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Macroeconomics Winter 2021

CLASS NOTES I - NATIONAL INCOME ACCOUNTING

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I.1 Gross Domestic Product (GDP) and Gross National Product (GNP): Output=Income

GDP: Value of all goods and services currently produced *within a country*, valued at market prices, during a specific period of time. Also, income earned in a country.

GNP: Value of all goods and services currently produced *by domestically owned factors of production*, valued at market prices, during a specific period of time. Also, income earned by a country's residents.

Both GDP and GNP are a measure of income and a measure of output. The key here is that everything that is produced creates income for someone. (Think of everything that is produced being sold. We will deal with inventories later.) GDP measures output produced in a country and income earned in the country, regardless of who produced the output and who earned the income. GNP measures output produced by a country's residents (not citizens) and income earned by a country's residents (not citizens), regardless of where the production takes place and where the income is earned.

Notes:

Both goods and services are included.

Goods that were produced in the past and currently sold are not included, e.g. a house produced ten years ago; although the brokerage fee on such a transaction is part of GNP.

Likewise, purchases and sales of assets are not counted in GNP but brokerage fees on these transactions are counted.

When market prices are not available goods and services are often valued at cost, e.g. many government services.

Home production (e.g. child care, home repairs, …) and illegal production are usually missed altogether – the informal sector, the underground economy, …

How is GNP related to GDP? Define

FPA = Factor Payments from Abroad = Income earned by domestic residents outside the country

FPF = Factor Payments to Foreigners = Income earned by foreign residents inside the country

NFP = Net Factor Payments = FPA – FPF

Then GNP = (GDP – FPF) + FPA = GDP + NFP

GNP is very hard to measure. Luckily, for most countries for which we have data, but admittedly not for all countries, the level and growth of GDP closely mirrors the level and growth of GNP.

When computing production in a closed economy (i.e. one with no exports or imports) there are two ways to measure GDP: (i) sum the *value added* of all firms located in the economy; (ii) sum the value of the output of all "final" goods produced by firms in the economy.

Here *value added* is defined as the value of output minus the value of intermediate goods used as inputs. Both methods appropriately avoid double counting the value of intermediate goods. See the discussion and example on pages 50-54 of the textbook for more details.

When computing the value of production in an open economy (i.e. one with exports and/or imports) there are two ways to measure GDP: (i) sum the value added of all firms located in the economy; (ii) sum the value of output of all "final" goods produced by firms in the economy, subtract the value of intermediate goods that are imported from the rest of the world and used by firms located in the economy, and add the value of intermediate goods produced by firms located in the economy that are exported. See the Homework Problem 1 at the end of these notes for an example.

In practice, GDP is calculated by summing value added.

The next four pages provide data on population, GDP, GNP, and NFP for a selection of countries. Data is expressed in a way that attempts to make it informative, accurate and easy to interpret. For example, to help interpret FPA, the ratio of FPA to GNP is given: the fraction of income residents of those countries earned outside the country. To help interpret FPF, the ratio of FPF to GDP is given: the fraction of income earned in the country that was earned by foreigners. Note: the ratio of FPF to GNP has no easy, meaningful interpretation.

For most countries the ratio of GDP to GNP, the ratio of income earned in the country to income earned by the country's residents, is close to one. In France the ratio is 98%; French residents earn more income outside of France than non-French residents earn inside France. In Switzerland the ratio is also 98%, although the Swiss earn more foreign income than the French (19% vs 7%).

Ireland has a GDP to GNP ratio that is very far from one: 125%. Given its low tax rate, international companies operating in Ireland have a big incentive to have accounting systems that show a lot of their profits occur there.

The Philippines is, in a way, the anti-Ireland. It has a GDP to GNP ratio of 83%. Philippine residents earn a lot more income outside the Philippines than non-Philippine residents earn inside the Philippines. My guess is that most of this income earned by Philippine residents is labor income. This is in contrast to Ireland, where income earned by foreign residents in Ireland is profit, i.e. capital income.

How many countries in the world have a population above 100 million?

	POP	GDP	NFP	FPA	FPF	GNP	FPA /	FPF /	GDP /		
Country	millions	billions	billions	billions	billions	billions	**GNP**	**GDP**	**GNP**	**YEAR**	**SOURCE**
Europe											
Belgium*	11	410	0	47	46	410	11%	11%	100%	2015	OECD
Czech Republic	11	4,555	-299	184	484	4,255	4%	11%	107%	2015	OECD
France*	64	2,181	35	152	116	2,216	7%	5%	98%	2015	OECD
Germany*	81	3,033	66	194	128	3,099	6%	4%	98%	2015	OECD
Greece*	11	176	1	5	5	176	3%	3%	100%	2015	OECD
Hungary	10	33,999	-1,595	3,203	4,798	32,404	10%	14%	105%	2015	OECD
Ireland*	5	256	-52	62	114	204	30%	44%	125%	2015	OECD
Italy*	60	1,672	3	57	54	1,675	3%	3%	100%	2016	OECD
Kazakhstan	17	34,194	-2,747	NA	NA	31,447	NA	NA	109%	2013	IMF
Netherlands*	17	677	-2	214	216	674	32%	32%	100%	2015	OECD
Norway	5	3,117	157	336	179	3,275	10%	6%	95%	2015	OECD
Poland	39	1,799	-66	43	110	1,732	3%	6%	104%	2015	OECD
Portugal*	10	185	-4	8	12	181	5%	7%	102%	2016	OECD
Romania	20	759	NA	NA	NA	NA	NA	NA	NA	2016	OECD
Russia	143	86,044	-2,280	2,721	5,001	83,764	3%	6%	103%	2016	OECD
Spain*	46	1,076	-1	53	53	1,075	5%	5%	100%	2015	OECD
Sweden	10	4,379	70	424	354	4,449	10%	8%	98%	2016	OECD
Switzerland	8	646	15	124	109	660	19%	17%	98%	2015	OECD
Turkey	79	2,338	-27	NA	NA	2,311	NA	NA	101%	2015	OECD
Ukraine	45	1,989	-24	NA	NA	1,964	NA	NA	101%	2015	IMF
United Kingdom	65	1,940	-23	143	166	1,917	7%	9%	101%	2016	OECD
Euro area* (19 countries)	332	10,135	63	628	565	10,205	6%	6%	99%	2014	OECD

Source: Population data is always from IMF International Financial Statistics (IFS). Other data from OECD or IMF (IFS) as indicated. Accessed June 27, 2017

Notes: * Signifies countries belonging to the Euro zone; NA = not available

	POP	GDP	NFP	FPA	FPF	GNP	FPA /	FPF /	GDP /		
Country	millions	billions	billions	billions	billions	billions	**GNP**	**GDP**	**GNP**	**YEAR**	**SOURCE**
Americas/Carribean											
Canada	36	1,986	-31	60	91	1,956	3%	5%	102%	2015	OECD
Mexico	127	18,195	-520	128	648	17,675	1%	4%	103%	2015	OECD
United States	322	18,037	206	813	607	18,496	4%	3%	98%	2015	OECD
Dominican Republic	11	3,068	NA	NA	NA	NA	NA	NA	NA	2015	IMF
Haiti	11	424	NA	NA	NA	NA	NA	NA	NA	2015	IMF
Guatemala	15	395	-13	NA	NA	382	NA	NA	103%	2012	IMF
Argentina	43	NA	NA	NA	NA	NA	NA	NA	NA	2015	IMF
Bolivia	10	187	-15	NA	NA	173	NA	NA	108%	2012	IMF
Brazil	208	5,904	-129	NA	NA	5,775	NA	NA	102%	2015	IMF
Chile	18	157,511	-4,058	5,233	9,291	153,453	3%	6%	103%	2015	OECD
Colombia	48	799,312	-19,807	10,585	30,392	779,505	1%	4%	103%	2015	OECD
Ecuador	16	NA	NA	NA	NA	NA	NA	NA	NA	2015	IMF
Peru	31	613	NA	NA	NA	NA	NA	NA	NA	2015	IMF
Venezuela	31	6,025	-212	NA	NA	5,814	NA	NA	104%	2015	IMF

Source: Population data is always from IMF International Financial Statistics (IFS). Other data from OECD or IMF (IFS) as indicated. Accessed June 27, 2017

Notes: NA = not available

	POP	GDP	NFP	FPA	FPF	GNP	FPA /	FPF /	GDP /		
Country	millions	billions	billions	billions	billions	billions	**GNP**	**GDP**	**GNP**	**YEAR**	**SOURCE**
Asia/Oceania											
Australia	24	1,655	-35	55	90	1,626	3%	5%	102%	2015	OECD
New Guinea	7	57	NA	NA	NA	NA	NA	NA	NA	2014	IMF
New Zealand	4	232	-9	7	16	223	3%	7%	104%	2013	OECD
Bangladesh	161	15,158	984	NA	NA	16,142	NA	NA	94%	2015	IMF
China	1,376	68,551	-283	1,419	1,701	68,268	2%	2%	100%	2015	OECD
Hong Kong	7	2,398	44	NA	NA	2,443	NA	NA	98%	2015	IMF
India	1,311	136,753	-1,598	NA	NA	135,156	NA	NA	101%	2015	IMF
Indonesia	258	11,531,717	-378,322	NA	NA	11,153,395	NA	NA	103%	2015	IMF
Japan	127	NA	20,078	29,964	9,886	550,624	5%	NA	NA	2015	OECD
Korea(South)	50	1,558,592	7,224	32,423	25,199	1,565,816	2%	2%	100%	2015	OECD
Myanmar	54	72,780	NA	NA	NA	NA	NA	NA	NA	2015	IMF
Pakistan	189	27,493	1,675	NA	NA	29,168	NA	NA	94%	2015	IMF
Philippines	101	13,322	2,793	NA	NA	16,115	NA	NA	83%	2015	IMF
Singapore	6	408	-18	NA	NA	390	NA	NA	105%	2015	IMF
Thailand	68	13,537	-576	NA	NA	12,961	NA	NA	104%	2015	IMF
Vietnam	93	4,192,862	-215,253	NA	NA	3,977,609	NA	NA	105%	2015	IMF

Source: Population data is always from IMF International Financial Statistics (IFS). Other data from OECD or IMF (IFS) as indicated. Accessed June 27, 2017

Notes: NA = not available

	POP	GDP	NFP	FPA	FPF	GNP	FPA /	FPF /	GDP /		
Country	millions	billions	billions	billions	billions	billions	**GNP**	**GDP**	**GNP**	**YEAR**	**SOURCE**
Africa/Middle East											
Iran	78	11,033,666	41,532	NA	NA	11,075,198	NA	NA	100%	2014	IMF
Iraq	33	214,768	38,375	NA	NA	253,143	NA	NA	85%	2012	IMF
Israel	8	1,164	-17	37	54	1,147	3%	5%	101%	2015	OECD
Saudi Arabia	32	2,423	80	NA	NA	2,503	NA	NA	97%	2015	IMF
Syria	19	NA	NA	NA	NA	NA	NA	NA	NA	2015	IMF
United Arab Emirates	9	1,315	NA	NA	NA	NA	NA	NA	NA	2015	IMF
Yemen	25	6,875	-91	NA	NA	6,784	NA	NA	101%	2012	IMF
Dem Rep Congo	73	36,985	NA	NA	NA	NA	NA	NA	NA	2013	IMF
Egypt	92	2,708	NA	NA	NA	NA	NA	NA	NA	2015	IMF
Ethiopia	99	1,237	56	NA	NA	1,293	NA	NA	96%	2015	IMF
Kenya	46	6,224	NA	NA	NA	NA	NA	NA	NA	2015	IMF
Mozambique	28	592	NA	NA	NA	NA	NA	NA	NA	2015	IMF
Nigeria	182	95,178	NA	NA	NA	NA	NA	NA	NA	2015	IMF
South Africa	54	3,796	-102	82	184	3,695	2%	5%	103%	2014	OECD
Tanzania	52	79,718	-473	NA	NA	79,245	NA	NA	101%	2014	IMF
Uganda	39	82,060	NA	NA	NA	NA	NA	NA	NA	2015	IMF

Source: Population data is always from IMF International Financial Statistics (IFS). Other data from OECD or IMF (IFS) as indicated. Accessed June 27, 2017

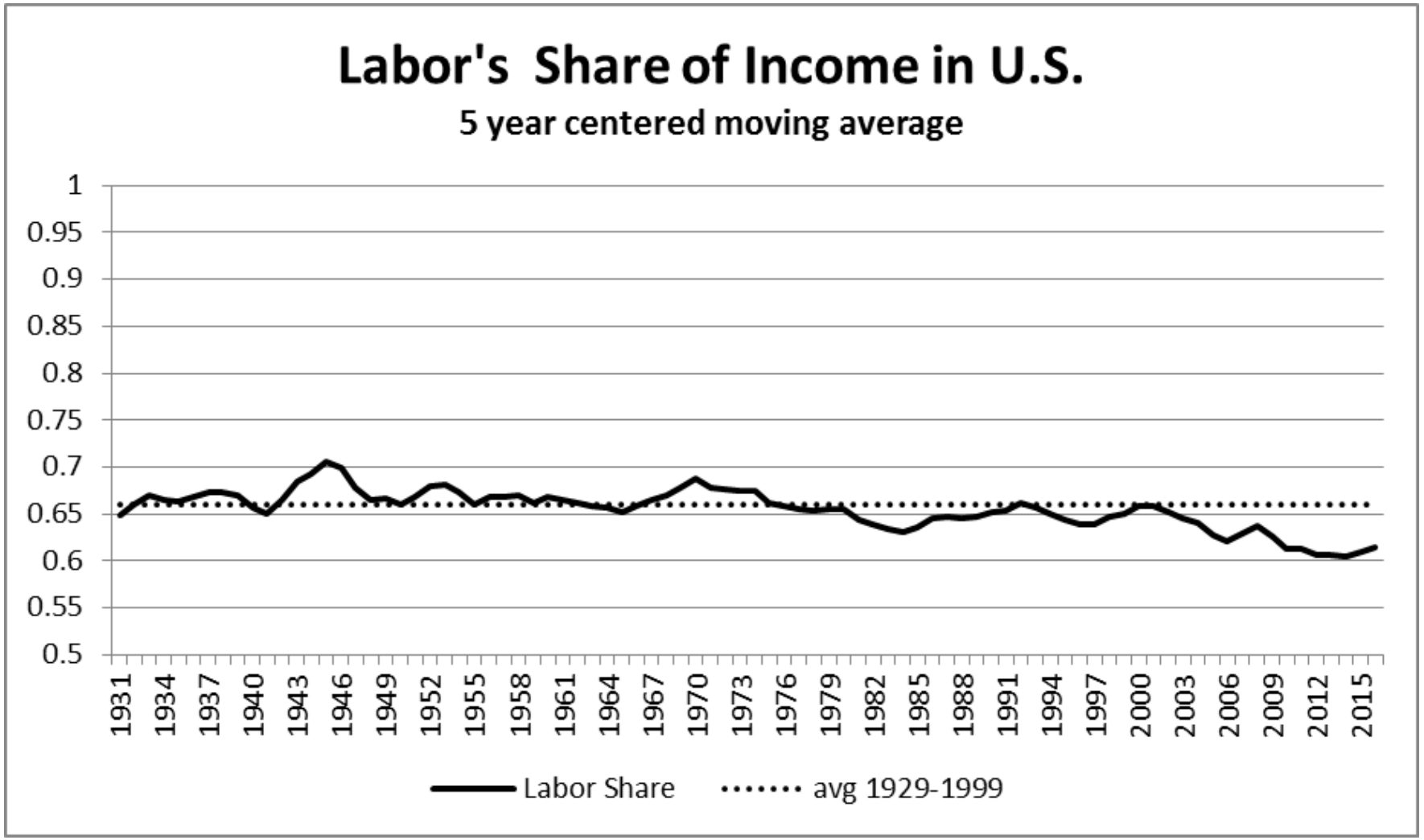
Notes: NA = not available

I.2 Who Earns the Income from GNP?

There are many ways to answer this question. For this class, the most important decomposition of income earned will be according to whether income is earned by supplying labor or capital. Throughout this course we will treat physical capital and labor as the two inputs which economies use to produce goods and services.

The data in the graphs and table on the following pages show a breakdown of income in the United States. The key take away of this data is shown by the graph on the next page. Historically, labor and capital have been thought to earn very steady shares of income over time: 66% for labor 34% for capital. This long-standing belief is now being challenged, both due to (i) historical data that is based on new definitions; and (ii) post 2000 data. Perhaps labor's share of income in the U.S. is now falling.

Though not shown here, stable labor and capital shares, though not necessarily 2/3 and 1/3, appear to have been true for almost all countries where reliable data exists. And like the U.S., other countries also seem to be experiencing a share in the decline of labor's share of income. More on this later.



Source: U.S. Bureau of Economic Analysis; NIPA Tables 1.7.5 and 1.12;

The data underlying the next graph can be found in the table on the next page. The data in the table show that for seventy years, from 1930 to 1999, decade averages for labor's share of income in the U.S. never rose above 67.9% or below 64.3%. Then, in the decade from 2000 to 2009 labor's share of income fell to 63.8% and in the seven year period from 2010 to 2016 it fell to 61.0%.

To interpret the data in the table you need to know the following terms: Consumption of Fixed Capital is depreciation of the physical capital stock; Taxes on Production & Imports include value-added taxes, sales taxes and import duties; Business Transfers are donations by companies; Net Interest is interest paid by companies to their bondholders.

Next, think of dividing up income into three parts: what part goes to labor, what part goes to capital, and what part are we unsure about where it goes. Then, remove the part that we are unsure about and look at what is left over.

To be more specific, taxes on production are an example of when we don't know where the income goes. Consider a sales tax. A company collects the tax and pays it directly to the government. We never see whether capital or labor would have earned the income had the tax not been there, or for that matter whether that income would have been earned at all. Perhaps without the sales tax the price of the good would be unchanged and measured income would have fallen by the amount of the sales tax. Another example is Business Transfer Payments, which are funds businesses give away rather than pay to either labor or capital. Lastly, there is proprietors' income, i.e. income earned by people who are providing both labor and capital. Think of self-employed businesses. We can't tell whether the business owner earned his/her income because he/she owns the capital or because he/she provides labor.

		YEARS								
		30-39	**40-49**	**50-59**	**60-69**	**70-79**	**80-89**	**90-99**	**00-09**	**10-16**
	GNP	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
1	Consumption of Fixed Capital	11.6%	10.5%	11.8%	12.0%	13.4%	14.9%	14.5%	15.3%	15.5%
2	Taxes on Production & Imports	9.9%	7.1%	7.5%	8.1%	7.7%	7.1%	7.2%	7.0%	6.9%
3	Business Transfers	0.6%	0.3%	0.3%	0.4%	0.4%	0.7%	0.6%	0.7%	0.8%
4	Compensation of Employees	51.5%	53.4%	54.4%	55.3%	56.1%	55.3%	55.2%	54.7%	52.6%
	Wages & Salaries	49.7%	49.8%	49.9%	49.4%	48.2%	46.0%	45.1%	44.3%	42.4%
	Supplements to Wages and Salaries	1.8%	3.6%	4.5%	5.9%	7.9%	9.4%	10.1%	10.4%	10.2%
5	Corporate Profits	5.3%	10.5%	10.7%	10.7%	9.1%	7.6%	8.5%	9.5%	11.7%
	Profits Taxes	1.2%	4.9%	4.9%	4.0%	3.4%	2.5%	2.6%	2.5%	2.6%
	Dividends	4.5%	2.5%	2.4%	2.5%	2.1%	2.4%	3.4%	4.5%	5.1%
	Undistributed Profits	-0.4%	3.1%	3.3%	4.2%	3.6%	2.7%	2.5%	2.6%	4.0%
6	Net Interest	5.2%	1.3%	1.5%	2.7%	4.7%	7.7%	5.4%	4.3%	3.1%
7	Proprietors' Income	11.5%	13.7%	10.7%	8.4%	7.1%	5.7%	6.5%	7.3%	7.3%
	Farm	4.5%	5.4%	2.9%	1.5%	1.1%	0.5%	0.4%	0.3%	0.4%
	Non-Farm	7.0%	8.3%	7.8%	6.8%	5.9%	5.2%	6.1%	7.1%	6.9%
8	Rental Income of Persons	4.3%	3.0%	3.0%	2.5%	1.2%	0.6%	1.5%	1.8%	3.3%
9	Net Surplus of Government Enterprises	-0.4%	-0.3%	-0.2%	-0.3%	-0.5%	-0.5%	-0.3%	-0.4%	-0.5%
10	Statistical Discrepancy	0.6%	0.5%	0.3%	0.1%	0.9%	1.0%	0.8%	-0.3%	-0.8%
	Labor's Share = 4/(1+4+5+6+8)	66.1%	67.9%	66.9%	66.4%	66.5%	64.3%	64.9%	63.8%	61.0%
	Capital's Share = (1+5+6+8)/(1+4+5+6+8)	33.9%	32.1%	33.1%	33.6%	33.5%	35.7%	35.1%	36.2%	39.0%
	Capital's Net Share = (5+6+8)/(4+5+6+8)	22.3%	21.7%	21.8%	22.4%	21.0%	22.3%	21.8%	22.3%	25.6%

Source: U.S. Bureau of Economic Analysis; NIPA Tables 1.7.5 and 1.12;

Examination of labor's share of income shown in the table above shows that this share has been falling slightly, but steadily, beginning in 1950's. This is shown quite clearly by the solid line in the graph on the next page, which has a different scale for the vertical axis than the first graph.

Importantly, however, until recently it was the broken line on the graph of the following page, not the solid line, on which economists focused. The broken line shows data that treat R&D spending (spending on research and development) as a cost of doing business. This is true for most countries in the world and was historically true in the U.S., but in the U.S. it is no longer the case. Starting in 2013, R&D spending is treated as investment, adding to the stock of intellectual capital with the addition to the capital stock being equal to the amount of the spending.

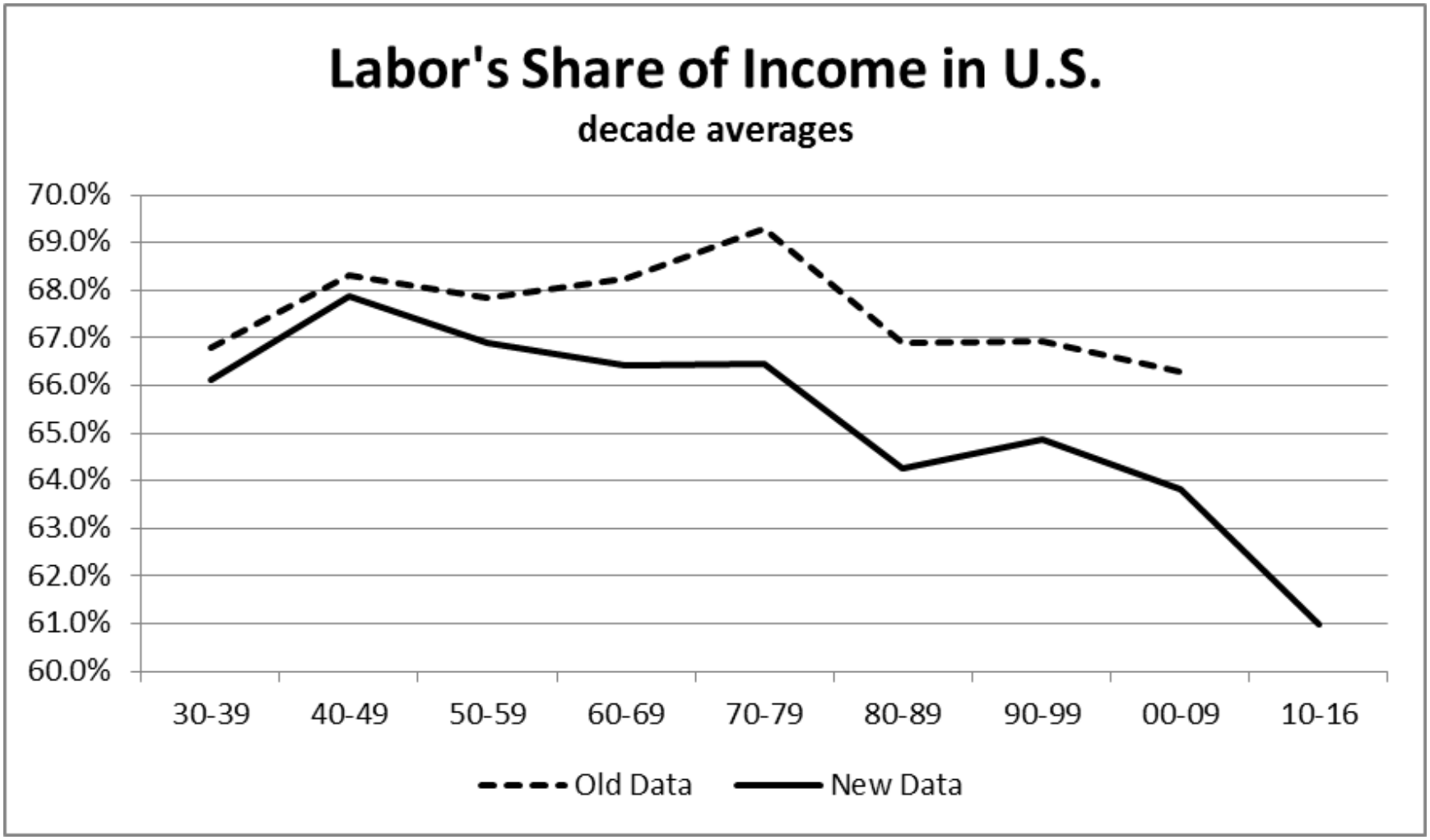
Homework Problem 2 at the end of these notes shows that this change to the treatment of R&D spending adds to the measure of profits. With R&D spending growing as a fraction of U.S. GNP, the difference between the broken and solid lines grows over time.

Looking at the broken line, we see labor's share relatively constant over time. And until 2000 there is no discernible trend, just an increase from the 1930's to the 1970's that is reversed from the 1970-79 period to the 1900-99 period. Unfortunately, data using the previous way of treating R&D spending is no longer produced.

Obviously this new approach assumes that 100% of R&D spending actually delivers lasting valuable output, whereas the previous approach assumes that 0% of R&D spending delivers lasting valuable output. Which of these assumptions is more likely to be true?

