	**1,712.9**	22	**GROSS SAVING AND STATISTICAL DISCREPANCY**	**1,712.9**

Figure 8: Financing Investment

Concepts you should know

1. Government Debt, Government Deficit
2. Current Account, Net Foreign Asset Position
3. Net Saving

Review Questions

1. The Italian government has decided to build the bridge that connects the island of Sicily to the mainland, a 10 billion dollars project. Assume that, on impact, taxes, transfers, private saving and investment will not change. What is the immediate impact of the project on government saving, deficit, debt and the current account?
2. Consider country A and country B. They have the same current GDP, investment, government spending but country A has higher private consumption. Both countries have the same level of negative foreign asset position, same net factor payments, and face the same interest rate on the world markets. Which one has the lowest current account balance? Which one do you think has better prospects of income growth?
3. At the beginning of the year Mary Rossi buys a 1 year treasury bond worth \$1000. At the end of the year she redeems the bond and gets \$1050. How does this transaction show up in US GDP. Explain.

Answers

1. The project is going to increase government investment but not government consumption so, since taxes and transfers do not change, it is not going to

affect government saving. The financing needs of the government do increase so government deficit will increase and so will government debt. Since private saving and investment are assumed not to change the bridge will have to be financed through international borrowing, i.e current account balance will go down.

2. Country A has the lowest current account balance (i.e. the most borrowing or the least lending) because it has the lowest net exports (remember that NX=Y-I-G-C) while net foreign payments are the same. Since both countries are equally expected to repay their debts (they face the same interest rate) the fact that country A is borrowing more could signal a higher future income growth, i.e country A could borrow more expecting to repay with high future income.

3. The $1000 do not enter GDP as it is just a transfer from Mary to the government and no value creation is directly connected to that transfer. Determining whether the $50 enter is harder. Since this is income on Mary's capital one might think that it should enter GDP when one uses the definition of GDP as income. In reality it does not enter as the government pays the interests by taxing some other source of income (and not by creating value) so that transaction too should be viewed as a transfer. Check also account 1 in the lecture notes "values and prices" to see that interests of government debt does not enter the income side of GDP.