If all R&D spending led to patents and all patents were sold on an open market, then we would have a good measure of the value of the knowledge R&D spending created. But that is obviously not the case.

An argument in favor of R&D spending leading to valuable output is that firms are willing do it. However, this still leaves open the questions of what fraction of the knowledge created is lasting and whether the appropriate depreciation rate for that knowledge is being used.



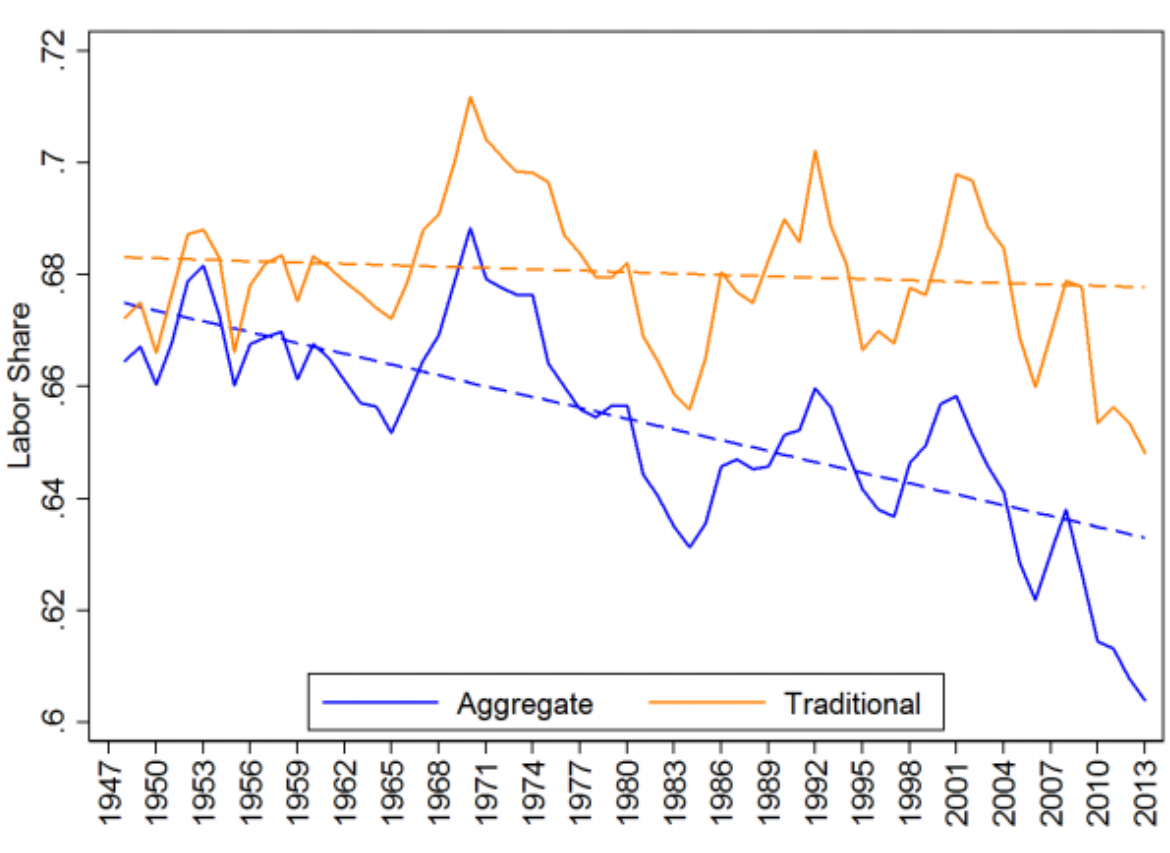
Source: U.S. Bureau of Economic Analysis; NIPA Tables 1.7.5 and 1.12;

On the following page there is a graph from a recent research paper that tells basically the same story as the previous. In this new graph, the traditional version of labor's share of income treats software expenditures a cost of doing business instead of as an investment.

A constant share of income for labor and capital is an important finding because it tells us that the economy operates with what is known as a Cobb-Douglas production function. We will discuss this more in Class Notes II.

As of now, economists do not have a widely accepted explanation for why, aside from R&D spending, labor's share of income has fallen so much since 2000. It is worth noting, however, that Brent Neiman (a Booth faculty member) and Loukas Karabounis (at the Federal Reserve Bank of Minneapolis and a former Booth faculty member), have demonstrated that, within the corporate sector of the economy, a decline in labor's share of income is a worldwide phenomenon and the decline appears larger in countries where the price of physical capital has declined more.

Figure 4: Effects of IPP Capital on Labor Share, US 1947-2013



Notes: The "Aggregate" labor share refers to the benchmark definition described in Section 3.1 (also depicted in panel (a) of Figure 1). The "Traditional" labor share includes only capital income from traditional capital, see Section 3. The underlying linear trend for the "Traditional" labor share is not significantly different from zero. Our data and all the results of our analysis are available in this permanent link: US Factor Shares.

Source: "Labor Share Decline and Intellectual Property Products Capital", Dongha Koh, Raul Santaeulalia-Llopis and Yu Zheng, February 29, 2016

I.3 The Most Famous Equation in Macro: GDP = C + I + G + NX (output=spending)

Standard notation for economists is:

C = Private Consumption, purchases of goods and services by domestic households (though usually, real world data on Private Consumption excludes residential housing).
Includes: 1. non-durable goods; 2. durable goods; and 3. services.

I = Private Investment, purchases of goods and services by domestic firms
Includes: 1. Non-residential Fixed Investment - Additions to physical capital stock like structures, equipment, and software; 2. Inventory Investment - Changes in inventories. In most data sources Private Investment also includes: 3.Residential Investment - Household purchases of residential housing; Starting in 2013 in the U.S., government data on Private Investment also includes: 4. R&D expenditures.
Excludes: Intermediate goods, i.e. goods completely used up in the production process.

G = Government Purchases of goods and services,
Includes goods that yield utility (consumption goods) and goods that can be used to increase future production (investment goods); sometimes consumption and investment goods are measured separately.

NX = Net Exports, i.e. Exports by domestic households, firms and the government (all entities can produce as well as purchase) minus Imports by domestic households, firms, and the government; exports and imports both include intermediate goods

Domestic Spending = C + I + G; includes imports

The fact that GDP = C + I + G + NX illustrates that output, and therefore income, equals spending. It is true because what is produced is either (i) sold to someone or (ii) put into inventory, in which case we treat firms as buying the increase in their inventory.

Output equal to spending is an important concept, and the equation above provides the basis for a logical framework for thinking about things. However, it is not, by itself, a useful policy tool.

> "The economy was also helped by robust state and local government spending, without which GDP would have contracted" from Economic Growth Slowed in Second Quarter to 0.7%, *The Wall Street Journal*, page A2, July 30, 2001.

Does higher government spending increase output? Maybe.

Does Y = C + I + G + NX imply that an increase in G increases Y? NO!

Consider: Maybe the increase in government spending increased the government budget deficit, causing higher interest rates than would otherwise have been the case and thereby lowering investment. Maybe the higher interest rates caused the domestic currency to appreciate, making foreign goods cheaper and domestic goods more expensive, thereby increasing imports and decreasing exports, i.e. reducing net exports. Maybe the higher government spending actually resulted in lower GDP, not higher!

Unless you have good information on what is driving all components of spending it is dangerous to use an accounting identity for economic policy analysis. What we need is a model of behavior and an identified shock to the system. The above quote uses (i) an incompletely specified shock (was the increased government spending accompanied by an increase in taxes or an increase in government debt or a cut in government transfers) and (ii) a bad model, namely that the components of expenditure are unrelated to each other.

The data on the following pages show how C, I, G, IM, EX, and NX vary (as a percentage of a relevant total) across countries. All investment data include residential construction and none include R&D spending.

This data (i) break down government spending into consumption and investment, so there is no separate government spending category; (ii) combine private and government consumption to get total consumption and combine private and government investment to get total investment; (iii) breakdown total investment into total changes in inventories and total fixed investment (acquisition of capital goods plus residential construction); and (iv) breakdown total fixed investment into private and government fixed investment.

Thus, the equation GDP = C + I + G + NX is rewritten as

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

and

$$GDP = C_{TOT} + I_{TOT} + NX$$

with

$$C_{TOT} = C + G^C$$

$$I_{TOT} = I + G^I = I_{inventory} + I_{fixed} = I_{inventory} + I_{fixed,P} + I_{fixed,G}$$

Note: In the original formulation total spending by domestic residents is C + I + G and in this formulation total spending by domestic residents is $C_{TOT} + I_{TOT.}$

Some notable elements of the data:

The lowest ratio of total consumption spending to domestic spending, by a large margin, is China (54%). The next lowest consumption shares are in Singapore (65%) and Iran (65%). Not surprisingly, the highest ratios of total fixed investment spending to domestic spending are in China (45%) and Singapore (34%). Iran's ratio of total fixed investment spending to total spending is not at the top because it has a very high ratio of inventory investment to total spending (7.6%).

At the other end of the spectrum, the highest ratio of total consumption to domestic spending is in Yemen (99%). The ratio is also quite high in Greece (90%), Guatemala (87%), Pakistan (86%). and Egypt (86%). Correspondingly, these countries have very low ratios of total fixed investment: Yemen(1%), Greece (12%), Guatemala (13%), Pakistan (13%), and Egypt (13%). The lowest ratio of total fixed investment to domestic spending is in Mozambique (11%), however because of its high ratio of inventory investment to domestic spending (4.9%), it is not among the countries with the highest ratio of total consumption spending to domestic spending.

Government consumption as a share of domestic spending is smallest in Bangladesh (6%), Vietnam (6%), Nigeria (6%) and Uganda (6%). It is largest in Saudi Arabia (26%), the Netherlands (28%) and Sweden (27%).

A breakdown of fixed investment into private and government components is not possible for all countries, e.g. Canada, China and Singapore. Where data on government fixed investment is available: (i) as a share of domestic spending it is smallest in Israel (0%), Yemen (0%) and Ukraine (1%) and is largest in Turkey (29%) and Iran (24%); (ii) as a share of government consumption plus government fixed investment it is smallest in Israel (0%), Yemen (4%) and Ukraine (6%) and is largest in Turkey (68%), Iran(68%), and Ethiopia (60%).

The only countries to export less of its GDP than the U.S. (13%) are Brazil (11%), Nigeria (11%), Egypt (10%), Pakistan (9%), Ethiopia (8%) and Yemen (3%).

The countries that export the highest fraction of its GDP are Hong Kong (187%), Singapore (172%), Ireland (1248%), and the United Arab Emirates (104%).

How can these countries export more than 100% of GDP? There are multiple ways.

One possibility involves the treatment of intermediate goods. Recall GDP is value added. Also recall that adding all categories of spending, when properly calculated, equals GDP. That means that both Imports and Exports must include intermediate goods. Failing to include intermediate goods that are imported will overstate value added, and therefore GDP, because that part of the value was not produced in the country. Failing to include intermediate goods that are exported will understate value added, and therefore GDP, because those goods would otherwise never get counted in production.

As an example, consider a country that imports bicycle parts worth $100, assembles them, and sells the assembled bicycles for $125 to a foreign consumer. The value added for the country is $25, imports are $100, which is 4 times value added, and exports are $125, which is 5 times value added. For more on this see Homework Problem 1 at the end of these notes. The answers to the Homework Problems at the end of the notes are provided after the questions.

For Hong Kong and Singapore, the assembly analogy is probably not the right one. Rather, the key is likely that they are large ports. Think of things made in China and exported to the rest of the world, but being shipped through Hong Kong. Hong Kong imports a finished good from China for $100, loads it on a ship and sells it for $110 to someone outside Hong Kong. Value added in Hong Kong is $10, imports $100 and exports $110.

The countries with the lowest fraction of their domestic spending on imports are Nigeria (11%), Brazil (13%), Argentina (13%), Pakistan (15%) and the United States (15%).

The countries with the highest fraction of their domestic spending on imports are Singapore (200%), Hong Kong (189%), Ireland (135%) , the United Arab Emirates (104%).

Note: Exports are expressed as a percentage of domestic production, whereas imports are expressed as a percentage of domestic spending. Exports as a percentage of spending and Imports as a percentage of production aren't intuitive, logical ratios.

The largest trade surpluses as a percentage of domestic spending are Ireland (46%), Singapore (35%) and the Kazakhstan (18%). The largest deficits are Haiti (-23%), Yemen (-18%) and Ethiopia (-17%).

Note: It is likely unclear why it is appropriate to divide net exports by domestic spending. We will see later in Class Notes I that a country's net exports are closely related to the change in its international net asset position, i.e. the change in domestic ownership of foreign assets minus the foreign ownership of domestic assets.

Thus, net exports are a component of saving or dissaving and a ratio of net exports to spending of 3% can be (roughly) thought of as the country's savings that were used to build up its net foreign assets were 3% of its spending and a ratio of net exports to spending equal to -2% can be (roughly) thought of as the country dissaved by drawing down its net foreign assets by 2% of its spending.

Expressing net exports as a percentage of GNP instead of domestic spending is sensible – saving as a fraction of income is common.

Expressing Net Exports as a percentage of GDP does not seem reasonable.

	Consumption			Investment						
	C_{tot} /	C /	G^C /	$I_{total,G}$ /	$I_{inventory}$ /	I_{fixed} /	$I_{fixed,P}$ /	$I_{fixed,G}$ /		
Country	$C_{tot} + I_{tot}$	$C_{tot} + I_{tot}$	$C_{tot} + I_{tot}$	$C_{tot} + I_{tot}$	$C_{tot} + I_{tot}$	$C_{tot} + I_{tot}$	$C_{tot} + I_{tot}$	$C_{tot} + I_{tot}$	**YEAR**	**SOURCE**
Europe										
Belgium*	76%	52%	24%	2%	0.2%	23%	21%	2%	2015	OECD
Czech Republic	71%	50%	21%	6%	1.1%	28%	23%	5%	2015	OECD
France*	78%	54%	23%	3%	1.2%	21%	18%	3%	2015	OECD
Germany*	79%	58%	21%	2%	-0.7%	22%	19%	2%	2015	OECD
Greece*	90%	70%	20%	5%	-1.7%	12%	8%	4%	2015	OECD
Hungary	76%	54%	22%	7%	0.1%	24%	17%	7%	2015	OECD
Ireland*	68%	50%	18%	3%	0.7%	31%	29%	2%	2015	OECD
Italy*	82%	63%	20%	2%	0.5%	17%	15%	2%	2015	OECD
Kazakhstan	69%	55%	14%	NA	3.0%	28%	19%	9%	2012	World Bank
Netherlands*	78%	50%	28%	4%	0.6%	22%	18%	4%	2015	OECD
Norway	70%	45%	25%	5%	5.1%	25%	20%	5%	2015	OECD
Poland	79%	60%	19%	5%	0.4%	21%	16%	5%	2015	OECD
Portugal*	84%	66%	18%	2%	0.2%	15%	13%	2%	2015	OECD
Romania	75%	62%	14%	NA	0.2%	25%	19%	5%	2015	World Bank
Russia	75%	55%	19%	NA	2.5%	23%	20%	2%	2016	World Bank
Spain*	79%	60%	20%	3%	0.4%	20%	18%	3%	2015	OECD
Sweden	75%	47%	27%	4%	0.6%	25%	20%	4%	2015	OECD
Switzerland	74%	61%	13%	NA	-1.9%	28%	NA	NA	2016	OECD
Turkey	72%	59%	14%	NA	-1.3%	29%	0%	29%	2015	World Bank
Ukraine	83%	63%	20%	NA	-1.3%	18%	17%	1%	2009	World Bank
United Kingdom	83%	64%	19%	3%	0.2%	17%	14%	3%	2015	OECD

Notes: * indicates member of Euro zone; NA indicates Not Available

	Consumption			Investment						
	C_{tot} /	C /	G^C /	$I_{total,G}$ /	$I_{inventory}$ /	I_{fixed} /	$I_{fixed,P}$ /	$I_{fixed,G}$ /		
Country	$C_{tot} + I_{tot}$	$C_{tot} + I_{tot}$	$C_{tot} + I_{tot}$	$C_{tot} + I_{tot}$	$C_{tot} + I_{tot}$	$C_{tot} + I_{tot}$	$C_{tot} + I_{tot}$	$C_{tot} + I_{tot}$	**YEAR**	**SOURCE**
Americas/Carribean										
Canada	78%	57%	21%	NA	-0.1%	22%	NA	NA	2016	World Bank
Mexico	78%	66%	12%	NA	0.4%	22%	19%	3%	2016	World Bank
United States	80%	66%	14%	3%	0.5%	19%	16%	3%	2015	OECD
Dominican Republic	78%	67%	11%	NA	0.6%	22%	NA	NA	2016	World Bank
Haiti	77%	69%	8%	NA	0.0%	23%	18%	5%	2016	World Bank
Guatemala	87%	78%	10%	NA	-0.2%	13%	11%	2%	2013	World Bank
Argentina	84%	66%	18%	NA	1.4%	15%	NA	NA	2016	World Bank
Bolivia	81%	64%	16%	NA	0.0%	19%	7%	12%	2016	World Bank
Brazil	80%	61%	19%	NA	0.7%	19%	NA	NA	2014	OECD
Chile	78%	65%	14%	NA	-1.6%	23%	NA	NA	2016	World Bank
Colombia	76%	59%	17%	NA	0.2%	24%	NA	NA	2016	World Bank
Ecuador	74%	60%	14%	NA	0.5%	26%	14%	12%	2015	World Bank
Peru	78%	65%	13%	NA	0.2%	22%	16%	5%	2016	World Bank
Venezuela	74%	62%	12%	NA	4.8%	21%	6%	15%	2013	World Bank

Notes: NA indicates Not Available

	Consumption			Investment						
	C_{tot} /	C /	G^C /	$I_{total,G}$ /	$I_{inventory}$ /	I_{fixed} /	$I_{fixed,P}$ /	$I_{fixed,G}$ /		
Country	$C_{tot} + I_{tot}$	$C_{tot} + I_{tot}$	$C_{tot} + I_{tot}$	$C_{tot} + I_{tot}$	$C_{tot} + I_{tot}$	$C_{tot} + I_{tot}$	$C_{tot} + I_{tot}$	$C_{tot} + I_{tot}$	**YEAR**	**SOURCE**
Oceania/Asia										
Australia	75%	56%	18%	NA	0.0%	25%	NA	NA	2016	World Bank
Papua New Guinea	77%	59%	18%	NA	2.2%	21%	NA	NA	2004	World Bank
New Zealand	77%	58%	19%	NA	0.3%	23%	NA	NA	2015	World Bank
Bangladesh	72%	66%	6%	NA	0.0%	28%	22%	6%	2016	World Bank
China	54%	39%	14%	NA	1.7%	45%	NA	NA	2015	World Bank
Hong Kong	78%	68%	10%	NA	0.2%	22%	17%	5%	2016	World Bank
India	70%	58%	12%	NA	3.2%	27%	NA	NA	2016	World Bank
Indonesia	66%	57%	9%	NA	1.7%	32%	NA	NA	2016	World Bank
Japan	76%	56%	20%	NA	0.5%	23%	18%	5%	2015	World Bank
Korea(South)	69%	53%	16%	NA	0.1%	31%	26%	4%	2014	OECD
Myanmar	NA	NA	NA	NA	NA	NA	NA	NA	2016	World Bank
Pakistan	86%	75%	11%	NA	1.5%	13%	9%	4%	2016	World Bank
Philippines	78%	68%	10%	NA	-0.3%	23%	20%	3%	2016	World Bank
Singapore	65%	50%	15%	NA	0.7%	34%	NA	NA	2016	World Bank
Thailand	75%	56%	19%	NA	-2.6%	27%	20%	7%	2016	World Bank
Vietnam	74%	67%	6%	NA	2.9%	23%	NA	NA	2016	World Bank

Notes: NA indicates Not Available

	Consumption			Investment						
	C_{tot} /	C /	G^C /	$I_{total,G}$ /	$I_{inventory}$ /	I_{fixed} /	$I_{fixed,P}$ /	$I_{fixed,G}$ /		
Country	$C_{tot} + I_{tot}$	$C_{tot} + I_{tot}$	$C_{tot} + I_{tot}$	$C_{tot} + I_{tot}$	$C_{tot} + I_{tot}$	$C_{tot} + I_{tot}$	$C_{tot} + I_{tot}$	$C_{tot} + I_{tot}$	**YEAR**	**SOURCE**
Middle East/Africa										
Iran	65%	53%	11%	NA	7.6%	28%	4%	24%	2014	World Bank
Iraq	83%	60%	22%	NA	-6.0%	23%	9%	15%	2016	World Bank
Israel	79%	56%	23%	2%	0.8%	20%	20%	0%	2015	OECD
Saudi Arabia	69%	43%	26%	NA	4.6%	27%	NA	NA	2016	World Bank
Syria	72%	60%	12%	NA	7.4%	21%	12%	9%	2007	World Bank
United Arab Emirates	74%	60%	14%	NA	1.5%	24%	13%	12%	2016	World Bank
Yemen	99%	88%	11%	NA	0.0%	1%	1%	0%	2016	World Bank
Dem Rep Congo	85%	74%	11%	NA	0.0%	15%	11%	3%	2016	World Bank
Egypt	86%	76%	10%	NA	0.5%	13%	8%	6%	2016	World Bank
Ethiopia	67%	59%	8%	NA	0.0%	33%	21%	12%	2016	World Bank
Kenya	84%	68%	16%	NA	-1.0%	17%	15%	2%	2005	World Bank
Mozambique	84%	69%	15%	NA	4.9%	11%	4%	7%	2006	World Bank
Nigeria	84%	79%	6%	NA	0.7%	15%	NA	NA	2015	World Bank
South Africa	80%	60%	21%	NA	-0.2%	20%	12%	8%	2016	World Bank
Tanzania	76%	59%	17%	NA	-1.6%	26%	15%	11%	2006	World Bank
Uganda	79%	73%	6%	NA	0.3%	21%	16%	5%	2016	World Bank

Notes: NA indicates Not Available

	Government		Imports & Exports				
	G^C /	$I_{fixed,G}$ /	IM /	EX /	NX /		
Country	$G^C + I_{fixed,G}$	$G^C + I_{fixed,G}$	$C_{tot} + I_{tot}$	GDP	$C_{tot} + I_{tot}$	YEAR	SOURCE
Europe							
Belgium*	91%	9%	83%	83%	2%	2015	OECD
Czech Republic	79%	21%	82%	83%	7%	2015	OECD
France*	87%	13%	31%	30%	-1%	2015	OECD
Germany*	90%	10%	42%	47%	8%	2015	OECD
Greece*	84%	16%	32%	32%	0%	2015	OECD
Hungary	75%	25%	90%	91%	10%	2015	OECD
Ireland*	88%	12%	135%	124%	46%	2015	OECD
Italy*	89%	11%	28%	30%	3%	2015	OECD
Kazakhstan	62%	38%	36%	44%	18%	2012	World Bank
Netherlands*	88%	12%	81%	83%	12%	2015	OECD
Norway	83%	17%	34%	37%	6%	2015	OECD
Poland	80%	20%	48%	50%	3%	2015	OECD
Portugal*	89%	11%	40%	41%	1%	2015	OECD
Romania	73%	27%	41%	41%	-1%	2015	World Bank
Russia	90%	10%	22%	26%	6%	2016	World Bank
Spain*	89%	11%	31%	33%	3%	2015	OECD
Sweden	86%	14%	43%	46%	5%	2015	OECD
Switzerland	NA	NA	61%	66%	14%	2016	OECD
Turkey	32%	68%	25%	23%	-3%	2015	World Bank
Ukraine	94%	6%	47%	46%	-2%	2009	World Bank
United Kingdom	88%	12%	29%	28%	-2%	2015	OECD

Notes: * indicates member of Euro zone; NA indicates Not Available

	Government		Imports & Exports				
	G^C /	$I_{fixed,G}$ /	IM /	EX /	NX /		
Country	$G^C + I_{fixed,G}$	$G^C + I_{fixed,G}$	$C_{tot} + I_{tot}$	GDP	$C_{tot} + I_{tot}$	YEAR	SOURCE
Americas/Carribean							
Canada	NA	NA	33%	31%	-2%	2016	World Bank
Mexico	79%	21%	39%	38%	-2%	2016	World Bank
United States	82%	18%	15%	13%	-3%	2015	OECD
Dominican Republic	NA	NA	28%	25%	-4%	2016	World Bank
Haiti	61%	39%	39%	21%	-23%	2016	World Bank
Guatemala	85%	15%	31%	24%	-10%	2013	World Bank
Argentina	NA	NA	13%	13%	-1%	2016	World Bank
Bolivia	57%	43%	30%	25%	-7%	2016	World Bank
Brazil	NA	NA	13%	11%	-3%	2014	OECD
Chile	NA	NA	28%	28%	1%	2016	World Bank
Colombia	NA	NA	19%	14%	-6%	2016	World Bank
Ecuador	54%	46%	23%	21%	-3%	2015	World Bank
Peru	71%	29%	22%	22%	0%	2016	World Bank
Venezuela	44%	56%	28%	25%	-5%	2013	World Bank

Notes: NA indicates Not Available

	Government		Imports & Exports				
	G^C /	$I_{fixed,G}$ /	IM /	EX /	NX /		
Country	$G^C + I_{fixed,G}$	$G^C + I_{fixed,G}$	$C_{tot} + I_{tot}$	**GDP**	$C_{tot} + I_{tot}$	**YEAR**	**SOURCE**
Oceania/Asia							
Australia	NA	NA	21%	19%	-2%	2016	World Bank
Papua New Guinea	NA	NA	68%	72%	15%	2004	World Bank
New Zealand	NA	NA	27%	28%	1%	2015	World Bank
Bangladesh	47%	53%	20%	17%	-4%	2016	World Bank
China	NA	NA	19%	22%	4%	2015	World Bank
Hong Kong	67%	33%	189%	187%	2%	2016	World Bank
India	NA	NA	20%	19%	-1%	2016	World Bank
Indonesia	NA	NA	18%	19%	1%	2016	World Bank
Japan	80%	20%	18%	18%	0%	2015	World Bank
Korea(South)	78%	22%	48%	50%	6%	2014	OECD
Myanmar	NA	NA	NA	16%	NA	2016	World Bank
Pakistan	76%	24%	15%	9%	-7%	2016	World Bank
Philippines	78%	22%	34%	28%	-8%	2016	World Bank
Singapore	NA	NA	200%	172%	35%	2016	World Bank
Thailand	72%	28%	60%	69%	16%	2016	World Bank
Vietnam	NA	NA	90%	94%	3%	2016	World Bank

Notes: NA indicates Not Available

	Government		Imports & Exports				
Country	G^C / $G^C + I_{fixed,G}$	$I_{fixed,G}$ / $G^C + I_{fixed,G}$	IM / $C_{tot} + I_{tot}$	EX / GDP	NX / $C_{tot} + I_{tot}$	YEAR	SOURCE
Middle East/Africa							
Iran	32%	68%	20%	24%	6%	2014	World Bank
Iraq	60%	40%	37%	33%	-6%	2016	World Bank
Israel	100%	0%	29%	31%	3%	2015	OECD
Saudi Arabia	NA	NA	30%	31%	0%	2016	World Bank
Syria	58%	42%	38%	39%	1%	2007	World Bank
United Arab Emirates	55%	45%	104%	104%	2%	2016	World Bank
Yemen	96%	4%	21%	3%	-18%	2016	World Bank
Dem Rep Congo	77%	23%	28%	25%	-4%	2016	World Bank
Egypt	65%	35%	18%	10%	-8%	2016	World Bank
Ethiopia	40%	60%	23%	8%	-17%	2016	World Bank
Kenya	87%	13%	33%	29%	-7%	2005	World Bank
Mozambique	70%	30%	37%	30%	-10%	2006	World Bank
Nigeria	NA	NA	11%	11%	0%	2015	World Bank
South Africa	73%	27%	30%	30%	0%	2016	World Bank
Tanzania	61%	39%	24%	17%	-7%	2006	World Bank
Uganda	53%	47%	25%	18%	-9%	2016	World Bank

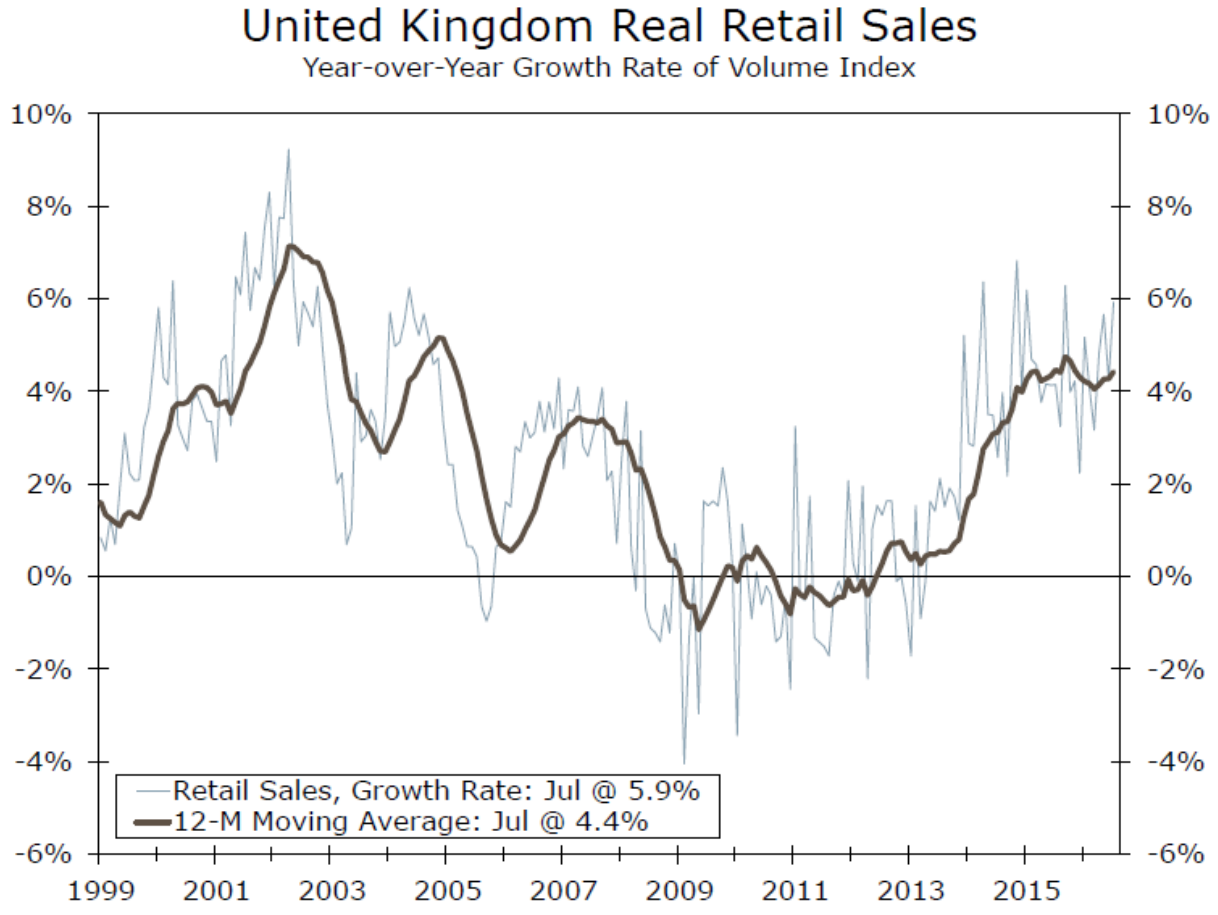
Notes: NA indicates Not Available

How much credence should we assign to this, and other types, of economic data?

Not as much as we would like, but they are not worthless.

Clearly data is often revised, so preliminary estimates are less credible than revised estimates.

And often a single month's or quarter's data can be contaminated by "noise", i.e. random, idiosyncratic and misleading factors. The graph below, from the August 19, 2016 issue of Wells Fargo Securities' *Weekly Economic & Financial Commentary* is a good example of how to deal with this issue: look at longer term moving averages.



Source: IHS Global Insight, Bloomberg LP and Wells Fargo Securities

Note: Retail sales = GDP – Change in Business Inventories

And finally, there are issues of intentional deception.

See **Superstition ain't the way**, *The Economist*, Sept 3, 2016 and **Called to account**, *The Economist*, Sept 3, 2016.

This section concludes by describing why the way data on the composition of GDP is currently collected is at odds with the way serious economists think about the world.

To a serious economist, Consumption reflects the purchase of goods and services that are bought because they yield utility, whereas Investment reflects the purchase of goods and services that are bought because they help produce more goods and services in the future. To a serious economist the distinction between Consumption and Investment is based on the nature of the good, not who does the purchasing.

To data collectors, Consumption (generally) is what is bought by households and Investment is what is bought by firms. Data is generally based on who made the purchase, not the nature of the good being bought.

To see the conflict between data collection and good economists, note that sometimes households are responsible for Investment. When a household purchases education it is investing in *human capital*. MBA students are not paying for their education for the joy of learning that it provides. They are making an investment in themselves, an investment that they expect to pay off in terms of higher future productivity, and therefore higher future income.

The treatment of residential housing is another example of the conflict between data collection and good economics. Data collection treats residential housing as Investment, even though it is purchased by households. This decision reflects confusion between investment and durable consumption. Durable consumption is the purchase of goods that will yield utility over time, whereas non-durable consumption is the purchase of goods that yield utility only at present.

Residential housing is durable consumption, not investment. It is like the purchase of an automobile, a television, or a large number of goods that will deliver utility over time. It is not Investment because it does not lead to higher future production; it leads to higher future utility.

I.4 GNP and Welfare

Why do economists frequently defend higher GNP (and because GDP is almost always very close to GNP, higher GDP) as a good thing? Because *everything else equal*, higher income is a good thing. The caveat "*everything else equal*" is important. Caveats are often important.

"Never give in. Never give in. Never, never, never, never – in nothing, great or small, large or petty – never give in, except to convictions of honor and good sense."

– Winston Churchill, Harrow School, October 29, 1941

Obviously if GNP is higher only because prices are higher or because people had to work harder to earn that income then people may not be better off. In addition, they may not be better off if in the production of that GNP air and water are polluted or other valuable assets are destroyed.

See if you can find where Bobby Kennedy is right and wrong is his famous rant against GNP:

"Too much and too long, we seem to have surrendered community excellence and community values in the mere accumulation material things. Our gross national product, now, is over $800 billion dollars a year, but that gross national product – if we should judge America by that – counts air pollution and cigarette advertising, and ambulances to clear our highways of carnage.

"It counts special locks for our doors and the jails for those who break them. It counts the destruction of our redwoods and the loss of our natural wonder in chaotic sprawl.

"It counts napalm and the cost of a nuclear warhead, and armored cars for police who fight riots in our streets. It counts Whitman's rifle and Speck's knife, and the television programs which glorify violence in order to sell toys to our children.

"Yet the gross national product does not allow for the health of our children, the quality of the education, or the joy of their play. It does not include the beauty of our poetry or the strength of our marriages, the intelligence of our public debate or the integrity of our public officials. It measures neither our wit nor our courage, neither our wisdom nor our learning, neither our compassion nor our devotion to our country; it measures everything, in short, except that which makes life worthwhile.

"And it tells us everything about America except why we are proud that we are Americans."

– Robert F. Kennedy, University of Kansas, March 18, 1968

Four important comments about GNP and Welfare:

(1) Most economists believe the quality of life is positively correlated with GNP (so long as GNP has been adjusted for inflation, a topic we address later in Class Notes I), but the correlation is certainly less than perfect, i.e. the correlation coefficient is less than one.

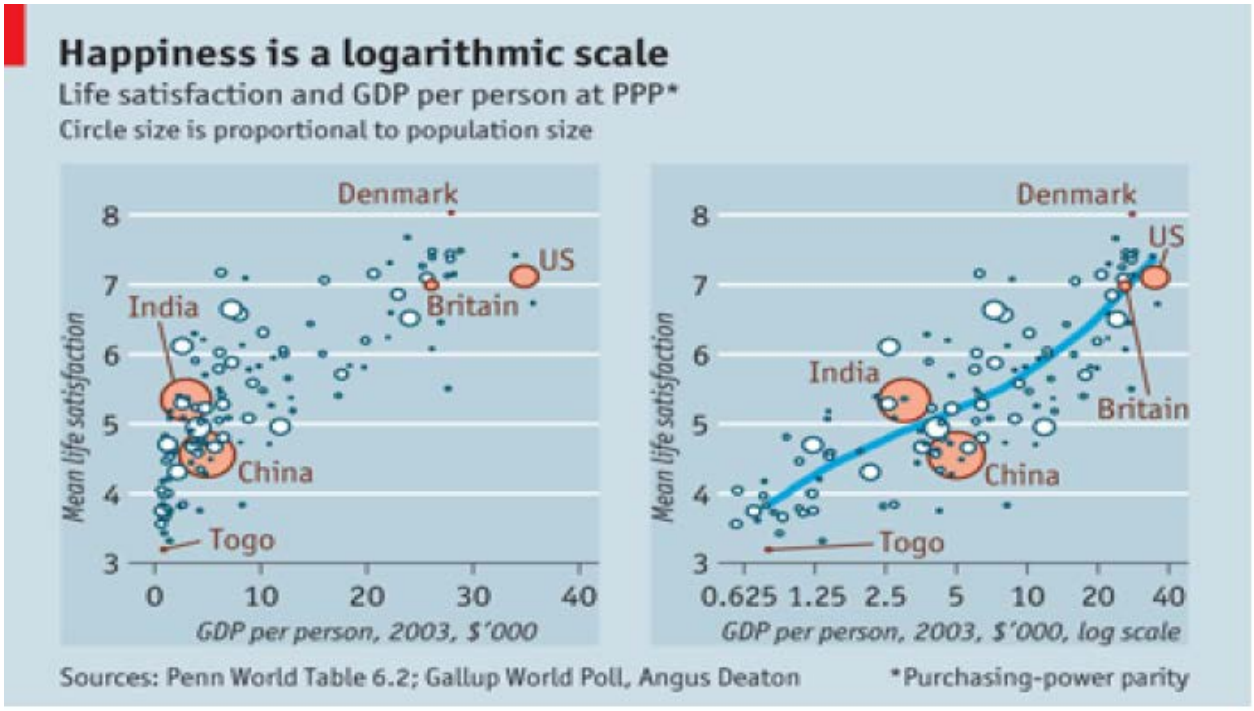
This positive correlation between quality of life and inflation-adjusted GNP is true in part because GNP is positively correlated with "non-economic" benefits such as life expectancy and strength of marriages and negatively correlated with "non-economic" costs such as crime.

Correlation between X and Y means knowing X can help predict Y and knowing Y can help predict X. Correlation does not mean predict perfectly, it means predict better than can be done ignoring the relationship.

Correlation does not prove anything about causation. If X and Y are correlated then (i) X could cause Y; (ii) Y could cause X; (iii) X could cause Y and Y could cause X; or (iv) X and Y could both be both caused by a third variable.

The figure below comes from **The joyless or the jobless**, *The Economist*, Nov 25, 2010 and was reproduced from work by Nobel Prize winning economist Angus Deaton.

Apparent interpretation: Since the change in the log of X is the percentage change in X, a given percentage increase in income *is associated with* a fixed (or possibly increasing) percentage increase in reported happiness.



The figures on the following pages come from “Health in an Age of Globalization” by Angus Deaton. Figure 1 shows that life expectancy rises dramatically with GDP at low levels of income and that after income reaches a certain level its association with life expectancy diminishes but does not disappear altogether. (Another logarithmic relationship? We will discuss what 2000 PPP $ means later in these notes.)

Figure 1 shows a positive correlation, but (as described above) does not prove anything about causation. Perhaps higher income causes longer life expectancy; perhaps longer life expectancy causes higher income; perhaps causation runs both ways; perhaps both higher income and longer life expectancy are the result of a third variable not shown on the graph.

Figure 2 shows that not only is life expectancy positively correlated with GDP, but changes in GDP are correlated with changes in life expectancy. Thus, we seem to be able to rule out certain explanations of the correlation shown in Figure 1. For example, suppose (i) countries with hospitable climates and/or a good gene pool make people healthy and being healthy allows people to both live longer and earn more income, but (ii) higher GDP has no direct causal effect on life expectancy and (iii) higher life expectancy has no direct causal effect on GDP. Then Figure 1 could look like it does, but if climate and the gene pool remain unchanged over time then we wouldn’t expect Figure 2 to look like it does.

While Figures 1 and 2 can be used to rule out certain explanations of how income and life expectancy are related, they are consistent with a large number of ways that these two variables are related and we will not pursue the causation issue further, it takes us too far astray.

The main point is that

(i) Correlation is relatively easy to measure and implies information can be used to predict;

(ii) Correlation is consistent with many types of causation and inferring causation is relatively difficult;

(iii) Policy analysis requires knowledge of causation, correlation is insufficient. Umbrella use is correlated with rainfall and helps predict rainfall. Does increasing umbrella production help with a drought?

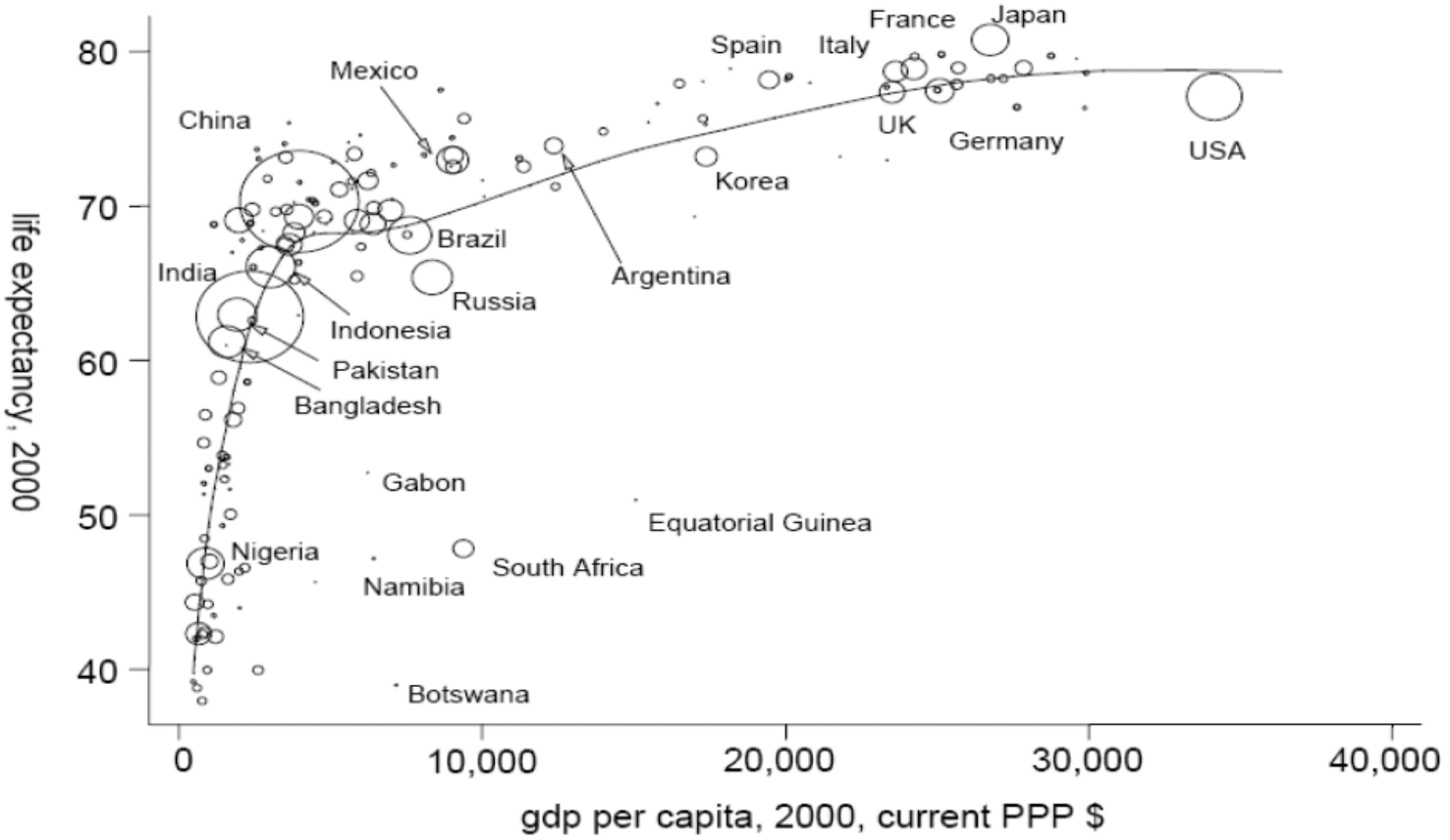


Figure 1: The Millennium Preston curve
Source: Author's calculations based on World Development Indicators 2003 (life expectancy and Penn World Table (GDP.)
Note: Circles have diameter proportional to population size

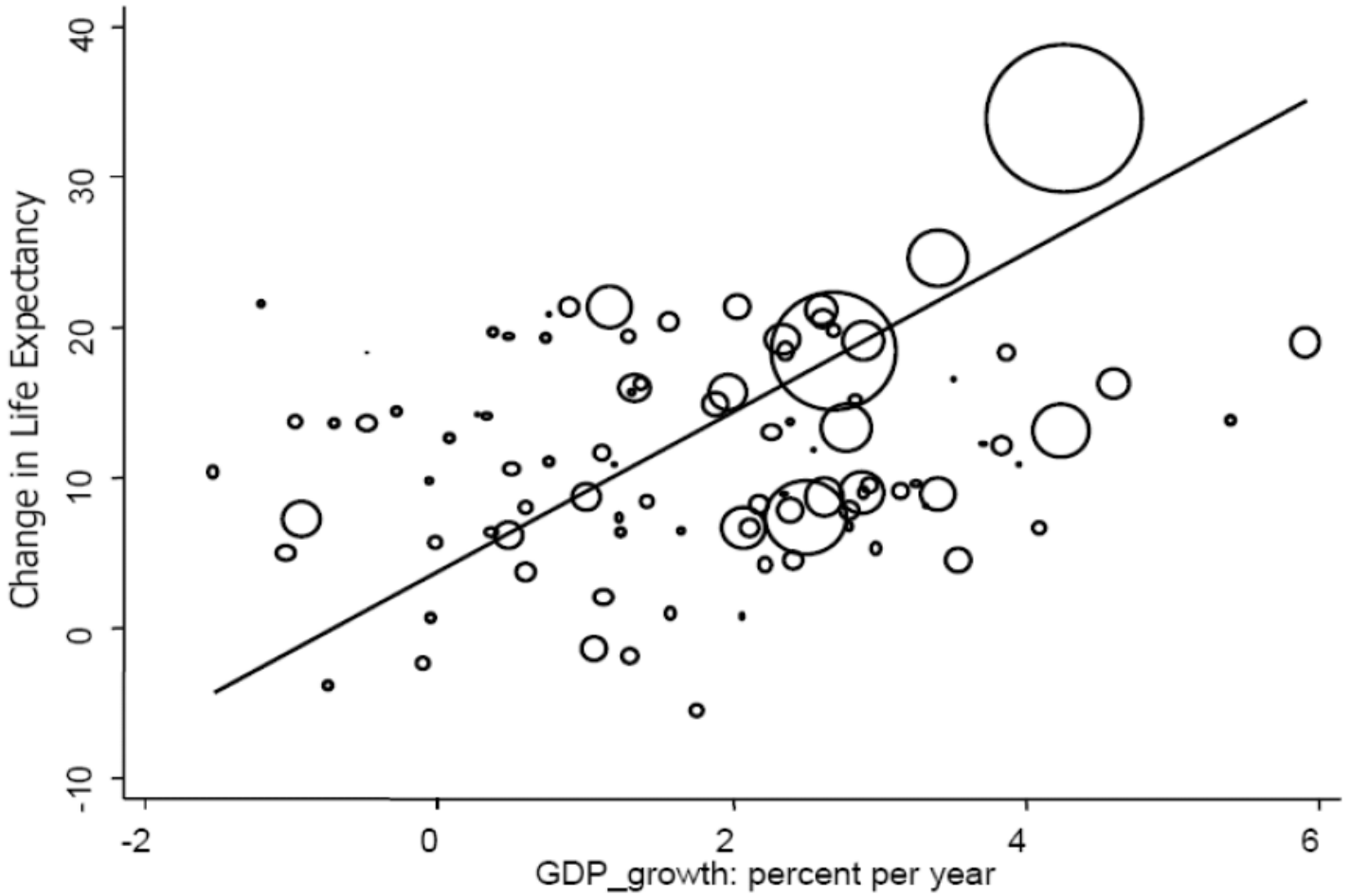


Figure 2: Change in life expectancy and GDP growth, 1960–2000
Source: See Figure 1. Note: Circles have diameter proportional to population size. The life-expectancy gain in China, which is the largest circle, is artificially by the famine conditions in 1960.

(2) Even though inflation-adjusted GNP is positively correlated with the quality of life, that does not justify higher GNP as an important goal of economic policy.

Producing GNP has costs as well as benefits. More GNP is not always better. The optimal level of GNP is the one where the marginal benefit of more GNP is equal to marginal cost of producing it.

In a world with no externalities (i.e. social cost = private cost and social benefit = private benefit) and a well-functioning private market (i.e. private marginal cost = private marginal benefit) the optimal amount of GNP will be reached.

(3) On a recurring basis, articles are written claiming that there are better measures of well-being than GNP.

This should not be surprising and no reasonable economist would disagree. GNP was never designed to measure well-being. It measures different, but related, important economic concepts: income and output.

Would you criticize a thermometer because it doesn't measure barometric pressure?

(4) Later in this class we will utilize a popular view (among economists) of how to measure economic welfare: utility depends on consumption (both private and public) and leisure. Since GDP contains both investment and net exports, which are not counted in this definition of economic welfare, and since GDP does not include a measure of the value of leisure, GDP will not be a reliable measure of economic welfare according to the definition we will use in class.

I.5 Comparing Output and Consumption Across Countries

Since GDP, GNP and other economic measures are computed in terms of local currency, direct comparison across countries is not possible (e.g. $ versus £, €, SFr and ¥).

Two ways to compare:

Market Exchange Rates: Convert foreign currency to domestic currency using actual exchange rate

PPP Exchange Rates: Convert foreign currency to domestic currency using the Purchasing Power Parity exchange rate, i.e. the rate where one unit of domestic currency converted at this rate and used to buy goods and services in the foreign country can buy the same amount of goods and services as that unit of domestic currency can buy in the home country.

	United States	Norway	China
GDP (local currency, billions)	$16,768	kr 3,069	¥58,667
$ / FX (actual)	$1.00	$0.17	$0.16
GDP (US$, billions)	$16,768	$522	$9,469
GDP Ratio (U.S. / Other)	1.0	32.1	1.8
$ / FX (PPP)	$1.00	$0.11	$0.28
GDP (US$-PPP, billions)	$16,768	$333	$16,173
GDP Ratio (U.S. / Other)	1.0	50.4	1.0

Source: April 2015 IMF World Economic Outlook (WEO). Data from 2013.

Why the difference? Obviously, actual and PPP exchange rates are not always equal.

In the case of China, if a yuan cost $0.28 then $1 could buy the same amount of goods and services in the U.S. and in China. However, a yuan only cost $0.16, so $1 can buy more in China than in the United States. Thus, things are cheaper in China and Chinese income, if spent in China, is higher than it looks using market exchange rates. Likewise, Chinese production is higher than it looks using market exchange rates.

In the case of Norway, if a Norwegian krone cost $0.11 then $1 could buy the same amount of goods and services in the U.S. and in Norway. However, a Norwegian krone cost $0.17, so $1 can buy less in Norway than in the United State. Thus, things are more expensive in Norway and Norwegian income, if spent in Norway, is lower than it looks using market exchange rates. Likewise, Norwegian production is lower than it looks using market exchange rates.

Is it coincidence that the PPP measure of the difference between Chinese and U.S. income is smaller than the actual exchange rate measure while the reverse is true for Norway?

It turns out the answer is NO! There is a very discernible pattern: things are typically more expensive in countries with higher per capita income.

So, poor countries (based on per capita income) are not as poor as they appear based on market exchange rates, and rich countries (based on per capita income) are not as rich as they appear. Poor countries produce more than they appear to produce based on market exchange rates, and rich countries produce less than they appear to produce.

Also, it follows that if one compares actual to PPP exchange rates to decide if a currency is "over-valued" or "under-valued", poor countries will appear to have an under-valued currency and rich countries will appear to have an over-valued currency. Put another way, PPP is bad theory of exchange rate determination not only because it is inaccurate, but also because it is on average biased, with the bias correlated with per capita GDP.

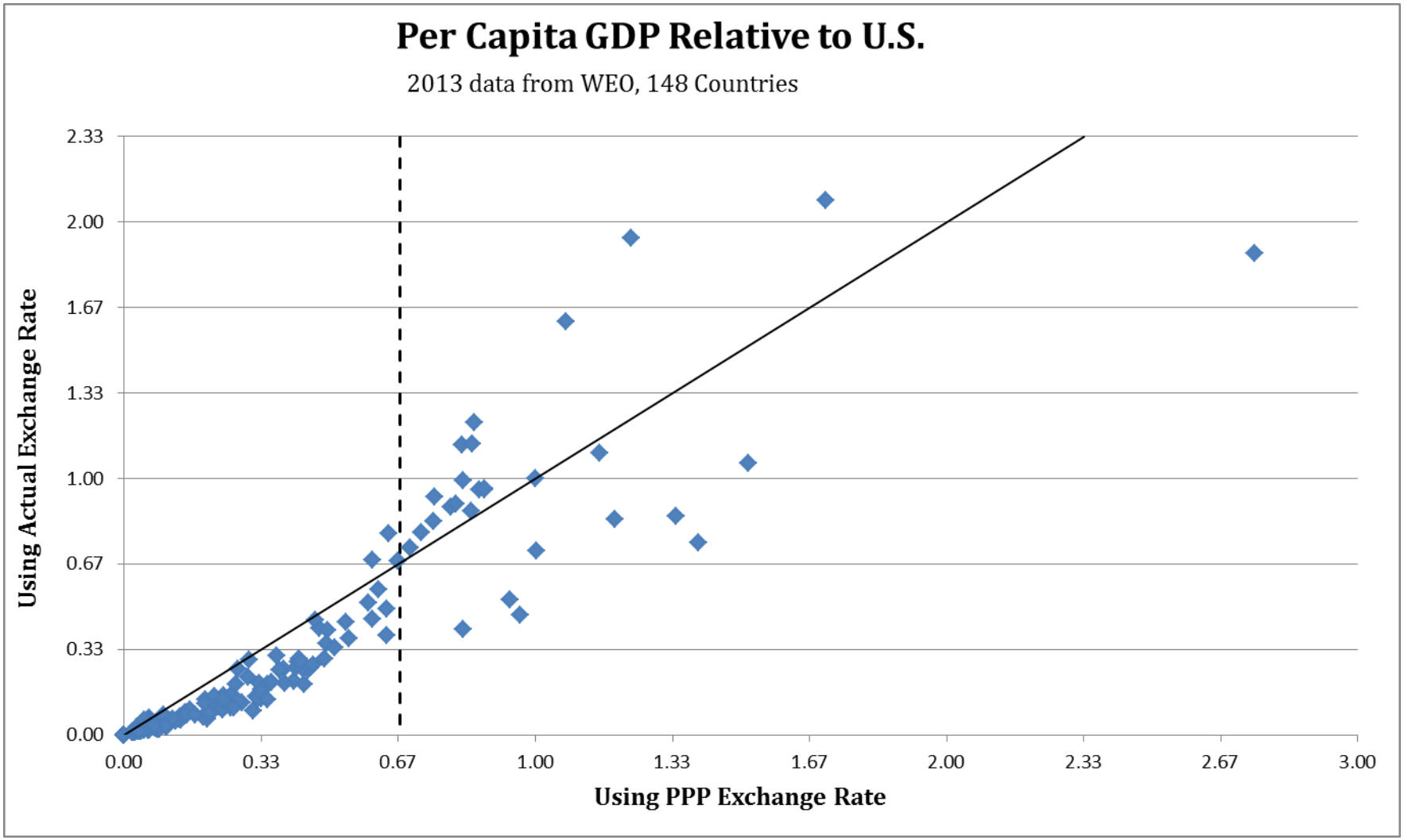
An implication of this fact is that if one wants to use the deviation of China's actual exchange rate from its PPP exchange rate as the basis for accusing the Chinese of manipulating their exchange rate to achieve an unfair advantage in world trade then that accusation needs to be leveled at virtually all countries with a low per capita income.

Evidence of this phenomenon is shown in the graphs on the next two pages. The first graph plots 2013 GDP per capita relative to the U.S. for 148 countries, calculated using both PPP and actual (market) and exchange rates. The second graph plots 2013 GDP per capita GDP relative to the U.S. using the PPP exchange rate and the ratio of the actual to PPP exchange rate. Both figures were constructed using data from the April 2015 IMF World Economic Outlook (WEO).

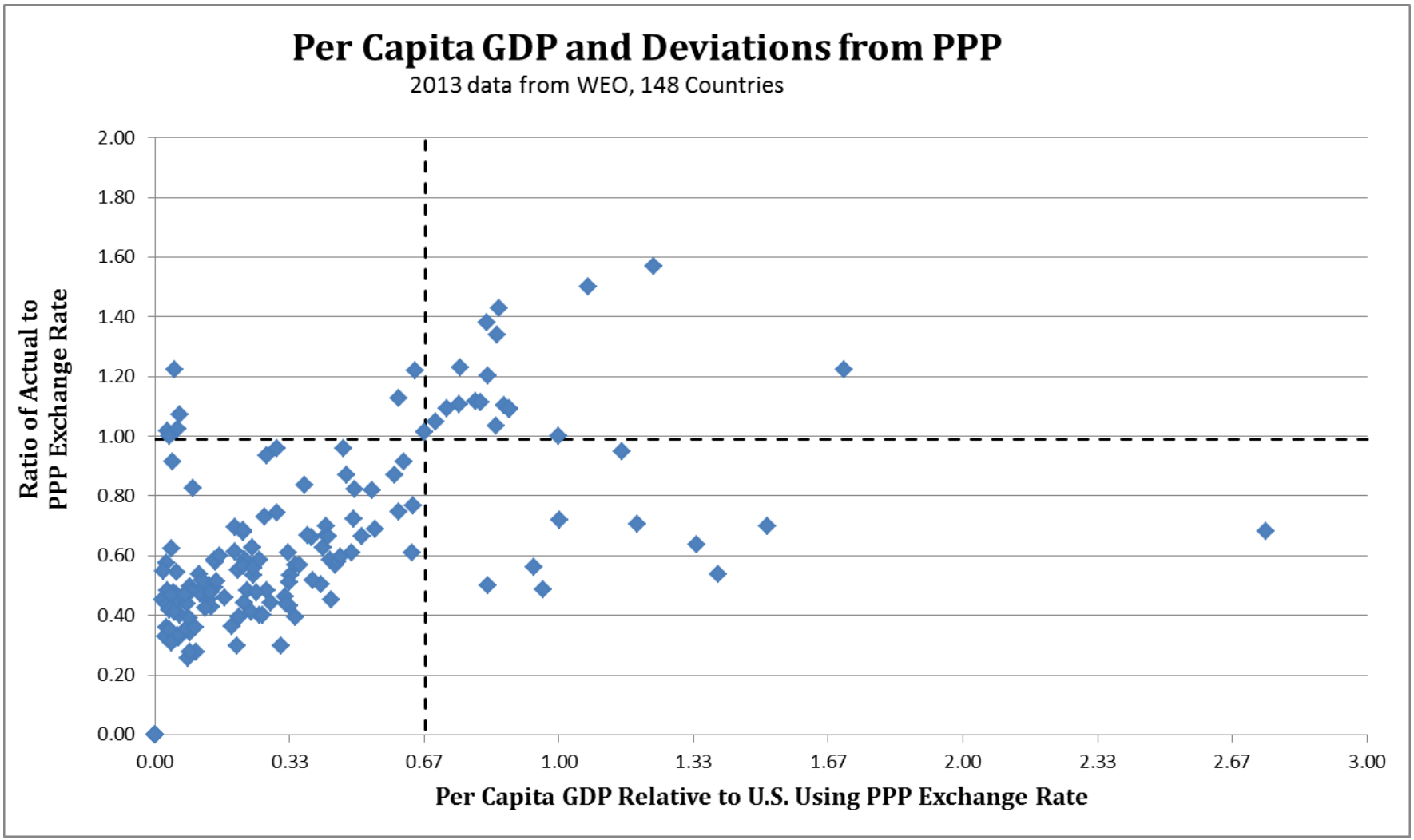
Note that most poor countries (GDP per capita relative to the U.S. using the PPP exchange rates less than .67) are like China. They are below the 45-degree line; their relative GDP is higher when using PPP exchange rates, meaning goods and services are relatively cheaper there and their exchange rate appears undervalued relative to PPP. Also, most rich countries (GDP per capita relative to the U.S. using the PPP exchange rates greater than .67) are like Norway. They are above the 45-degree line; their relative GDP is lower when using PPP exchange rates, meaning goods and services are relatively more expensive there and their exchange rate appears overvalued relative to PPP. In addition, these differences can be quite astoundingly large (more details on this to follow).

In terms of specifics, 130 of the 148 countries for which data is shown fit the pattern described; this is 88% of the sample. Note: Even though there are exceptions, they are sufficiently few that it is reasonable to declare that there is a pattern in the data. The existence of exceptions doesn't invalidate the general principle.

Of the 18 exceptions, 10 countries are exceptions where rich countries have cheaper prices and over-valued currencies (including Hong Kong, Singapore, United Arab Emirates and Qatar) and 8 countries are exceptions where poor countries have higher prices and under-valued currencies (including Israel and New Zealand). That means 10/28 = 36% of rich countries are exceptions and 8/120 = 7% of poor countries are exceptions.



Source: April 2015 IMF World Economic Outlook (WEO)



Source: April 2015 IMF World Economic Outlook (WEO)

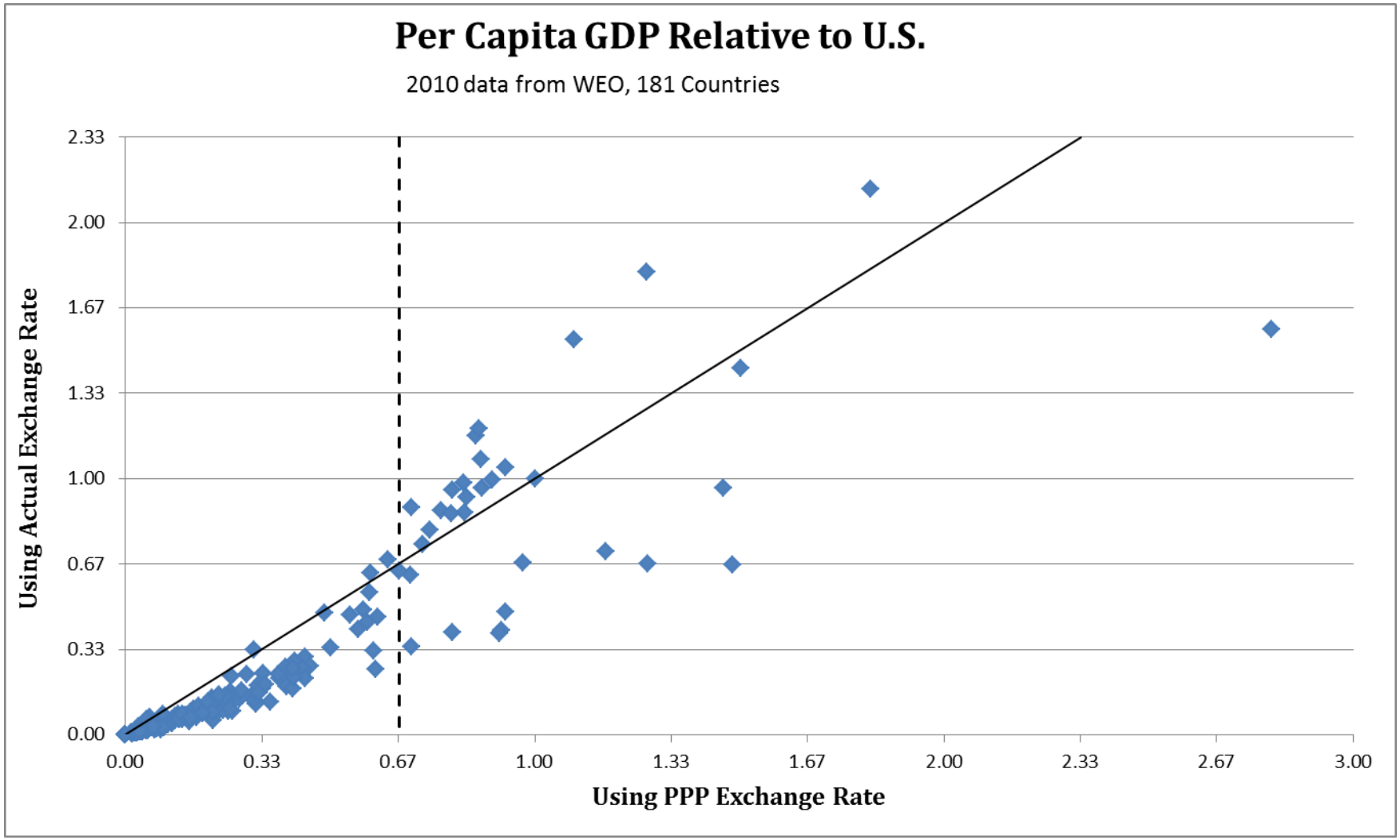
It is important to know that there is nothing special about 2013. The graphs on the next two pages use data from 2010, resulting in a slightly larger sample: 181 countries instead of 148.

The results are essentially the same. 162 of the 181 countries for which data is shown fit the pattern described; this is 90% of the sample.

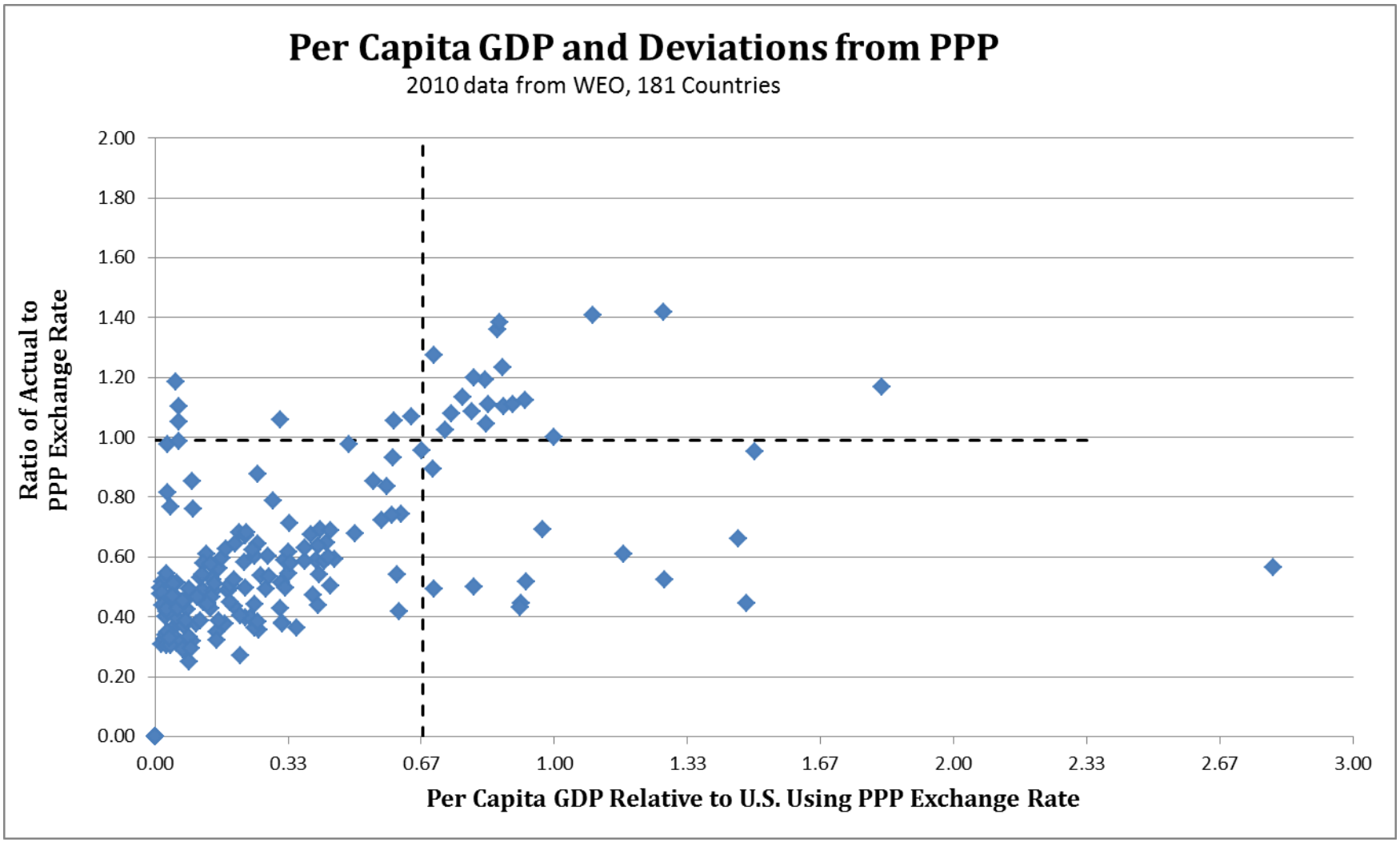
Of the 19 exceptions, 13 countries are exceptions where rich countries have cheaper prices and over-valued currencies and 6 countries are exceptions where poor countries have higher prices and under-valued currencies. . That means 13/32 = 41% of rich countries are exceptions and 6/149 = 4% of poor countries are exceptions.

Another interesting feature of the data is this: There are 147 countries that have valid data in both 2013 and 2010. Of these countries, 14 are exceptions in both years, 3 are exceptions only in year 2010 and 4 are exceptions only in 2013. Thus, there is significant persistence to the list of countries that are exceptions.

The leading explanation for goods and services being more expensive in high income countries is known as the Belassa-Samuelson hypothesis. For a discussion of the Belassa-Samuelson hypothesis and other PPP issues see Michael Pakko and Patricia Pollard**, Burgernomics: A Big Mac Guide to Purchasing Power Parity**, *Review*, Federal Reserve Bank of St. Louis, November/December 2003.



Source: April 2015 IMF World Economic Outlook (WEO)



Source: April 2015 IMF World Economic Outlook (WEO)

The tables that follow on the next few pages show data for a subset of the countries whose data is displayed in the previous two graphs.

The data in the second and third columns show how important the choice of exchange rate is when comparing data across countries. For example, in 2013 per capita Czech GDP is only 38% of U.S. per capita GDP using the market exchange rate but is 55% of U.S. per capita GDP using the PPP exchange rate. Likewise, in 2013 per capita Norwegian GDP is 194% of U.S. per capita GDP using the market exchange rate but is only 123% of U.S. per capita GDP using the PPP exchange rate.

The data in the third and fourth columns show how things have changed over a decade. Based on PPP exchange rates, from 2003 to 2013 per capita GDP relative to the U.S. rose for over 75% of the countries. Some extreme examples: Singapore (116% to 152%), Hong Kong (75% to 100%), Saudi Arabia (79% to 96%), Kazakhstan (28% to 44%) and Korea (50% to 64%). Over this period per capita GDP relative to the U.S. fell most for the following countries: the United Arab Emirates (221% to 119%), Greece (61% to 47%), Italy (78% to 67%), Ireland (96% to 88%) and Spain (68% to 62%).

The data in the fifth and sixth columns show that the distinction between the growth of per capita GDP and growth of total GDP is an important one empirically. For example, between 2003 and 2013 the German economy shrank from being 22.6% as large as the U.S. economy to 21.5%, while at the same time per capita German GDP relative to the U.S. rose from 80% to 84%. How can this be? As shown in the final column, the German population fell by 2% while the U.S. population rose by 9%.

Japan and Norway are other interesting cases.

Japanese per capita GDP relative to the U.S. rose slightly from 69% to 70%. Meanwhile 0% population growth meant total Japanese GDP relative to the U.S. fell significantly, from 30.5% to 27.9%.

Norwegian per capita GDP relative to the U.S. fell from 128% to 123%. Meanwhile 11% population growth meant total Norwegian GDP relative to the U.S. stayed unchanged at 2.0%.

The empirical differences between changes in relative total GDP and changes in relative per capita GDP are important because some economic issues are tied to total GDP and others to per capita GDP. Fiscal financial crises, the ability to afford a strong military and the ability to provide foreign aid are more closely connected to total GDP, whereas economic well-being is more closely connected to per capita GDP.

Exchange Rate	Actual	PPP	PPP	PPP	PPP	
Year	2013	2013	2003	2013	2003	2003-2013
Table Variable	Per Cap GDP % of U.S.	Per Cap GDP % of U.S.	Per Cap GDP % of U.S.	Total GDP % of U.S.	Total GDP % of U.S.	Pop Growth
Europe						
Belgium*	89%	79%	81%	2.8%	2.9%	8%
Czech Republic	38%	55%	48%	1.8%	1.7%	3%
France*	83%	75%	78%	15.1%	16.1%	6%
Germany*	87%	84%	80%	21.5%	22.6%	-2%
Greece*	41%	47%	61%	1.7%	2.3%	1%
Hungary	25%	45%	43%	1.4%	1.5%	-2%
Ireland*	95%	88%	96%	1.3%	1.3%	15%
Italy*	68%	67%	78%	12.6%	15.3%	4%
Kazakhstan	26%	44%	28%	2.4%	1.4%	15%
Netherlands*	96%	88%	88%	4.7%	4.9%	4%
Norway	194%	123%	128%	2.0%	2.0%	11%
Poland	26%	45%	33%	5.4%	4.3%	0%
Portugal*	41%	49%	55%	1.6%	2.0%	0%
Romania	17%	33%	26%	2.2%	1.9%	-2%
Russia	27%	46%	34%	20.8%	16.6%	0%
Spain*	56%	62%	68%	9.1%	9.9%	10%
Sweden	113%	85%	82%	2.6%	2.5%	7%
Switzerland	161%	107%	103%	2.7%	2.6%	10%
Turkey	20%	36%	28%	8.6%	6.4%	14%
Ukraine	8%	17%	14%	2.3%	2.2%	-10%
United Kingdom	79%	72%	75%	14.6%	15.4%	8%

Source: April 2015 IMF World Economic Outlook (WEO)

Exchange Rate	Actual	PPP	PPP	PPP	PPP	
Year	2013	2013	2003	2013	2003	2003-2013
Table Variable	Per Cap GDP % of U.S.	Per Cap GDP % of U.S.	Per Cap GDP % of U.S.	Total GDP % of U.S.	Total GDP % of U.S.	Pop Growth
Americas/Carribean						
Canada	99%	82%	82%	9.1%	8.9%	11%
Mexico	20%	33%	31%	12.3%	11.2%	13%
United States	100%	100%	100%	100.0%	100.0%	9%
Dominican Republic	11%	23%	18%	0.8%	0.5%	19%
Haiti	2%	3%	3%	0.1%	0.1%	15%
Guatemala	7%	14%	14%	0.7%	0.6%	28%
Argentina	28%	42%	29%	5.5%	3.7%	12%
Bolivia	5%	11%	9%	0.4%	0.3%	22%
Brazil	22%	30%	25%	19.2%	15.4%	11%
Chile	30%	42%	32%	2.4%	1.8%	11%
Colombia	15%	24%	18%	3.6%	2.7%	13%
Ecuador	11%	21%	17%	1.0%	0.8%	18%
Peru	12%	22%	15%	2.1%	1.4%	17%
Venezuela	14%	35%	26%	3.3%	2.2%	18%

Source: April 2015 IMF World Economic Outlook (WEO)

Exchange Rate	Actual	PPP	PPP	PPP	PPP	
Year	2013	2013	2003	2013	2003	2003-2013
Table Variable	Per Cap GDP % of U.S.	Per Cap GDP % of U.S.	Per Cap GDP % of U.S.	Total GDP % of U.S.	Total GDP % of U.S.	Pop Growth
Oceania/Asia						
Australia	122%	85%	82%	6.3%	5.6%	18%
New Zealand	78%	64%	63%	0.9%	0.9%	10%
Papua New Guinea	4%	4%	4%	0.1%	0.1%	33%
Bangladesh	2%	6%	4%	3.0%	1.9%	13%
China	13%	22%	10%	96.5%	43.2%	5%
Hong Kong	72%	100%	75%	2.3%	1.7%	7%
India	3%	10%	6%	40.5%	22.8%	15%
Indonesia	7%	19%	14%	15.0%	10.0%	15%
Japan	73%	70%	69%	27.9%	30.5%	0%
Korea	49%	64%	50%	10.1%	8.2%	5%
Myanmar	2%	8%	4%	1.3%	0.7%	7%
Pakistan	2%	9%	7%	5.0%	3.7%	24%
Philippines	5%	12%	10%	3.8%	2.7%	19%
Singapore	106%	152%	116%	2.6%	1.6%	31%
Thailand	11%	27%	21%	5.8%	4.7%	7%
Vietnam	4%	10%	6%	2.8%	1.8%	11%

Source: April 2015 IMF World Economic Outlook (WEO)

Exchange Rate	Actual	PPP	PPP	PPP	PPP	
Year	2013	2013	2003	2013	2003	2003-2013
Table Variable	Per Cap GDP % of U.S.	Per Cap GDP % of U.S.	Per Cap GDP % of U.S.	Total GDP % of U.S.	Total GDP % of U.S.	Pop Growth
Middle East/Africa						
Iran	9%	31%	30%	7.6%	6.9%	14%
Iraq	13%	29%	16%	3.1%	1.4%	32%
Israel	68%	60%	52%	1.5%	1.2%	20%
Saudi Arabia	47%	96%	79%	9.1%	6.0%	36%
Syria	NA	NA	11%	NA	0.7%	NA
United Arab Emirates	84%	119%	221%	3.4%	2.7%	154%
Yemen	NA	NA	8%	NA	0.6%	35%
Dem Rep Congo	NA	NA	1%	NA	0.2%	34%
Egypt	6%	20%	18%	5.4%	4.1%	25%
Ethiopia	1%	3%	1%	0.8%	0.3%	26%
Kenya	2%	6%	5%	0.7%	0.5%	31%
Mozambique	1%	2%	1%	0.2%	0.1%	30%
Nigeria	6%	11%	7%	5.8%	3.3%	31%
South Africa	13%	24%	22%	4.1%	3.5%	15%
Tanzania	NA	NA	4%	NA	0.4%	30%
Uganda	1%	4%	3%	0.4%	0.3%	38%

Source: April 2015 IMF World Economic Outlook (WEO)

The table below shows that in terms of PPP adjusted total GDP, the world's top 12 countries remained the same from 2003 to 2013, but the ranking within the top 12 shifted. Indonesia, Brazil, and India moved up, while Japan, France, the United Kingdom, Italy and Mexico moved down.

	Total PPP$ GDP Relative to U.S. 2013	Total PPP$ GDP Relative to U.S. 2003	Rank of PPP Adjusted Total GDP 2013	Rank of PPP Adjusted Total GDP 2003	Change
United States	100%	100%	1	1	none
China	96%	43%	2	2	none
India	40%	23%	3	4	up 1
Japan	28%	30%	4	3	down 1
Germany	22%	23%	5	5	none
Russia	21%	17%	6	6	none
Brazil	19%	15%	7	8	up 1
France	15%	16%	8	7	down 1
Indonesia	15%	10%	9	12	up 3
United Kingdom	15%	15%	10	9	down 1
Italy	13%	15%	11	10	down 1
Mexico	12%	11%	12	11	down 1

Source: April 2015 IMF World Economic Outlook (WEO)

For a recent analysis of the relative growth rates of developed economies and developing economies **Hold The Catch-Up**, *The Economist*, September 13, 2014 and **The Headwinds Return**, *The Economist*, September 13, 2014.

Next we consider an across-country comparison of PPP adjusted per capita consumption (including both private and government). As described earlier, economists typically assume economic welfare is driven by consumption and leisure, not GDP.

From UChicagoNews, Sept 26, 2017 :
https://news.uchicago.edu/article/2017/09/12/researchers-find-sharp-decline-poverty-us-despite-census-report?utm_source=%2A+UChicago+News+-+All+Subscribers&utm_campaign=7b9ee844db-EMAIL_CAMPAIGN_2017_09_25&utm_medium=email&utm_term=0_4d15d79ba2-7b9ee844db-154056609

Researchers find sharp decline in poverty in U.S. despite census report

Consumption-based measure reveals more accurate picture of poverty

Contrary to numbers released by the U.S. Census Bureau on Sept. 12, researchers at the University of Chicago Harris School of Public Policy (https://harris.uchicago.edu/) and the University of Notre Dame find that poverty has fallen sharply in the U.S. in recent decades. The U.S. Census Bureau's annual income-based poverty report provides data that inform a range of policies and issues affecting Americans from taxes to immigration to trade policy.

This year's report estimates poverty in the U.S. to be 12.7 percent for 2016, which is very close to the rate in 1980, suggesting little progress or change in the fight against poverty.

Meyer and Sullivan analyzed more than 50 years of data from the Bureau of Labor Statistics' Consumer Expenditure Survey for their report. Looking at poverty patterns in the U.S. from the early 1960s to 2016, the researchers found contradictory results to studies that have shown little improvement in poverty over time or that antipoverty measures have been ineffective.

"Relying on the official poverty rate, many have concluded that we have lost the 'War on Poverty,' but improved measures of poverty show that we have actually made tremendous progress," Sullivan said.

The data below show that the distinction between GDP and consumption is an important one.

The table below uses data from the World Bank, in contrast to the data above which was from the IMF's World Economic Outlook (WEO). The reason for the switch is that the WEO database does not have the necessary consumption data.

The data in the table below show that some countries that appear rich in terms of high PPP adjusted per capita GDP (and presumably high per capita GNP) are not currently benefitting as much as one might expect in terms of having an equally high PPP adjusted per capita consumption. For example, in Singapore per capita GDP relative to the U.S. is significantly higher than per capita consumption relative to the U.S. (152% vs 85%); likewise for the United Arab Emirates (119% vs 81%), Saudi Arabia (95% vs 60%), Norway (124% vs 91%), Switzerland (107% vs 84%), and Ireland (86% vs 64%).

Exchange Rate	PPP	PPP
Year	2013	2013
Variable	Per Cap GDP % of U.S.	Per Cap Consumption % of U.S.
Europe		
Belgium*	78%	71%
Czech Republic	55%	45%
France*	71%	67%
Germany*	83%	74%
Greece*	48%	53%
Hungary	44%	38%
Ireland*	86%	64%
Italy*	66%	64%
Kazakhstan	44%	32%
Netherlands*	87%	74%
Norway	124%	91%
Poland	45%	43%
Portugal*	52%	53%
Romania	36%	33%
Russia	47%	41%
Spain*	62%	58%
Sweden	84%	73%
Switzerland	107%	84%
Turkey	35%	36%
Ukraine	16%	17%
United Kingdom	72%	73%

Source: World Bank
Notes: * indicates member of Euro zone

Exchange Rate	PPP	PPP
Year	2013	2013
Variable	Per Cap GDP % of U.S.	Per Cap Consumption % of U.S.
Americas/Carribean		
Canada	81%	75%
Mexico	31%	30%
United States	100%	100%
Dominican Republic	23%	23%
Haiti	3%	4%
Guatemala	14%	16%
Argentina	NA	NA
Bolivia	12%	11%
Brazil	30%	29%
Chile	41%	38%
Colombia	24%	22%
Ecuador	21%	18%
Peru	22%	19%
Venezuela	34%	32%

Source: World Bank

Exchange Rate	PPP	PPP
Year	2013	2013
Variable	Per Cap GDP % of U.S.	Per Cap Consumption % of U.S.
Oceania/Asia		
Australia	82%	71%
Papua New Guinea	5%	NA
New Zealand	66%	60%
Bangladesh	6%	5%
China	23%	14%
Hong Kong	101%	91%
India	10%	8%
Indonesia	19%	15%
Japan	68%	67%
Korea	62%	49%
Myanmar	NA	NA
Pakistan	9%	10%
Philippines	12%	13%
Singapore	152%	85%
Thailand	27%	22%
Vietnam	10%	9%

Source: World Bank

Exchange Rate	PPP	PPP
Year	2013	2013
Variable	Per Cap GDP % of U.S.	Per Cap Consumption % of U.S.
Middle East/Africa		
Iran	30%	NA
Iraq	30%	NA
Israel	61%	58%
Saudi Arabia	95%	60%
Syria	NA	NA
United Arab Emirates	119%	81%
Yemen	7%	NA
Dem Rep Congo	1%	1%
Egypt	20%	22%
Ethiopia	3%	3%
Kenya	5%	6%
Mozambique	2%	2%
Nigeria	11%	10%
South Africa	24%	23%
Tanzania	4%	5%
Uganda	3%	3%

Source: World Bank

For countries whose relative consumption is much lower than their relative GDP there are two possible interpretations.

First, a lot of the country's income (assuming away differences between GNP and GDP) is being spent on investment goods that do not directly increase well-being.

This can happen in a country with a very large, stable ratio of capital to labor, meaning depreciation of the capital stock is very large, and the economy must spend a large fraction of its income just to replace the capital that wore out in the production process.

It can also happen in a country that is rapidly building up its capital stock. If this build up is in productive capital, more output and higher consumption will be possible in the future. However, if this build up is unproductive capital then the higher investment is a waste.

Second, a country's consumption can be much lower than its GDP if it has a large positive net exports position. We will see later in these notes that in this case the country is saving a large portion of its income and this saving is being used to improve the country's net international asset position, i.e. buying assets in foreign countries or reducing liabilities to foreigners.

In the case of buying foreign assets, if these assets pay off then higher consumption in the future will be possible. However, if the assets don't pay off then buying them was a waste.

In the case of reducing foreign liabilities, the large positive net export position is paying for past consumption or for past investment.

Aside: A comparison of the PPP adjusted per capita GDP from the IMF's World Economic Outlook to the PPP adjusted per capita GDP from the World Bank reveals there can be noticeable differences. For example, for France PPP adjusted per capita GDP as a % of the U.S. using WEO data is 75% vs 71% using World Bank data. For Mexico the difference is 33% vs 31%.

The table on the following page investigates the sources of these differences. For GDP measured in local currency, there are 147 countries with data from both the WEO and World Bank. Although there are few counties for whom the two data sources differ considerably, for only 10% of the countries is the absolute value of the percentage difference between the WEO and World Bank data greater than 2% and the two measures have a correlation coefficient that is virtually indistinguishable from one. Although it is not shown in any of the tables presented in these notes, the countries with large disparities are typically small countries or countries where war /civil unrest make data collection difficult, e.g. WEO reports GDP in South Sudan to be 34.82 billion South Sudanese pounds whereas the World Bank reports it to be 44.59 billion South Sudanese pounds (a 22% difference) and WEO reports GDP in Panama to be 42.65 billion balboas whereas the World Bank reports it to be 40.39 billion balboas (a 6% difference).

The table also shows that the measures of actual exchange rates are in closer agreement than measures of PPP exchange rates, though even for the PPP exchange rates the two measures have a correlation coefficient of .98. It also shows significant differences between the two data sources in measures of population which result in per capita measures of GDP being more disparate than measures of total GDP.

Hopefully the table below (i) alerts you to the fact that economic data are estimates that can vary by source and (ii) convinces you that despite this variation economic data contains considerable information. Just because data is not exact does not mean that it is useless.

	COMPARISON OF WEO AND WORLD BANK DATA				
Year	2013				
Variable	GDP LOCAL CURRENCY	ACTUAL EXCHANGE RATE	GDP US$	PPP EXCHANGE RATE	GDP PPP$
Number of Countries	147	147	147	145	145
Minimum % Difference	-22%	-1%	-22%	-15%	-15%
Mean % Difference	0%	1%	1%	0%	0%
Median % Difference	0%	0%	0%	0%	0%
Maximum % Difference	6%	67%	70%	21%	15%
|% diff| > 2%	10%	3%	12%	25%	27%
Correlation Coefficient	0.9998	0.9903	1.0000	0.9832	0.9999
Year	2013				
Variable	POPULATION	PER CAPITA GDP LOCAL CURRENCY	PER CAPITA GDP US$	PER CAPITA GDP PPP$	
Number of Countries	186	146	146	144	
Minimum % Difference	-21%	-26%	-26%	-25%	
Mean % Difference	1%	-1%	0%	-1%	
Median % Difference	0%	0%	0%	0%	
Maximum % Difference	30%	10%	68%	18%	
|% diff| > 2%	38%	37%	38%	48%	
Correlation Coefficient	0.9999	0.9997	0.9990	0.9982	

This section concludes with the graphs on the following pages, which show what economic growth around the world has accomplished over the 30 year period from 1970 to 2000. The graphs are taken from *The World Distribution of Income: Falling Poverty…Convergence, Period* by Xavier Sala-i-Martin in the May 2006 Quarterly Journal of Economics. Data are PPP adjusted 1985 U.S. dollars. (The term 1985 dollars means that they have been adjusted for inflation. More on this later in these notes.) The term $3/day means $3 or less per day.

Clearly much progress has been made. And clearly Africa remains an enormous problem.

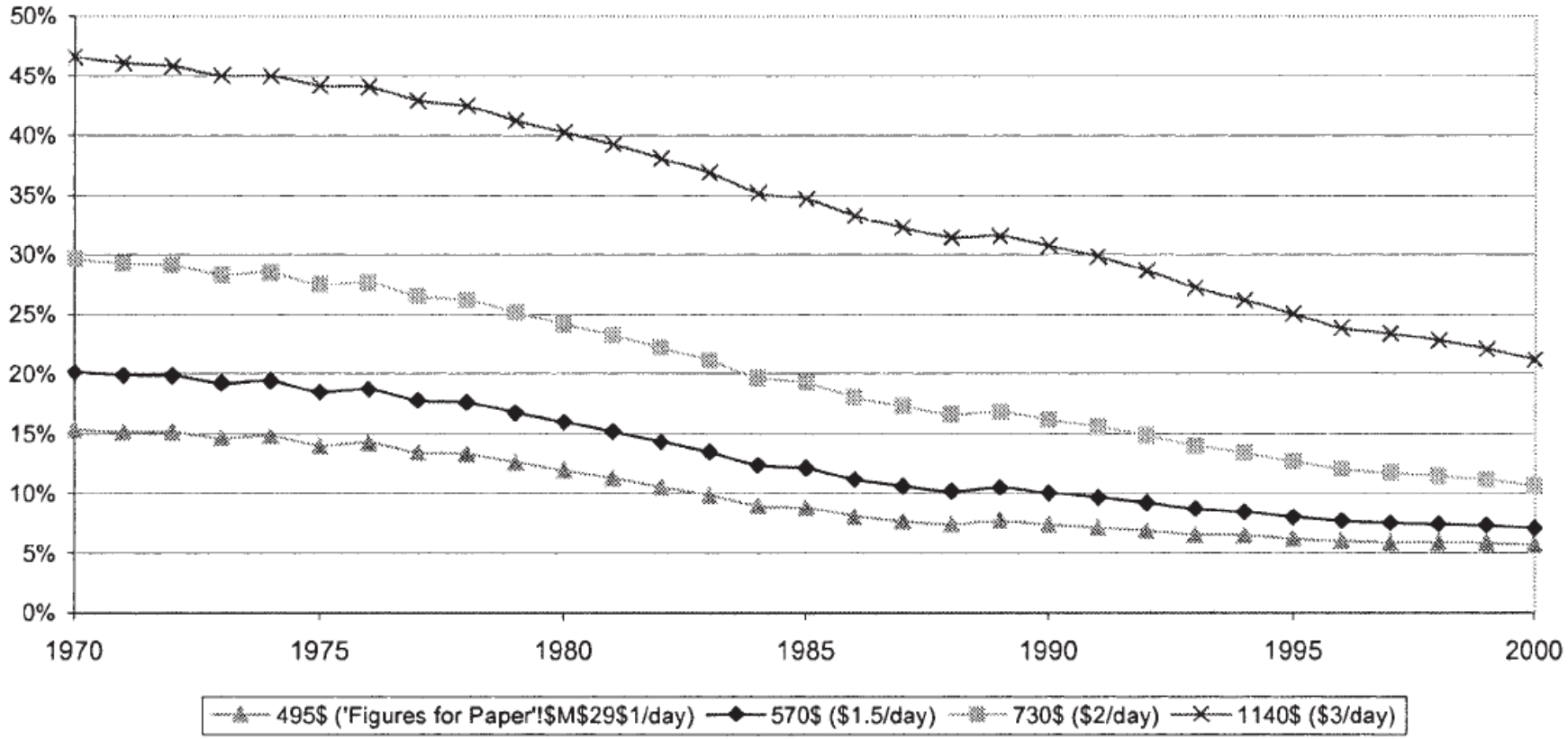


FIGURE VI
Poverty Rates

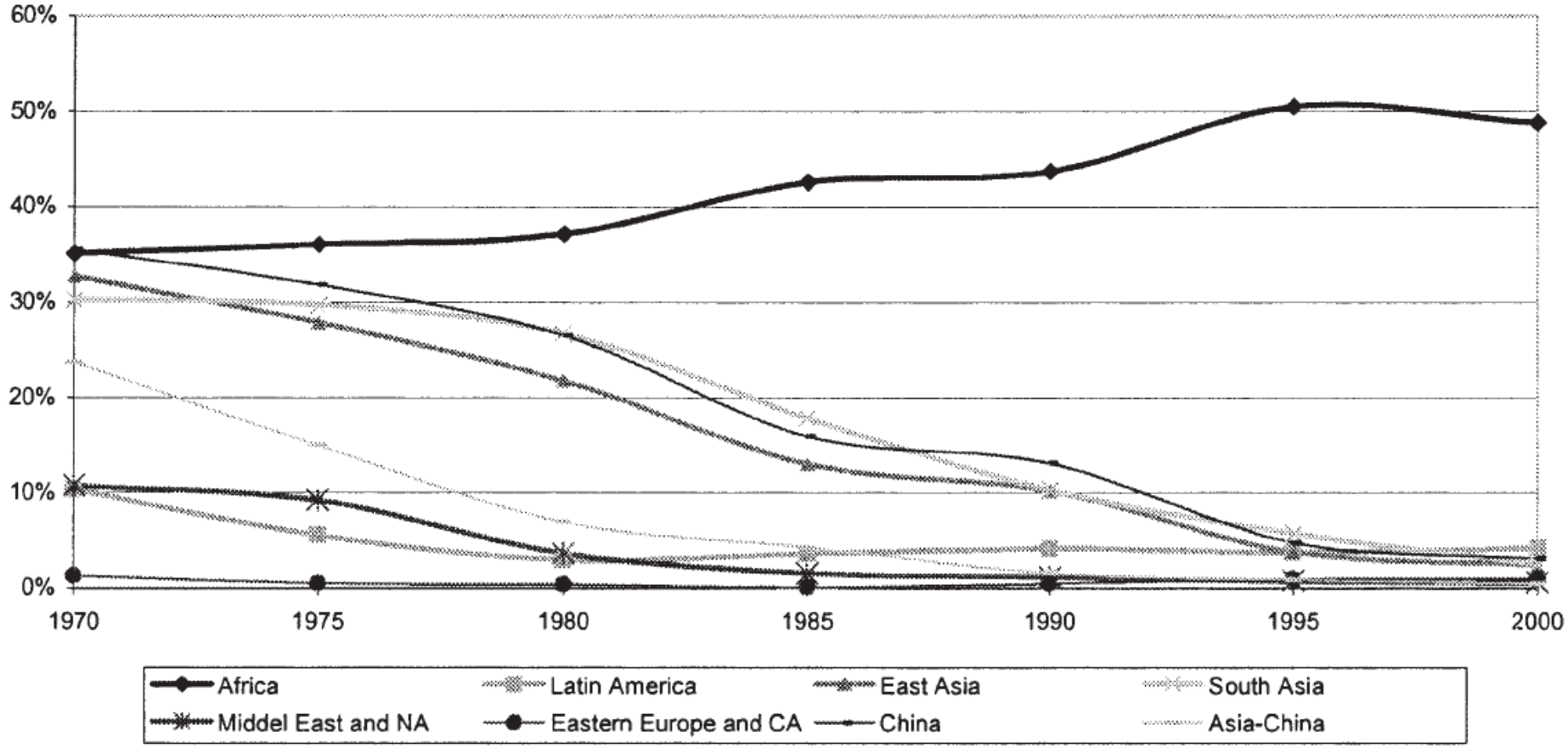


FIGURE VII
Regional Poverty Rates ($1.5 a Day Line)

I.6 Disposable Income, Saving and Government Budget Deficits

The presence of the government in an economy means that not all the income earned in a country will be available to the residents of that country to spend on consumption goods, spend on acquiring new capital or be saved.

The following notation will be used throughout these notes (and to keep things concise the term Government indicates the domestic government):

TRGP = Transfers by Government to Private Sector (including interest payments)

TRGF = Net Transfers by Government to Foreigners (including interest payments)

TRPF = Net Transfers by Private Sector to Foreigners

TA = Taxes paid by the Private Sector to the Government

G^C = Government Purchases of Consumption Goods

G^I = Government Purchases of Investment Goods

YD = Private Disposable Income

S^P = Private Savings

S^G = Government Savings

S^N = National Savings

BD = Government Budget Deficit

Along with the following definitions:

$G = G^C + G^I$

$YD = GNP + TRGP - TA$

$S^P = YD - C - TRPF$

$S^G = TA - G^C - TRGP - TRGF$

$BD = G + TRGP + TRGF - TA$

$S^N = S^P + S^G$

Note 1: Not all spending is subtracted from disposable income to get private saving. Only consumption spending and transfers are subtracted. Investment spending is not subtracted. Likewise for the definition of government saving.

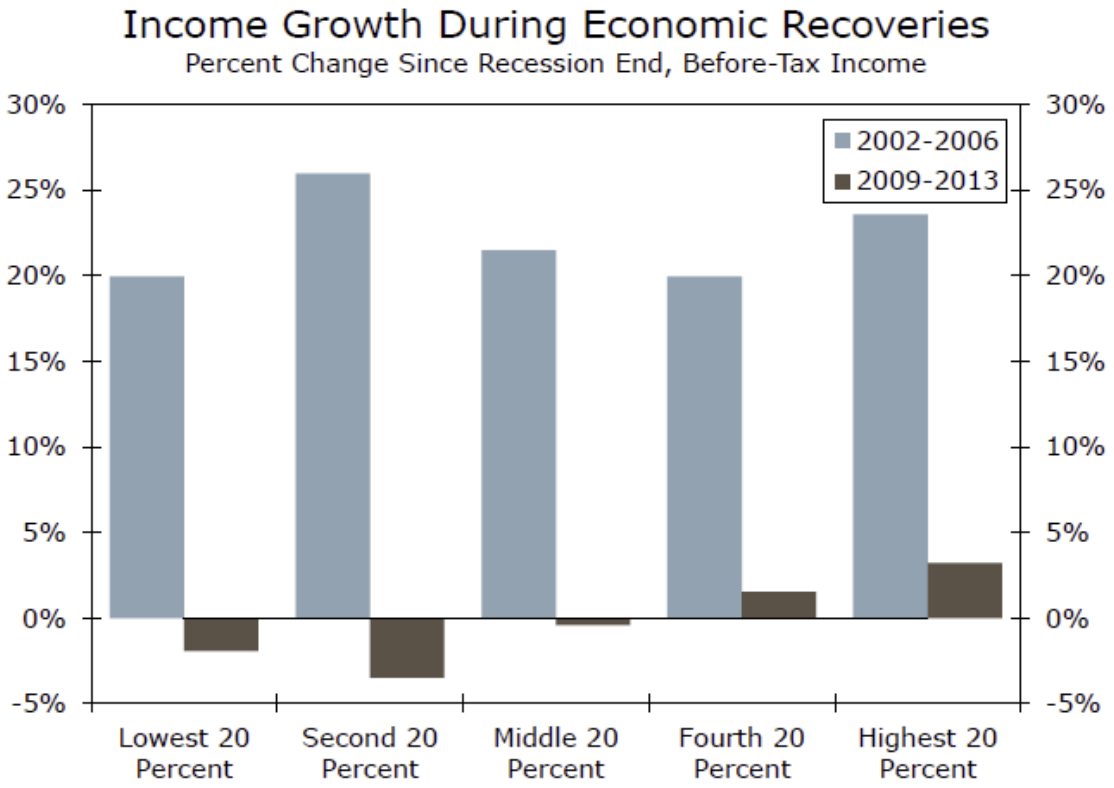
Note 2: Neither S^P nor S^G include capital gains and losses on existing assets.

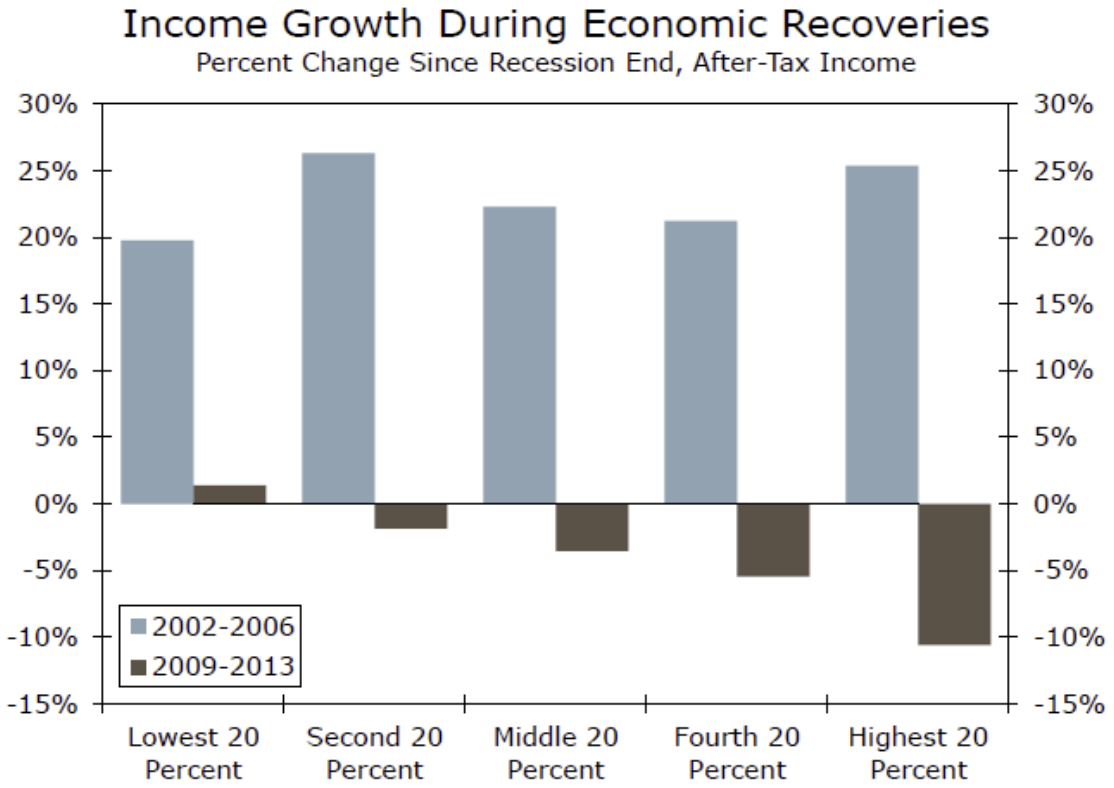
Note 3: If $G = G^C$ then $BD = -S^G$

Note 4: If the government earns profits from state-run enterprises those revenues should be added to S^G and subtracted from BD.

Note 5: The above definitions assume that the domestic private sector does not pay taxes to foreign governments and foreigners do not pay taxes to the domestic government.

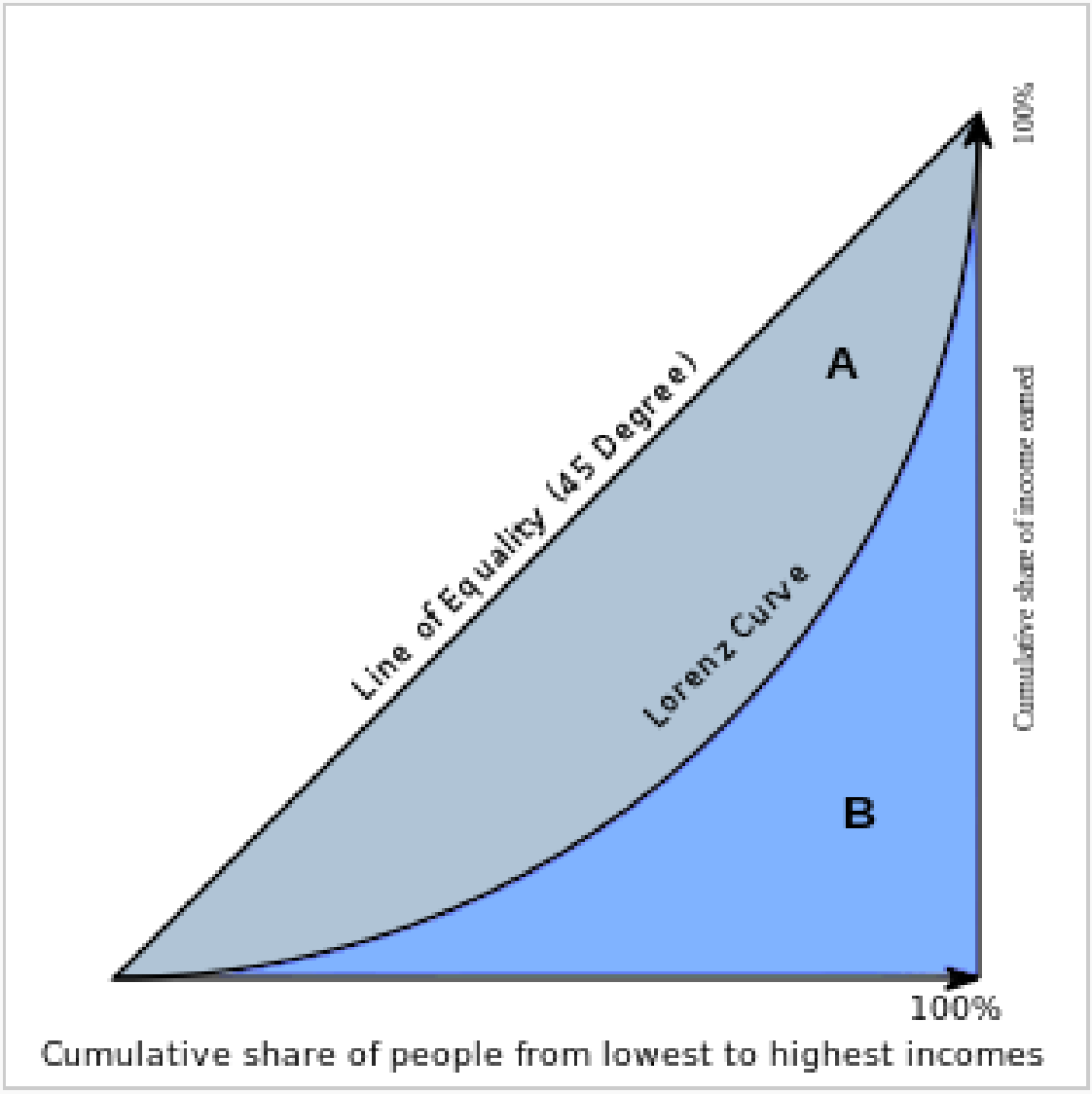
The following graphs (taken from John Silva and E. Nelson, “Income Growth: The Taxman Cometh”, Wells Fargo Economics Group, October 20, 2014) show the importance of distinguishing between before tax and after tax income.





The above graphs also touch on an important issue that will not be discussed much in this class: income distribution. For an interesting article on a perceived tension between income growth and income inequality see John Paul Rathbone and Santiago Benedict Mander, **Chile business sees 'ghost' of Allende in free market reforms,** *Financial Times,* December 8, 2014.

The graph below is taken from that article and shows a common tool for measuring inequality, the Gini coefficient. According to this measure, Brazil, Chile, Mexico, and Argentina all have more income inequality than the U.S., while Spain has less.



Graphical representation of the Gini coefficient

The graph shows that the Gini coefficient is equal to the area marked *A* divided by the sum of the areas marked *A* and *B*. that is, Gini = *A* / (*A* + *B*). It is also equal to 2**A* due to the fact that *A* + *B* = 0.5 (since the axes scale from 0 to 1).

For a recent interesting take on the world becoming more equal see Nicholas Eberstadt**, How the World is Becoming More Equal**, *The Wall Street Journal*, August 26, 2014.

Also, I highly encourage you to watch the video **Human Capital Investment, Inequality and Growth**, which is a talk Kevin Murphy (a Booth faculty member) gave to University alumni. You can find a link to the video on the class website; just click *Murphy on Inequality*.

And finally, you mish wish to look at two articles that touch on likely results of increased income inequality in China and in America – the revised popularity of Mao in China and Donald Trump in America. See Jamil Anderlini, **The Return of Mao**, *Financial Times*, October 1, 2016 and Martin Wolfe, **If trust crumbles, the west is lost**, *Financial Times*, September 28, 2106

Martin Wolfe is an intelligent writer for the FT, one worth reading on a regular basis.

Mao, through his promotion of the "Great Leap Forward", is responsible for the worst famine in human history, claiming between 40 and 70 million lives. He was also the architect of China's disastrous "Cultural Revolution."

Donald Trump is the most unqualified person to be elected president of the United States that I know of.

I.7 Flows & Stocks: Saving & Wealth, Deficits & Debt . . .

Income, saving, and government budget deficits are flows. They have to have units of time associated with them to be meaningful. For example, is a $1 income a high income or a low income? If it is $1 per year it is low. If it is $1 per millisecond it is high. Without a per unit measure of time we can't evaluate what a $1 income means.

Wealth and government debt are stocks, not flows. They have no units of time associated with them. If you have $1 million in wealth (stocks, bonds, real estate, etc.) there is no per unit measure of time needed to decide if that is a lot or a little. If you are $2 million in debt, there is no per unit measure of time needed to decide if that is a lot or a little.

Stocks and flows are related, but distinct concepts. Flows tell you how fast stocks are changing. Think of flows as measuring how fast water is coming out of the faucet and stocks as measuring how much water is in the bathtub. Saving (a flow) tells you how fast wealth (a stock) is changing, and a government deficit (a flow) tells you how fast government debt (a stock) is changing.

Although stocks and flows are related, they are distinct. Knowing saving doesn't tell you about the amount of wealth and knowing deficits doesn't tell you about the amount of debt. Saving can be high and wealth low (a poor country in the sense of having low wealth may be saving a lot of its income), or saving can be low and wealth high (a rich country in the sense of having high wealth may be saving very little of its income), or saving can be high and wealth high (a rich country in the sense of having high wealth may be saving almost all of its income).

Is the way private saving is measured in macroeconomics a good measure of the change in private wealth? The answer is no. That's because wealth can change due to saving or due to capitals gains and losses and capital gains and losses are not captured by the macroeconomic definition of saving. If the value of the stock market rises, people who own that stock become wealthier, but this is not captured as higher private saving according to the definition we use because there is no effect on GDP. In fact, we will see later in the course that higher wealth due to capital gains may actually cause private saving to fall because higher wealth will likely raise consumption relative to disposable income.

Two other cautionary notes:

First, many countries measure "personal" or "household" saving in addition to private saving. The relationship between these measures is:

private savings = personal/household savings + business savings

That is, the private sector is comprised of households and businesses, both of whom can save. Businesses save via retained earnings.

Don't confuse personal/household savings with private savings. There are often big movements in business savings that can make private savings move in a different direction than personal/household savings.

Second, savings measures can either be reported in gross or net terms. Net saving means an estimate of the depreciation of a country's physical capital stock has been subtracted from the definition of gross saving given above.

The data in the next table, from the April 2017 issue of the IMF's World Economic Outlook, show what has been happening with government budgets. A negative value for the budget means a deficit and a positive value means a surplus.

Columns 2 through 4 of the table display government budget data for 2007 (before the financial crisis and worldwide recession), 2010 (during the financial crisis and worldwide recession) and 2015 (the most recent data available). Interestingly, Greece's government budget deficit in 2010 (11.2% of GDP) was not noticeably larger than the government budget deficit in the United States (10.9% of GDP) or the United Kingdom (9.5% of GDP). Meanwhile, Italy's budget deficit (4.2% of GDP) was less than half the U.K.'s. With Greece and Italy having fiscal crises around this time and the U.S. and U.K. not having such crises, this points out that a fiscal crisis involves more than just the standard measure of a budget deficit.

Columns 5 and 6 of the table display primary government budget data for 2010 and 2015. The primary government budget removes interest payments from the standard government budget.

Note that interest paid on Greek government debt in 2010 was 5.9% of GDP (11.2% government budget deficit minus a 5.3% primary government budget deficit), and interest on Italian government debt was 4.1% of GDP. In contrast, interest paid on U.S. government debt was 2.0% of GDP and interest paid on British government debt was 2.5% of GDP. It appears high interest rates on government debt and/or large amounts of government debt, the two

ways that interest payments on government debt can be large, are somehow connected to fiscal crises.

Column 7 of the table displays structural government budget data. The structural government budget measures (is an estimate of) what the government budget would be if the economy was operating at sustainable full capacity. In 2015 Greece had a budget deficit of 3.4% of GDP, which was larger than Italy's deficit of 2.7% However, if both these economies were operating at sustainable full capacity (generating more tax revenues and providing less government assistance) then the budget in Greece would have a smaller deficit than Italy, 0.8% vs. 0.9%.

If Greece, France, Germany, Italy, the U.S. and the U.K. were all operating at sustainable full capacity in 2015 then (i) only Germany would have had a government budget surplus (0.7% of GDP); and (ii) Greece would have had a smaller government budget deficit than all the remaining countries (0.8% of GDP vs. 0.9% in Italy, 2.0% in France, 3.4% in the U.S. and 4.1% in the U.K.)

The massive deterioration in the Norwegian government budget between the actual and structural budgets in 2015 is puzzling. It is not plausible that the Norwegian economy is so far above sustainable full-capacity. A similar relationship between actual and structural government budgets in 2015 exists in Japan, although the magnitude is much smaller.

Variable	Govt Budget % GDP	Govt Budget % GDP	Govt Budget % GDP	Primary Govt Budget % GDP	Primary Govt Budget % GDP	Structural Govt Budget % GDP
Year	**2007**	**2010**	**2015**	**2010**	**2015**	**2015**
Europe						
Belgium*	0.1	-4.0	-2.5	-0.7	0.1	-2.2
Czech Republic	-0.7	-4.4	-0.6	-3.3	0.3	-0.6
France*	-2.5	-6.8	-3.5	-4.5	-1.6	-2.0
Germany*	0.2	-4.2	0.7	-2.1	1.9	0.7
Greece*	-6.7	-11.2	-3.4	-5.3	0.2	-0.8
Hungary	-5.1	-4.5	-2.0	-0.7	1.4	-1.7
Ireland*	0.3	-32.1	-1.9	-29.8	0.5	-1.1
Italy*	-1.5	-4.2	-2.7	-0.1	1.3	-0.9
Kazakhstan	5.1	1.5	-6.3	1.8	-5.9	-6.7
Netherlands*	0.2	-5.0	-1.9	-3.8	-0.9	-1.3
Norway	17.0	10.9	5.7	8.8	3.2	-6.7
Poland	-1.9	-7.3	-2.6	-4.9	-0.8	-2.6
Portugal*	-3.0	-11.2	-4.4	-8.5	-0.1	-1.0
Romania	-3.1	-6.3	-1.5	-5.0	-0.2	-0.5
Russia	5.6	-3.2	-3.4	-3.1	-3.1	-2.4
Spain*	2.0	-9.4	-5.1	-7.8	-2.4	-2.3
Sweden	3.3	-0.1	0.2	0.3	0.0	-0.1
Switzerland	1.6	0.3	0.0	0.8	0.3	0.3
Turkey	-1.9	-2.8	-1.2	0.7	0.6	-2.2
Ukraine	-1.9	-5.8	-1.2	-4.1	3.0	-0.5
United Kingdom	-2.7	-9.5	-4.4	-7.0	-2.9	-4.1

Source: April 2017 IMF World Economic Outlook

Variable	Govt Budget % GDP	Govt Budget % GDP	Govt Budget % GDP	Primary Govt Budget % GDP	Primary Govt Budget % GDP	Structural Govt Budget % GDP
Year	**2007**	**2010**	**2015**	**2010**	**2015**	**2015**
Americas/Carribean						
Canada	1.8	-4.7	-1.1	-3.9	-0.5	-0.7
Mexico	-1.2	-3.9	-4.0	-1.4	-1.1	-4.6
United States	-2.9	-10.9	-3.5	-8.9	-1.6	-3.4
Cuba	NA	NA	NA	NA	NA	NA
Dominican Republic	0.1	-2.7	-0.2	-0.9	2.4	-3.3
Haiti	-2.5	-2.7	-2.5	-2.2	-2.2	NA
Guatemala	-1.4	-3.3	-1.4	-1.8	0.1	NA
Argentina	-0.1	-1.3	-5.6	-0.4	-4.4	-7.0
Bolivia	1.7	1.7	-6.9	3.1	-5.9	NA
Brazil	-2.7	-2.7	-10.3	2.3	-1.9	-9.7
Chile	7.9	-0.4	-2.1	-0.3	-1.9	-2.0
Colombia	-0.8	-3.3	-3.5	-1.6	-0.7	-3.5
Ecuador	2.6	-1.4	-5.2	-0.8	-3.9	-4.5
Peru	3.3	0.1	-2.2	1.2	-1.3	-1.7
Venezuela	-2.8	-10.4	-17.6	-8.6	-15.9	NA

Source: April 2017 IMF World Economic Outlook
Notes: NA indicates Not Available

Variable	Govt Budget % GDP	Govt Budget % GDP	Govt Budget % GDP	Primary Govt Budget % GDP	Primary Govt Budget % GDP	Structural Govt Budget % GDP
Year	**2007**	**2010**	**2015**	**2010**	**2015**	**2015**
Oceania/Asia						
Australia	1.5	-5.1	-2.7	-4.8	-1.7	-2.1
New Guinea	7.0	3.1	-5.1	4.0	-3.3	NA
New Zealand	3.2	-5.9	0.6	-5.4	1.1	0.7
Bangladesh	-2.2	-2.7	-3.9	-0.8	-1.8	NA
China	0.1	-0.4	-2.8	0.1	-2.2	-2.5
Hong Kong	7.3	4.1	0.6	2.3	0.6	0.0
India	-4.5	-8.6	-7.1	-4.4	-2.5	-7.0
Indonesia	-0.9	-1.2	-2.5	0.0	-1.1	-2.5
Japan	-2.8	-9.1	-3.5	-8.6	-3.1	-3.9
Korea	2.2	1.5	0.3	0.8	-0.4	0.6
Myanmar	-3.1	-5.5	-4.4	-4.6	-3.3	NA
Pakistan	-5.1	-6.0	-5.2	-1.7	-0.5	NA
Philippines	-0.3	-2.4	0.6	0.7	2.7	0.7
Singapore	10.1	6.0	3.7	5.4	2.9	3.8
Thailand	0.2	-1.3	0.1	-0.7	0.7	0.5
Vietnam	-2.0	-2.8	-6.2	-1.6	-4.2	NA

Source: April 2017 IMF World Economic Outlook
Notes: NA indicates Not Available

Variable	Govt Budget % GDP	Govt Budget % GDP	Govt Budget % GDP	Primary Govt Budget % GDP	Primary Govt Budget % GDP	Structural Govt Budget % GDP
Year	**2007**	**2010**	**2015**	**2010**	**2015**	**2015**
Middle East/Africa						
Iran	6.7	2.8	-1.8	2.7	-1.7	NA
Iraq	7.8	-4.2	-12.3	-3.7	-11.7	NA
Israel	-0.6	-4.1	-2.7	-0.3	-0.1	-2.5
Saudi Arabia	11.8	3.6	-15.8	4.0	-17.8	NA
Syria	-3.0	-7.8	NA	-7.3	NA	NA
United Arab Emirates	21.8	2.0	-2.1	2.3	-1.9	NA
Yemen	-7.2	-4.1	-10.6	-1.7	-3.1	NA
Dem Rep Congo	0.4	2.4	-0.1	2.7	0.2	NA
Egypt	-7.2	-7.9	-11.4	-3.6	-4.7	-11.2
Ethiopia	-3.6	-1.3	-1.9	-0.9	-1.5	NA
Kenya	-2.4	-4.4	-8.2	-2.5	-5.3	NA
Mozambique	-2.5	-3.8	-7.4	-3.1	-6.1	NA
Nigeria	-1.1	-4.2	-3.5	-3.6	-2.4	NA
South Africa	1.3	-4.7	-3.6	-2.1	-0.3	-2.8
Tanzania	-1.5	-4.8	-3.3	-4.1	-1.8	NA
Uganda	-1.1	-5.7	-2.7	-4.8	-1.0	NA

Source: April 2017 IMF World Economic Outlook
Notes: NA indicates Not Available

The next table shows data (also from the April 2017 of the IMF's World Economic Outlook) on government deficits alongside data on government debt.

Gross debt is all debt issued.

Net debt is debt that is not held by government and quasi-government agencies. In many countries, a major part of the difference between gross and net debt is debt held by the central bank, though in some countries there are other government or quasi-government agencies that hold government debt.

The U.S. is a good illustration of the following general principle: It is hard to know exactly how much liability is involved with government debt. Clearly net debt is a liability, while some, but likely not all, gross debt is a liability.

Details: In the U.S., the Social Security Trust Fund is another example, in addition to the Fed, of a government entity owning federal government debt. When the U.S. Treasury pays the Fed interest, the Fed returns most of it. (The Fed uses some of the interest to cover its operating budget, making it financially independent of Congress.) On the other hand, when the U.S. Treasury pays the Social Security Trust Fund interest, the Social Security Trust Fund does not return the interest; the interest is needed to pay Social Security's obligations to older Americans.

Greece, Italy, and Portugal show up as countries with debt problems, both in 2010 and in 2015. Italy and Portugal have net debt to GDP ratios over 100% of GDP in 2015 (net debt is not available for Greece), and all three countries have ratios for gross debt to GDP above 100%.

Germany is one of the few countries to reduce it net government debt to GDP % since the end of the fiscal crisis; down from 57.0% to 47.8%.

Consistent with the previous results, high debt seems to be connected somehow to fiscal crises. However, Japan had the highest gross debt to GDP ratio in the world in both 2010 (215.9%) and 2016 (238.0%). And in 2016 it has a net debt to GDP ratio (118.5%) that is close to Italy's (112.5%) and Portugal's (121.6%). Is Japan next for a fiscal crisis? Some people think so.

Note, in several countries (such as Norway, Saudi Arabia and the United Arab Emirates) the government is actually a net creditor not a net debtor. This is true for the state of Alaska in the United States. These governments put aside a fraction of their oil revenues to build up a national / state trust.

In Sweden and Chile, the governments are net creditors without (so far as I know) having significant oil revenues.

Variable	Govt Budget % GDP	Govt Budget % GDP	Gross Govt Debt % GDP	Gross Govt Debt % GDP	Net Govt Debt % GDP	Net Govt Debt % GDP
Year	**2010**	**2015**	**2010**	**2015**	**2010**	**2015**
Europe						
Belgium*	-4.0	-2.5	99.7	105.8	59.6	61.1
Czech Republic	-4.4	-0.6	38.2	40.3	NA	NA
France*	-6.8	-3.5	81.6	96.2	74.0	87.4
Germany*	-4.2	0.7	81.0	71.2	57.0	47.8
Greece*	-11.2	-3.4	146.3	179.4	NA	NA
Hungary	-4.5	-2.0	80.5	74.7	75.1	70.8
Ireland*	-32.1	-1.9	86.3	78.7	74.6	71.8
Italy*	-4.2	-2.7	115.4	132.0	98.4	112.5
Kazakhstan	1.5	-6.3	10.7	21.9	-10.2	-30.9
Netherlands*	-5.0	-1.9	59.3	65.1	23.7	34.4
Norway	10.9	5.7	42.4	33.2	-170.1	-282.8
Poland	-7.3	-2.6	53.1	51.1	15.2	15.9
Portugal*	-11.2	-4.4	96.2	129.0	91.6	121.6
Romania	-6.3	-1.5	30.5	39.4	NA	NA
Russia	-3.2	-3.4	10.6	15.9	NA	NA
Spain*	-9.4	-5.1	60.1	99.8	42.3	80.2
Sweden	-0.1	0.2	37.6	42.9	-17.1	-19.4
Switzerland	0.3	0.0	46.1	45.8	26.4	24.7
Turkey	-2.8	-1.2	40.1	27.6	32.9	20.3
Ukraine	-5.8	-1.2	40.6	79.3	NA	49.8
United Kingdom	-9.5	-4.4	76.0	89.0	68.7	80.4

Source: April 2017 IMF World Economic Outlook

Variable	Govt Budget % GDP	Govt Budget % GDP	Gross Govt Debt % GDP	Gross Govt Debt % GDP	Net Govt Debt % GDP	Net Govt Debt % GDP
Year	**2010**	**2015**	**2010**	**2015**	**2010**	**2015**
Americas/Carribean						
Canada	-4.7	-1.1	81.1	91.6	26.8	25.2
Mexico	-3.9	-4.0	42.2	53.7	36.2	47.3
United States	-10.9	-3.5	95.7	105.6	70.4	80.5
Cuba	NA	NA	NA	NA	NA	NA
Dominican Republic	-2.7	-0.2	23.7	33.0	23.7	33.0
Haiti	-2.7	-2.5	17.3	30.2	NA	NA
Guatemala	-3.3	-1.4	24.1	24.2	NA	NA
Argentina	-1.3	-5.6	42.6	52.0	NA	NA
Bolivia	1.7	-6.9	38.5	40.6	17.7	24.0
Brazil	-2.7	-10.3	63.0	72.5	38.0	35.6
Chile	-0.4	-2.1	8.6	17.4	-7.0	-3.5
Colombia	-3.3	-3.5	36.4	50.7	28.4	42.3
Ecuador	-1.4	-5.2	13.3	22.6	NA	NA
Peru	0.1	-2.2	25.5	24.0	10.3	5.6
Venezuela	-10.4	-17.6	36.5	32.1	NA	NA

Source: April 2017 IMF World Economic Outlook
Notes: NA indicates Not Available

Variable	Govt Budget % GDP	Govt Budget % GDP	Gross Govt Debt % GDP	Gross Govt Debt % GDP	Net Govt Debt % GDP	Net Govt Debt % GDP
Year	**2010**	**2015**	**2010**	**2015**	**2010**	**2015**
Oceania/Asia						
Australia	-5.1	-2.7	20.5	37.6	3.9	17.8
New Guinea	3.1	-5.1	17.3	30.4	NA	NA
New Zealand	-5.9	0.6	26.0	29.6	2.5	6.4
Bangladesh	-2.7	-3.9	36.6	33.9	NA	NA
China	-0.4	-2.8	33.7	42.6	NA	NA
Hong Kong	4.1	0.6	0.6	0.1	NA	NA
India	-8.6	-7.1	67.5	69.6	NA	NA
Indonesia	-1.2	-2.5	24.5	26.9	NA	NA
Japan	-9.1	-3.5	215.9	238.0	106.2	118.4
Korea	1.5	0.3	30.8	37.8	28.9	35.6
Myanmar	-5.5	-4.4	49.6	34.9	NA	NA
Pakistan	-6.0	-5.2	60.7	63.6	52.0	57.0
Philippines	-2.4	0.6	43.5	36.3	NA	NA
Singapore	6.0	3.7	97.0	103.2	NA	NA
Thailand	-1.3	0.1	39.8	42.7	NA	NA
Vietnam	-2.8	-6.2	48.1	58.3	NA	NA

Source: April 2017 IMF World Economic Outlook
Notes: NA indicates Not Available

Variable	Govt Budget % GDP	Govt Budget % GDP	Gross Govt Debt % GDP	Gross Govt Debt % GDP	Net Govt Debt % GDP	Net Govt Debt % GDP
Year	**2010**	**2015**	**2010**	**2015**	**2010**	**2015**
Middle East/Africa						
Iran	2.8	-1.8	12.2	42.4	2.0	25.6
Iraq	-4.2	-12.3	53.5	55.0	NA	NA
Israel	-4.1	-2.7	70.7	64.1	64.1	60.9
Saudi Arabia	3.6	-15.8	8.4	5.0	-37.8	-38.0
Syria	-7.8	NA	30.0	NA	18.8	NA
United Arab Emirates	2.0	-2.1	22.2	18.1	-227.9	-243.6
Yemen	-4.1	-10.6	42.4	66.7	38.3	65.6
Dem Rep Congo	2.4	-0.1	31.9	18.8	NA	NA
Egypt	-7.9	-11.4	69.6	88.5	57.1	78.8
Ethiopia	-1.3	-1.9	40.5	54.6	35.5	49.1
Kenya	-4.4	-8.2	44.4	52.4	40.2	47.2
Mozambique	-3.8	-7.4	43.3	88.1	NA	NA
Nigeria	-4.2	-3.5	9.6	12.1	8.9	11.3
South Africa	-4.7	-3.6	34.7	49.8	28.5	43.6
Tanzania	-4.8	-3.3	27.3	36.9	NA	NA
Uganda	-5.7	-2.7	22.4	33.2	NA	NA

Source: April 2017 IMF World Economic Outlook
Notes: NA indicates Not Available

I.8 The Government Debt to GNP Ratio

There has been a lot of attention to fiscal crises around the world lately. In the discussion of the data in the previous section it was suggested that identifying fiscal crises solely with budget deficits or solely with a high debt to GNP ratio is not very accurate. Which raises the following question: Is there a better way to identify fiscal crises?

The most popular answer to this question among economists is yes, fiscal crises are about investors losing confidence that a country has the financial ability and/or the political will to repay their debt, either now or in the foreseeable future. Furthermore, as is common in financial markets, because investors are forward looking, a country which is able and willing to repay its debt today but is not expected to be able or willing to repay its debt tomorrow will have a crisis today because investors will take action today; thus, there are advantages to governments acting now and avoiding the future problems.

Even though GNP is not a perfect measure of a country's ability and willingness to pay, it certainly is an important part of the analysis. High GNP generally means a larger tax base that can be tapped to repay the debt; and higher GNP may also be associated with ability and willingness to pay because higher income may mean people are more willing and able to pay higher tax rates.

Given the above, it is not surprising economists find it valuable to have a formula that describes how a country's debt to GNP ratio changes over time. Here it is (a similar equation applies with GDP replacing GNP):

Δ (Debt/GNP) = Primary Deficit/GNP + (Debt/GNP) * (interest rate on debt – %ΔGNP)

Several important points flow from this key equation.

Point 1: This key equation makes clear that if a country allows its debt to GNP ratio to get too high then it can get caught in a vicious cycle. Once the debt to GNP ratio gets high enough that creditors worry about getting paid back, they will demand a higher interest rate. Assuming the debt needs to be rolled over, this will push up the interest rate paid on the debt, which then will increase the debt to GNP ratio, which then creates more default risk, which then increases the interest rate further, and the cycle repeats.

To avoid getting caught in such a vicious cycle a country should keep its debt to GNP ratio at a "sufficiently low level". This level is, of course, not knowable with certainty and no doubt varies by country. What is known, is that investor confidence can move very quickly in a short period of time, so long-term debt and a safe cushion on the debt to GNP ratio are helpful.

Point 2: This key equation also makes clear that, in some circumstances, once a fiscal crisis starts merely altering the primary budget may be insufficient for stopping the rise in the debt to GNP ratio and ending the crisis.

This can be seen by computing what it takes for the debt to GNP ratio in an economy to remain unchanged, i.e. determining the "break-even" primary government budget. Setting Δ (Debt/GNP) = 0 in the key equation above and solving for Primary Deficit/GNP yields

Break-even Primary Deficit/GNP = (Debt/GNP) * (%ΔGNP – interest rate on debt)

Examination of this equation reveals that for a country with a high debt to GNP ratio, where fear of default has pushed the interest rate on the debt sufficiently above the growth rate of the economy, the break-even primary deficit could be a very large negative ratio, i.e. to keep the debt to GNP ratio from rising requires an enormously large primary budget surplus. In fact, the break-even budget surplus could be so large as to be impossible in practice. In such a situation stopping the fiscal crisis will need to involve (i) defaulting on the debt (i.e. reduce the debt to GNP ratio), (ii) getting the economy growing, (iii) getting a guarantor for the debt to bring down the interest rate or (iv) reducing the interest rate by issuing new, low interest rate debt to a "bailout" organization that can be used to pay off the existing high interest rate debt.

Most economists who look at fiscal crises in the way described in this section felt that when the Greek fiscal crisis hit, despite the continual focus of Germany on reducing the Greek primary budget deficit, this action alone would be insufficient to solve the problem. One of the following was also essential: interest rate reduction via the EU acting as a guarantor of Greek debt (highly unlikely); interest rate reduction through issuing new low interest rate debt to the IMF, EU or ECB; or debt reduction via default.

Point 3: For many economists, responsible tax and spending policy, i.e. responsible fiscal policy, does not consist of always running a balanced budget. Rather, responsible fiscal policy consists of (i) selecting a "safe and appropriate" value for the debt to GNP ratio; and (ii) choosing a time path of primary budgets that, along with reasonable forecasts of future growth rates of GNP and interest rates on government debt, put the debt to GNP ratio on a path that converges over time to that "safe and appropriate" level.

A "safe" level of the debt to GNP ratio is one that is low enough to convince investors that debt could be repaid if need be, even after allowing for the possibility that the country may need to handle unexpected emergencies in the future. Put another way, the debt to GNP ratio is safe if it is low enough to avoid getting caught in the vicious cycle described in Point 1 above.

An “appropriate” level of the debt to GNP ratio is one that reflects the value of the government spending that it allows, the efficiency of the country’s tax collection system and other relevant factors.

For economists who think in these terms, the key equation above that describes what causes changes in the debt to GNP ratio is the standard way to forecast the future time path of this critical ratio and thereby determine if a country’s fiscal policy is responsible.

To illustrate how this works, consider the following simple case: Going forward, the %ΔGNP, denoted g, and the interest rate on government debt, denoted i, are constant with $g > i$.

In this situation a country can pick a fixed primary deficit as a % of GNP and over time, regardless of the current debt to GNP ratio, the debt to GNP ratio will converge to a unique level defined by:

Steady State (Debt/GNP) = (Primary Deficit/GNP) / (%ΔGNP - interest rate on debt)

(This equation can be derived by setting Δ (Debt/GNP) = 0 in the key equation above and solving for Debt/GNP.)

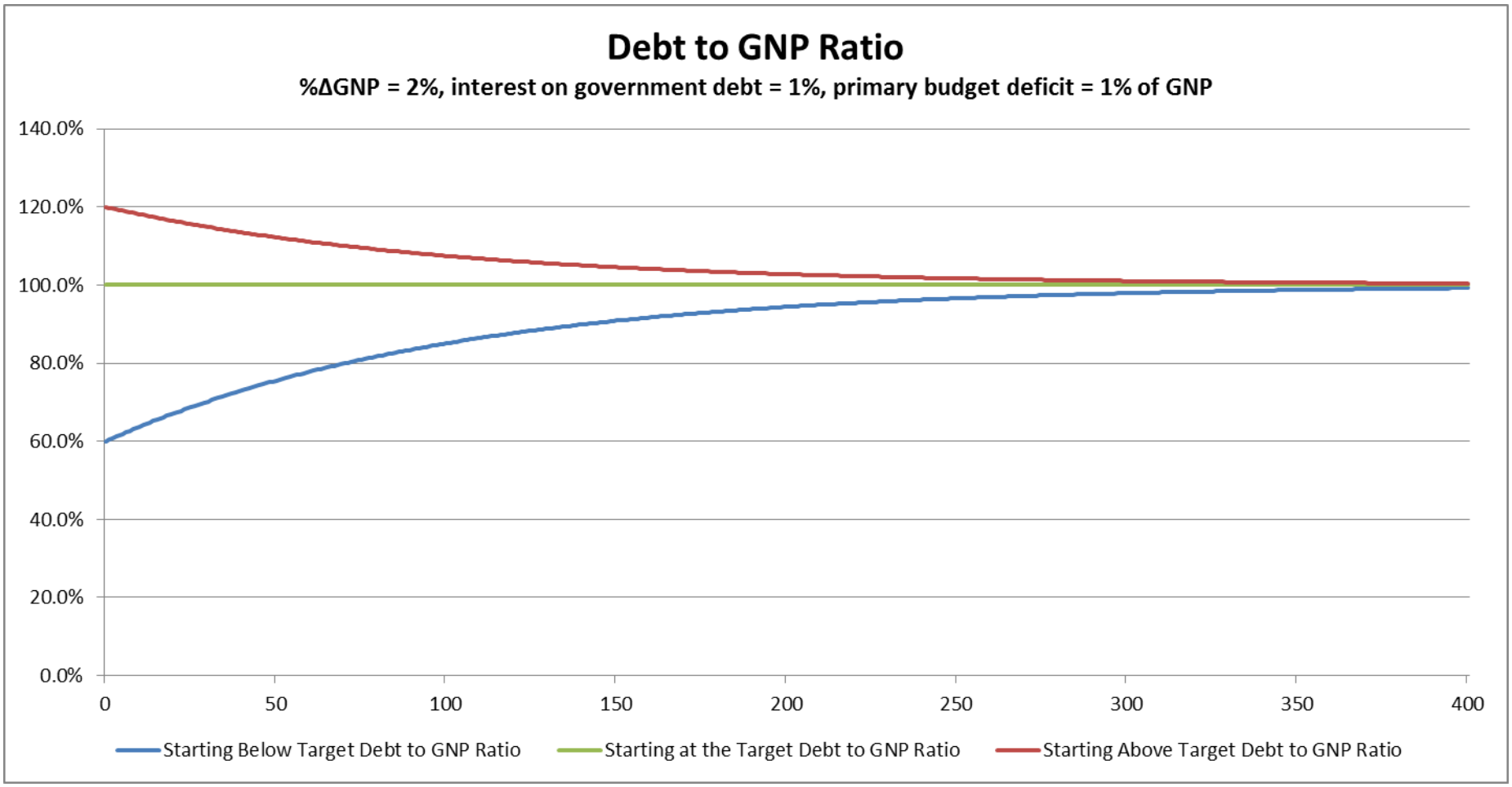
Next, pick some numerical values. Specifically, assume g = 2.0%, i = 1.0% and that a country has a “target” debt to GNP ratio of 100% (i.e. if the debt to GNP ratio is at 100%, the country will be able to pay off the debt if need be, even after allowing for the possibility of unexpected emergencies in the future).

Plugging these numerical values into the above equation gives

100% = (Primary Deficit/GNP) / (2% - 1%) => Primary Deficit/GNP = 1%.

What happens when the government runs a primary deficit that is 1% of GNP forever? The answer is graphed on the following page. (Note: The spreadsheet used to create this graph, and thus the spreadsheet showing the application of the equations in this section to this numerical example, is available on the class website. The spreadsheet is entitled “Debt – GNP calcs” and can be found by clicking on the link for Section I.)

The red line shows that if the country starts with a debt to GNP ratio of 120%, over time that ratio will gradually decline to the target level of 100%. The use of the term gradual is important here. After 100 periods the ratio will have declined to only 107%. The blue line shows that if the country starts with a debt to GNP ratio of 60%, over time that ratio will gradually increase to the target level of 100%. After 100 periods the ratio will have increased to only 85%. The green line shows that if the country starts with a debt to GNP ratio of 100%, that debt to GNP ratio will never change.


Debt to GNP Ratio
%ΔGNP = 2%, interest on government debt = 1%, primary budget deficit = 1% of GNP
140.0%
120.0%
100.0%
80.0%
60.0%
40.0%
20.0%
0.0%
0
50
100
150
200
250
300
350
400
Starting Below Target Debt to GNP Ratio
Starting at the Target Debt to GNP Ratio
Starting Above Target Debt to GNP Ratio

In this instance, where g > i, a country can have responsible fiscal policy and perpetually run both a primary budget deficit (1% of GNP) and a total budget deficit (2% of GNP = 1% of GNP primary deficit + 1% interest on a debt of 100% of GNP). High economic growth, in particular growth that exceeds the interest rate on the government debt, makes things easy for a government.

What happens when g < i? Things change in two important ways.

This can be illustrated by choosing the following numerical values: g = 0.0%, i = 1.0% and the country has a "target" debt to GNP ratio of 100%. So, the only change from above is that economic growth has been reduced from 2% to 0%.

The first important change, which follows from the above equation for Steady State (Debt/GNP), is that a stable debt to GNP ratio will require a primary budget surplus instead of a primary budget deficit. To see this note that plugging in the new numerical values yields

100% = (Primary Deficit/GNP) / (0% - 1%) => Primary Deficit/GNP = -1%
=> Primary Surplus/GNP = 1%.

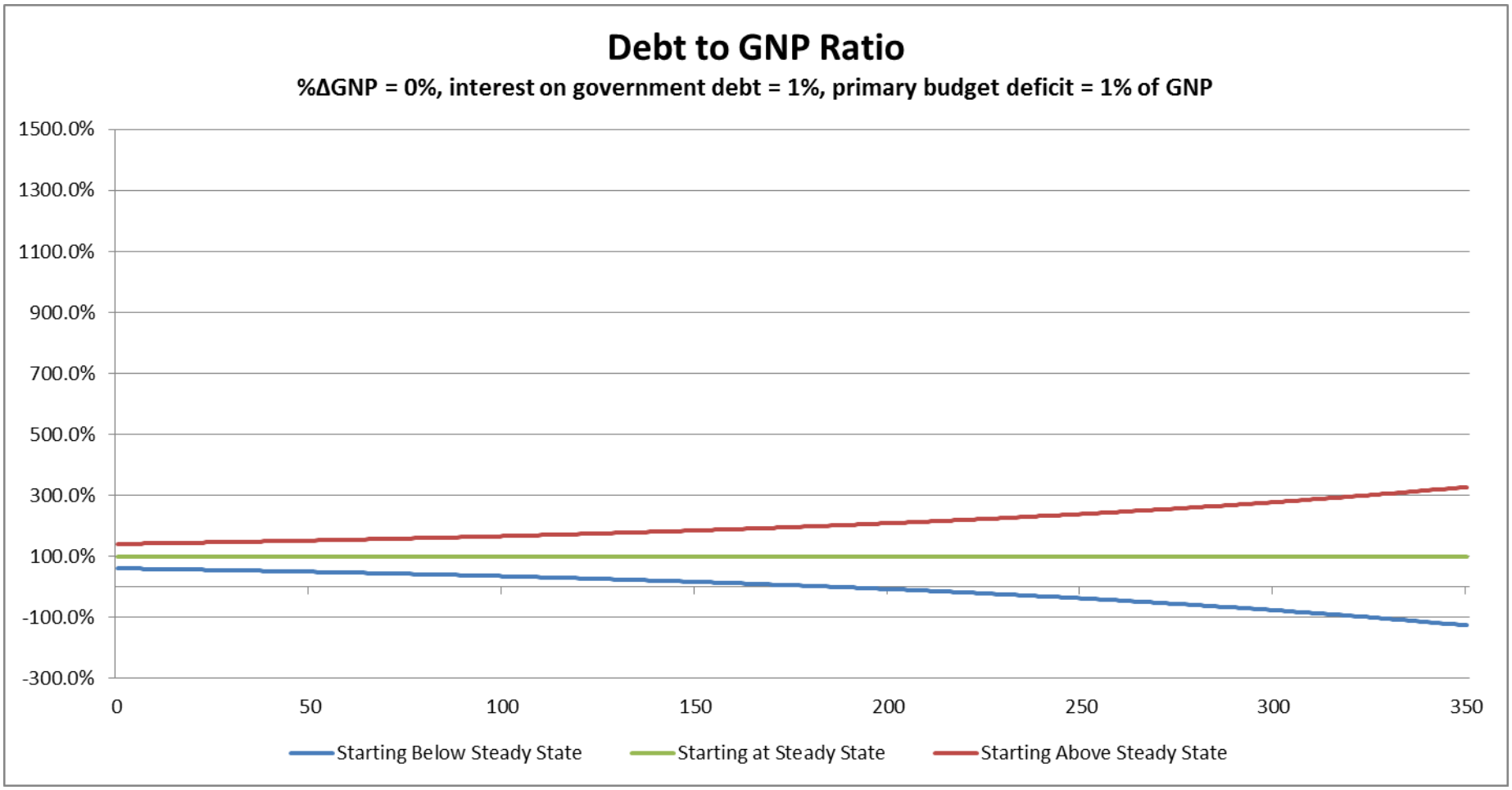
This result makes intuitive sense. With no GNP growth, the only way to keep the debt to GNP ratio unchanged is to make sure no new debt is issued. In addition, with positive government debt outstanding and a positive interest rate, there is positive interest expense. Hence, it follows that a primary budget surplus is needed to offset the interest expense.

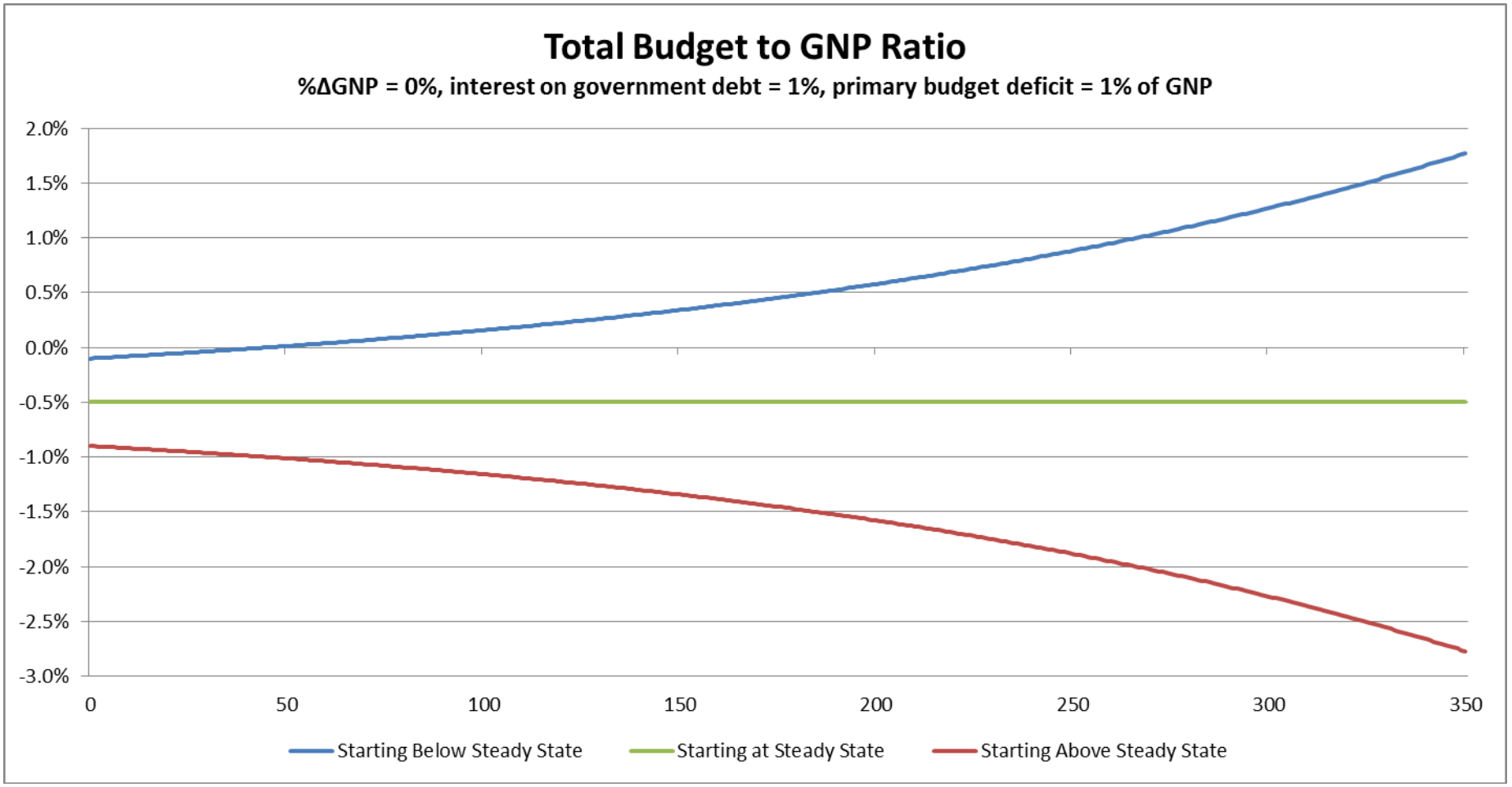
The second important change is shown in the graph on the following page. When the initial debt to GNP ratio is not equal to the target debt to GNP ratio, a constant primary budget surplus will not lead to convergence. Rather, the debt to GNP ratio will either explode or implode, depending on whether the initial debt to GNP ratio is above or below the target level.

What does this second important change imply for responsible fiscal policy? It implies that responsible fiscal policy depends on whether the current debt to GNP ratio is above or below the target ratio.

If the current debt to GNP ratio is above the target, then the primary budget surplus must be set above the break-even level and kept there until the target ratio is achieved. At that point, the primary surplus may be maintained at the break-even level; it no longer needs to exceed it.

If the current debt to GNP ratio is below the target, then the primary budget surplus may be set below the break-even level and kept there until the target ratio is achieved. At that point, the primary surplus must be maintained at the break-even level; it no longer can fall short of it.


Debt to GNP Ratio
%ΔGNP = 0%, interest on government debt = 1%, primary budget deficit = 1% of GNP
1500.0%
1300.0%
1100.0%
900.0%
700.0%
500.0%
300.0%
100.0%
-100.0%
-300.0%
0
50
100
150
200
250
300
350
Starting Below Steady State
Starting at Steady State
Starting Above Steady State


Total Budget to GNP Ratio
%ΔGNP = 0%, interest on government debt = 1%, primary budget deficit = 1% of GNP
2.0%
1.5%
1.0%
0.5%
0.0%
-0.5%
-1.0%
-1.5%
-2.0%
-2.5%
-3.0%
0
50
100
150
200
250
300
350
Starting Below Steady State
Starting at Steady State
Starting Above Steady State

To test convince yourself on whether that you fully understand responsible fiscal policy in the case of g< i, explain the following: With g= 0 responsible policy in the steady state has a primary surplus that is exactly offset with interest expense so the total budget is 0. But with 0 < g < i, there can be a permanent primary surplus and a permanent total budget deficit in steady state.

Point 4: This key equation makes clear that slower population growth can make the debt to GNP ratio more of a problem. Slower population growth, with no change in output per person, means slower GNP growth. If that slower population growth does not somehow result in a suitably lower primary deficit or a lower interest rate, then it will push the debt to GNP ratio up.

Real World Applications:

The table below applies the formulas above to the 2010 real world data from the previous table.

The table shows calculations of the forecast change in the debt to GDP ratio based on (i) the primary deficit to GDP ratio (assuming it remains unchanged), (ii) the net debt to GDP ratio, (iii) the implied interest rate on debt (assuming it remains unchanged) and (iv) the actual rate of GDP growth (assuming it remains unchanged). Note: For Greece net debt has been replaced by gross debt because net debt is not available.

The implied interest rate on debt is (govt budget – primary govt budget) / gross govt debt. The numerator is interest payments and the denominator is the base on which the interest payments are calculated. Since all variables used to calculate the implied interest rate are expressed as ratio to GDP, the GDP's cancel and drop out. Note this assumes interest is paid on gross debt, even if some of the interest payments are returned.

It is easy to see from the first table above why Greece had a fiscal crisis. In 2010 the ratio of gross government debt to GDP had reached 146% and with no change in the interest on government debt, GDP growth, or the primary government budget deficit that ratio would rise to 164% of GDP in 2011.

It is also easy to see that the Greek fiscal crisis in 2010 could not be solved solely by changing the primary government budget. To have done so would have required switching from a 5.3% of GDP deficit to a 12.2% of GDP surplus, without lowering the growth rate of GDP. Even if the Greek economy could stabilize with 0% growth and keep an unchanged interest rate on government debt, the break-even primary government budget would have been a 5.9% of GDP surplus.

It was undoubtedly necessary in 2010 for Greece to improve its primary government budget, both as a sign of good faith movement toward a sustainable position and to help slow the growth of the debt to GDP ratio. However, it was obvious at the time that to control the spiraling debt to GDP ratio other measures would be needed.

The table also shows that in 2010 the Italian government debt situation was relatively stable in the short run, in the sense that from 2010 to 2011 the net debt to GNP ratio was forecast to rise to only 99% from 98% (assuming no changes in their interest rate on government debt or GDP growth rate). Nonetheless, the situation was fragile given the high debt to GDP ratio.

In this way Italy was much like Japan, with a net debt to GNP ratio of 106% that was forecast to rise to 109%.

In other ways Italy and Japan were very different. Italy had essentially a balanced primary budget in 2010, and was forecast to have a slight increase in the net debt to GDP ratio because its growth rate of GDP was below the interest rate on government debt. In contrast, Japan had a large primary government budget deficit, so large that it more than offset the effect of Japan's growth rate of GDP far exceeding the interest rate on Japanese government debt. Japan could have run a primary government budget deficit of 5.5% of GDP and still not had an increase in its debt to GDP ratio!

					Forecast	Actual	Break-even	Steady
				Net	Net	Primary	Primary	State
	Implied	Actual	Forecast	Govt	Govt	Govt	Govt	Net Govt
	Interest	GDP	GDP	Debt	Debt	Budget	Budget	Debt
Variable	Rate	Growth	Growth	% GDP	% GDP	% GDP	% GDP	% GDP
Year	2010	2010	2011	2010	2011	2010	2011	2010
Germany*	2.7%	5.2%	5.2%	57%	58%	-2.1%	-1.5%	80.8%
Greece*	4.0%	-4.3%	-4.3%	146%	164%	-5.3%	12.2%	DNE
Ireland*	2.7%	3.2%	3.2%	75%	104%	-29.8%	-0.4%	5368.8%
Italy*	3.6%	2.9%	2.9%	98%	99%	-0.1%	0.6%	DNE
Portugal*	2.8%	3.1%	3.1%	92%	100%	-8.5%	-0.3%	2561.7%
Spain*	2.6%	1.2%	1.2%	42%	51%	-7.8%	0.6%	DNE
United Kingdom	3.3%	3.2%	3.2%	69%	76%	-7.0%	0.1%	DNE
United States	2.1%	3.8%	3.8%	70%	78%	-8.9%	-1.2%	536.2%
Japan	0.3%	5.5%	5.5%	106%	109%	-8.6%	-5.5%	164.9%

Source: April 2017 IMF World Economic Outlook
Note: For Greece net debt is replaced by Gross debt because net debt is unavailable.

The table above shows Ireland facing a fiscal crisis in the 2010. The net government debt to GDP ratio is forecast to rise from 75% to 104% in a single year, driven by the largest primary government budget deficit in the world, nearly 30% of GDP.

Spain, the U.K. and the U.S. looked to have significant upcoming increases in their government debt to GDP ratios, but in 2010 their government debt to GDP ratios were lower than in Greece, Japan, and Ireland.

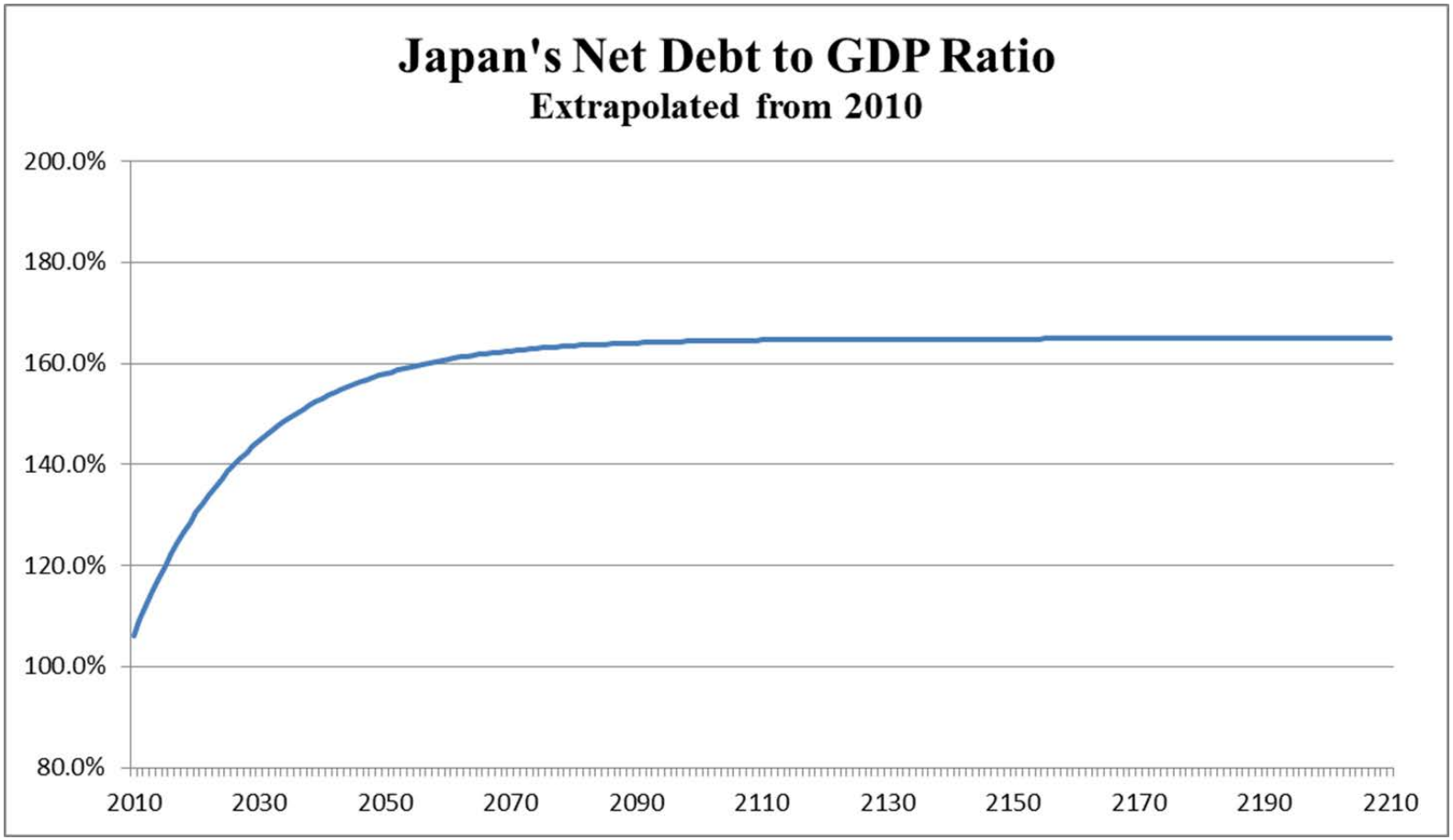
Given its high growth rate for GDP and low interest rate on government debt in 2010, Germany could run a primary government budget deficit of 2.1% of GDP and still see only a one percentage point increase in its projected government debt to GDP ratio over the upcoming year. This is quite a nice position relative to Italy, where a primary budget deficit of 0.1% is forecast to cause the same one percentage point increase in the government debt to GDP ratio.

The final column of the above table shows that in 2010 only Germany, and possibly Japan, had net government debt to GNP ratios that, given unchanged fundamentals, would eventually stabilize at reasonable levels (both had growth rates that exceeded the interest rate paid on government debt and sufficiently small primary budget deficits).

In 2010, Greece, Italy, Spain, and the U.K. were paying an interest rate on their government debt that exceeded their growth rate of GDP, thereby requiring a primary budget surplus to stabilize the debt to GNP ratio. All of these countries were running primary budget deficits.

In Ireland, Portugal and the U.S. the growth rate of GDP exceeded the interest rate paid on the government debt, allowing these countries to run a primary budget deficit and still have the debt to GDP ratio eventually stabilize. However the level at which it would eventually stabilize is unlikely to be one that the market would ever tolerate.

The graph below shows the convergence of the Japanese debt to GNP ratio, assuming the primary government budget, interest rate on government debt and GDP growth rate continue on unchanged from their 2010 levels. The debt to GNP ratio would hit 158% by 2050 and stabilize at 165% by 2175.



Source: April 2017 IMF World Economic Outlook

I.9 The Current Account and the Sectoral Balance Equation

Definition: CA = Current Account = NX + NFP - TRPF - TRGF

The current account is the broadest measure yet of international transactions. It includes Net Exports, Net Factor Payments and Net International Transfers.

Point 1: **CA = GNP - (C + I + G + TRPF + TRGF),**

The current account measures whether the sum of a country's spending and net giving is more or less than its income.

A current account surplus indicates that a country's spending plus net giving is less than its income and as a result it is increasing its net asset position vis a vis the rest of the world. This means the country is either on net buying assets from foreigners or on net reducing liabilities to foreigners.

A current account deficit indicates that a country's spending plus net giving is more than its income and as a result it is decreasing its net asset position vis a vis the rest of the world. This means the country is either on net selling assets to foreigners or on net increasing liabilities to foreigners.

The mathematics: add NFP to each side of GDP = C + I + G + NX to get

GDP + NFP = C + I + G + NX + NFP.

Use GDP + NFP = GNP to simplify the left side and subtract TRPF + TRGF from both sides

GNP - (TRPF + TRGF) = C + I + G + NX + NFP - TRPF – TRGF.

Use the definition of CA to simplify the right side and subtract C + I + G from both sides to get

GNP - (C + I + G + TRPF + TRGF) = CA

Intuition of why CA = NX + NFP - TRPF - TRGF is connected to international borrowing/lending:

Suppose there is just the U.S. and Japan, there are no net factor payments, there are no transfer payments across countries, and NX is negative for the U.S. and thereby positive for Japan. In this case CA = NX.

Why would Japan send the U.S. goods and services worth more than they receive in return? Pity? Stupidity? Testosterone? Getting something else in return?

Japan gets something else in return – an improved net asset position. This could be buying assets (Hawaiian real estate, U.S. government debt) or reducing liabilities (paying off principal on previous loans). The Japanese Capital and Financial Account records these transactions. For every country, the Current Account plus the Capital and Financial Account cancel each other out and sum to zero!

What is the cost to the U.S. of having a deficit in net exports? None, there is a free lunch, a way to painlessly get more goods and services than you give? Loss of jobs at home? Giving something else in return?

U.S. gives something else in return – a deteriorated net asset position. Could be selling off assets (Hawaiian real estate) or incurring liabilities (issuing debt that needs to be paid off in the future, like U.S. government debt). The U.S. Capital and Financial Account records these transactions.

Is a current account deficit bad? Only if it is bad to spend in excess of income. My guess is that there have been times when some of you have felt that it was a reasonable/desirable policy for your family or company to spend in excess of its income and other times when the reverse was true. Since a country is the aggregation of households, firms, and the government, this is likely true for countries as well.

Does a country need assistance from any other country to eliminate its current account deficit? No. It can do it unilaterally. It just needs to increase output or cut spending. This can be unpleasant and/or difficult, however. It is easier to blame foreigners for the situation.

Is a current account deficit a sign of weakness? Weak countries can’t borrow.

What do you think happened to the current account deficit of Mexico following the increase in oil prices in the mid-1970’s?

The next table shows the breakdown of the current accounts for various countries. Data are from the IMF Balance of Payments Statistics, measured in billions of $U.S., for 2015.

Net International transfers are broken down into (i) net transfers made by the government; (ii) net remittances (net transfers made by non-citizen residents to their home countries); and (iii) net transfers made by private citizens and domestic firms.

For Germany, the current account was a surplus of $288 billion. That made Germany the world's second largest net purchaser of assets in world capital markets, behind only China's current account surplus of $304 billion. The U.S. was the world's largest net seller of assets in world capital markets, with a current account deficit of $435 billion.

As is true for most countries, the largest component of the $288 billion German current account is net exports, a surplus of $269 billion. The German current account is slightly more than net exports because German net factor payments of $64 billion more than offset German net international transfers of $45 billion.

German net internal transfer of $45 billion can be decomposed as follows: The German government made net international transfers of $28 billion, while net remittances (transfers made by foreign residents in Germany in excess of transfers made by German citizens residing elsewhere in the world) were $4 billion and net international transfers of German private citizens residing in Germany and German domestic firms were $13 billion.

Variation in net exports across countries is highly correlated with variation in current accounts across countries. The correlation coefficient between current accounts and net exports is 0.95. The correlation coefficient between current accounts and net factor income is .21. The correlation coefficient between current accounts and net transfers is .28.

Furthermore, net exports are usually the largest component of a country's current account. There exceptions, however.

In both Brazil and Indonesia, the largest component of the current account deficit is the deficit in net factor payment exports; and in Japan the largest component of the current account surplus is the surplus in net factor payments. In the past Japan ran large surpluses in net exports, which led to large current account surpluses, which meant a buildup in net foreign asset holdings, and that now means earning significant income on those investments. This is an illustration of how current account surpluses (and deficits) can be self-sustaining.

In the Philippines and Saudi Arabia, the largest component of the current account is transfers. These two countries are similar in that the largest component of net international transfers is net remittances. They are different in that non-citizen residents of other countries sent $23 billion back to the Philippines, while non-citizen residents of Saudi Arabia sent $45 billion back to their home countries.

Variable	Current Account	=	Net Exports	Net Factor +Payments	-Transfers	- Transfers: Government	- Transfers: Remittances	- Transfers: Other
Europe								
Belgium*	$1.9		$10.3	-$1.0	-$7.4	-$4.3	-$0.5	-$2.6
Czech Republic	$0.5		$10.8	-$10.4	$0.0	$0.8	$0.1	-$0.9
France*	-$10.8		-$18.0	$56.4	-$49.2	-$31.5	-$10.2	-$7.5
Germany*	$288.2		$269.0	$63.6	-$44.5	-$27.8	-$3.9	-$12.8
Greece*	$0.2		-$0.3	$1.1	-$0.6	-$0.7	-$0.3	$0.4
Hungary	$4.0		$10.9	-$5.7	-$1.2	-$0.5	$0.6	-$1.3
Ireland*	$29.0		$90.1	-$57.6	-$3.5	-$2.6	-$0.9	-$0.1
Italy*	$26.1		$53.1	-$10.2	-$16.7	-$13.1	-$4.7	$1.0
Kazakhstan	-$5.1		$7.6	-$11.2	-$1.6	$0.0	-$1.3	-$0.3
Netherlands*	$65.2		$80.1	-$1.8	-$13.0	-$4.7	-$1.8	-$6.5
Norway	$33.7		$21.1	$19.6	-$6.9	-$5.5	NA	-$1.4
Poland	-$2.9		$14.6	-$16.6	-$1.0	-$3.2	$3.3	-$1.0
Portugal*	$0.1		$3.5	-$5.0	$1.7	-$1.8	NA	NA
Romania	-$2.2		-$1.1	-$4.2	$3.1	$0.2	$1.9	$1.0
Russian Federation	$68.8		$111.5	-$36.9	-$5.7	$2.0	-$7.7	$0.0
Spain*	$16.2		$29.1	-$0.8	-$12.1	-$9.4	NA	NA
Sweden	$23.3		$24.5	$7.0	-$8.2	-$6.0	$0.1	-$2.3
Switzerland	$77.4		$72.2	$18.4	-$13.3	-$3.9	NA	NA
Turkey	-$32.1		-$23.9	-$9.6	$1.4	$0.5	NA	$0.0
Ukraine	-$0.2		-$1.7	-$1.1	$2.6	$0.8	$1.1	$0.7
United Kingdom	-$122.6		-$45.7	-$39.2	-$37.7	-$31.1	-$5.6	-$1.0

Source: IMF, Balance of Payments Statistics. Data are for 2015, expressed in billions of $U.S.
Notes: * denotes countries belonging to the Euro zone; NA denotes not available

Variable	Current Account	=	Net Exports	Net Factor +Payments	-Transfers	- Transfers		
						Government	Remittances	Other
Americas/Carribean								
Canada	-$53.1		-$37.3	-$12.9	-$2.8	$1.8	NA	-$2.6
Mexico	-$28.2		-$24.4	-$28.0	$24.1	NA	$24.0	$0.2
United States	-$434.6		-$500.4	$181.0	-$115.1	-$26.0	NA	NA
Cuba	NA		NA	NA	NA	NA	NA	NA
Dominican Republic	-$1.3		-$3.1	-$2.9	$4.8	$0.4	$4.5	-$0.1
Haiti	-$0.3		-$2.7	$0.0	$2.4	NA	$1.9	NA
						NA	NA	NA
Guatemala	-$0.1		-$5.9	-$1.4	$7.2	$0.2	$6.5	$0.5
						NA	NA	NA
Argentina	-$17.2		-$6.1	-$12.1	$1.1	$1.0	-$0.2	$0.3
Bolivia	-$1.9		-$1.9	-$1.1	$1.2	$0.1	$1.0	$0.1
Brazil	-$59.4		-$19.2	-$42.9	$2.7	$0.0	$1.2	$1.5
Chile	-$4.7		$0.0	-$6.6	$1.9	$1.9	NA	NA
Colombia	-$18.6		-$18.5	-$5.5	$5.4	$0.2	$4.6	$0.6
Ecuador	-$2.1		-$2.5	-$1.7	$2.1	$0.1	$2.1	-$0.2
Peru	-$9.2		-$5.0	-$7.5	$3.3	$0.0	NA	NA
Venezuela	-$20.4		-$11.9	-$8.2	-$0.2	-$0.2	$0.0	$0.0

Source: IMF, Balance of Payments Statistics. Data are for 2015, expressed in billions of $U.S.
Notes: NA denotes not available

Variable	Current Account	=	Net Exports	Net Factor +Payments	-Transfers	- Transfers		
						Government	Remittances	Other
Oceania/Asia								
Australia	-$58.0		-$27.5	-$29.1	-$1.4	$0.1	NA	-$0.6
New Guinea	$5.7		$6.0	-$0.4	$0.1	NA	-$0.2	-$0.1
New Zealand	-$5.5		$1.4	-$6.6	-$0.3	$0.2	-$0.1	-$0.3
Bangladesh	$2.6		-$10.6	-$2.6	$15.8	NA	$15.2	$0.5
China	$304.2		$357.9	-$41.1	-$12.6	NA	-$3.4	NA
Hong Kong	$10.3		$7.4	$5.7	-$2.9	NA	NA	NA
India	-$22.5		-$63.2	-$23.4	$64.2	-$0.4	$62.7	$1.9
Indonesia	-$17.5		$5.4	-$28.4	$5.5	$0.1	$6.4	-$1.1
Japan	$134.1		-$23.3	$173.7	-$16.3	-$4.5	-$0.6	-$11.2
Korea(South)	$105.9		$107.4	$3.6	-$5.0	-$1.4	-$1.9	-$1.7
Myanmar	-$2.5		-$2.4	-$2.7	$2.5	NA	$0.0	$2.1
Pakistan	-$2.1		-$19.4	-$5.0	$22.3	$0.5	$19.2	$2.6
Philippines	$7.3		-$17.9	$1.9	$23.3	$0.6	$21.9	$0.7
Singapore	$53.8		$76.9	-$13.2	-$10.0	$0.8	NA	NA
Thailand	$32.1		$46.0	-$20.6	$6.7	$0.0	$1.3	$5.4
Vietnam	$0.9		$3.1	-$9.9	$7.7	NA	NA	NA

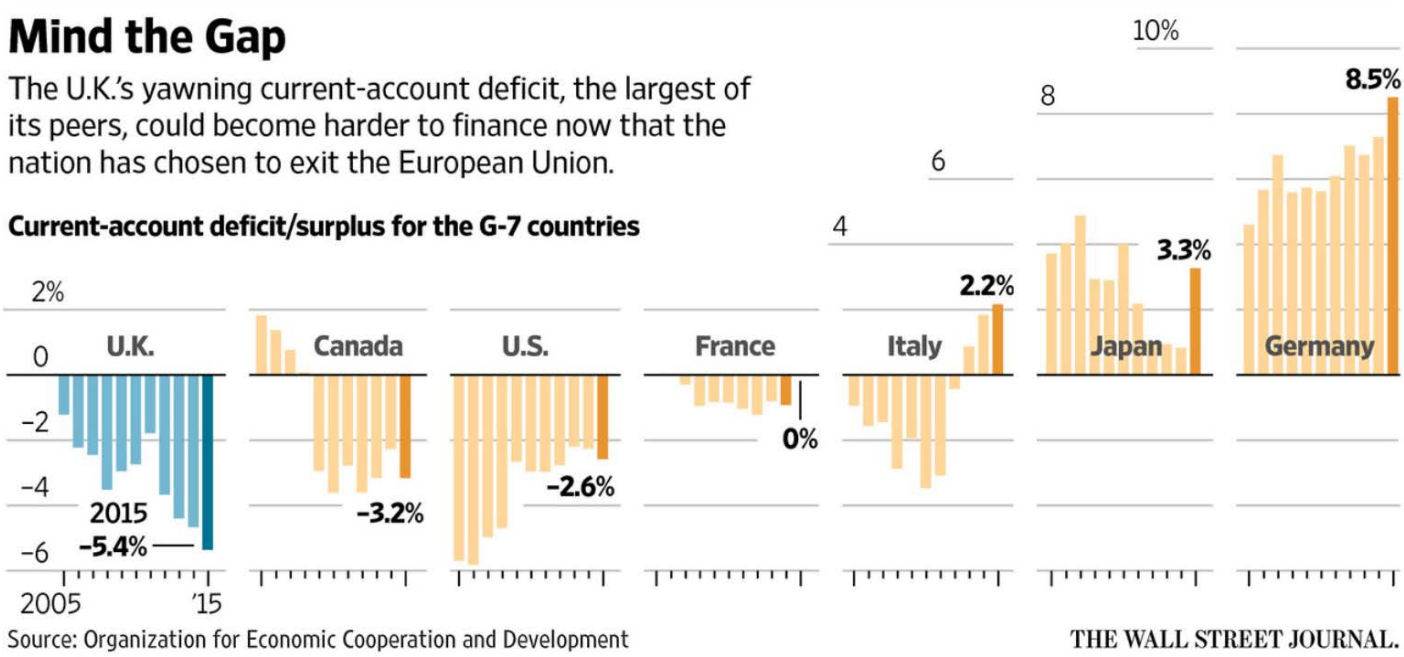
Source: IMF, Balance of Payments Statistics. Data are for 2015, expressed in billions of $U.S.
Notes: NA denotes not available

Variable	Current Account	=	Net Exports	Net Factor +Payments	-Transfers	- Transfers		
						Government	Remittances	Other
Middle East/Africa								
Iran	NA		NA	NA	NA	NA	NA	NA
Iraq	$4.1		$3.9	-$0.3	$0.5	$0.1	$0.4	$0.0
Israel	$15.1		$9.0	-$3.1	$9.2	$4.2	NA	$4.9
Saudi Arabia	-$56.7		-$29.3	$17.3	-$44.7	-$6.5	-$37.8	-$0.4
Syria	$0.0		$0.0	$0.0	$0.0	$0.0	$0.0	NA
United Arab Emirates	NA		NA	NA	NA	NA	NA	NA
Yemen	-$3.0		-$5.8	-$0.5	$3.3	$0.0	$3.3	$0.0
Dem Rep Congo	-$1.5		-$2.1	-$0.8	$1.4	$1.3	NA	$0.1
Egypt	-$16.8		-$30.0	-$5.0	$18.2	$0.1	$17.7	$0.4
Ethiopia	$0.0		$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Kenya	$0.0		$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Mozambique	-$6.0		-$6.5	-$0.3	$0.8	$0.5	$0.0	$0.3
Nigeria	-$15.8		-$23.4	-$13.0	$20.6	$1.6	$19.8	-$0.8
South Africa	-$13.9		-$3.5	-$7.8	-$2.6	-$3.6	NA	$1.0
Tanzania	-$4.1		-$3.7	-$0.9	$0.5	$0.2	$0.3	NA
Uganda	-$1.8		-$2.7	-$0.4	$1.3	$0.2	$0.8	NA

Source: IMF, Balance of Payments Statistics. Data are for 2015, expressed in billions of $U.S.
Notes: * denotes countries belonging to the Euro zone; NA denotes not available

A recent article analyzing what will likely happen to the U.K.'s current account after the Brexit vote is worth reading. See Jason Douglas, **U.K.'s Current Account Deficit Stands to Shrink After Brexit**, *The Wall Street Journal*, August 14, 2016.

In addition to having sensible analysis (i.e. it is based on the fact the current account is the difference between income and spending), the article presents the following interesting data on the time series of current accounts:



Point 2: $S^P = I + BD + CA$ (the Sectoral Balance Equation).

Private Savings, Private Investment, the Government Budget Deficit, and the Current Account are inextricably linked.

If one moves, at least one other must move. A higher government budget deficit must be associated with either higher private savings, lower private investment, or a lower current account.

If one moves, another might not move. Higher private savings won't necessarily lead to higher investment, and a higher government budget deficit won't necessarily cause private investment to fall.

The mathematics: Add NFP to each side of GDP = C + I + G + NX to get

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

Use equation GNP = GDP + NFP and add TRGP - TA - TRPF - C to both sides to get

$$GNP + TRGP - TA - TRPF - C = I + G + TRGP - TA + NX + NFP - TRPF.$$

Use the definition of YD we can simplify the left side of this to get

$$YD - C - TRPF = I + G + TRGP - TA + NX + NFP - TRPF.$$

Use the definition of S^P we can simplify the left side of this to get

$$S^P = I + (G + TRGP - TA) + (NX + NFP - TRPF).$$

Add and subtract TRGF from the right side of this to get

$$S^P = I + (G + TRGP + TRGF - TA) + (NX + NFP - TRPF - TRGF).$$

Use the definitions of BD and CA to get the sectoral balance equation

The intuition: If the private sector saves, it has funds left over from its after tax income that it does not spend on consumption goods or transfers to foreigners. There are three alternatives for where these funds can go: (i) acquire newly produced capital, Investment, (ii) loan to the government so that the government can cover its deficit, Government Budget Deficit, or (iii) acquire new assets abroad or reduce liabilities abroad, Current Account Surplus.

USEFULNESS OF SECTORAL BALANCE EQUATION

What is the cost of a government budget deficit?

Leaving our children in debt? Imposing a burden on future generations?
It depends on whether S^P rises, I falls, or CA falls.

If the U.S. got China to eliminate its CA surplus, would the U.S. be better off?

It depends on whether S^P rises, I falls, or BD falls.

Do you believe someone who says that a policy of tax breaks that stimulate savings will lead to increased investment?

Even with no change in CA, it depends on whether S^P rises more or less than BD.

The data in the following table show national savings (S^N), private savings (S^P), and the breakdown of private savings into the components identified by the sectoral balance equation. Data are from the IMF's April 2017 World Economic Outlook, expressed as % of GDP.

Note 1: There are other ways to express the components of the sectoral balance equation, e.g. GNP would be preferable to GDP, and it would be interesting to express CA as a percentage of the net foreign asset position.

Note 2: Due to data errors, the decomposition of the private savings rate into its three components results in a violation of the sectoral balance equation in several countries (all with names in *italics*): the U.S., Bolivia, Venezuela, Australia, New Guinea, New Zealand, Bangladesh, Iraq, the United Arab Emirates, Ethiopia, and Tanzania.

China has the highest private savings rate in the world (50.2% of GDP). The majority of the private savings goes to finance one of the highest private investment rate in the world (44.7% of GDP); the remainder is used to build up their international net asset position (2.7% of GDP) and lent to the Chinese government (2.8% of GDP).

Switzerland and Ireland have the highest private saving rates in Europe (34.5% and 33.9% of GDP, respectively). In both countries government deficits are small relative the private saving rates (0.0% and 1.9% of GDP), leaving a sizable amount private saving to go into building up their international asset position (11.5% and 10.2% of GDP, respectively)

The U.K. has one of the lowest private saving rates among large economies (17.3% of GDP). This saving rate is just large enough to finance one of the lowest private investment rates (17.2% of GDP). As a result, the government budget deficit (4.4.% of GDP) is nearly matched by a reduction in net international assets (4.3% of GDP).

Both Norway and India have high private investment rates (28.2% and 32.7% of GDP, respectively). However they differ in the following way: In Norway there is a government budget surplus of 5.7% of GDP, so that the private saving rate of 31.2% of GDP means a net increase in international assets of 8.7% of GDP. In India there is a government budget deficit of 7.1% of GDP, so that the private saving rate of 38.8% of GDP means a net decrease in international assets of 1.1% of GDP.

When measured as a percentage of GDP, Singapore increased its net international asset positions by the most of all countries. The Singapore government ran a budget surplus (3.7% of GDP), which combined with a high private saving rate (41.2% of GDP), led to a high national savings rate (44.9% of GDP) that partly was invested at home (26.8% of GDP) and partly used to build up its international asset position (18.1% of GDP).

The country in the world that drew down their international net asset position was Mozambique (24.4% of GDP). What was Mozambique doing with the funds it obtains by drawing down its international net asset position? Its government budget deficit is above average (7.4% of GDP). However, what really stands out is unusually high investment rate (53.6 of GDP), which far exceeds its low private savings rate (14.2% of GDP).

Variable	S^N / GDP		S^P / GDP	= I / GDP	+ BD / GDP	+ CA / GDP
Europe						
Belgium*	23.7%		26.2%	23.2%	2.5%	0.4%
Czech Republic	28.3%		28.9%	27.4%	0.6%	0.9%
France*	22.2%		25.7%	22.4%	3.5%	-0.2%
Germany*	27.6%		26.9%	19.2%	-0.7%	8.3%
Greece*	9.8%		13.1%	9.8%	3.4%	0.1%
Hungary	25.1%		27.1%	21.7%	2.0%	3.4%
Ireland*	32.0%		33.9%	21.8%	1.9%	10.2%
Italy*	18.9%		21.6%	17.3%	2.7%	1.6%
Kazakhstan	26.5%		32.8%	29.5%	6.3%	-3.0%
Netherlands*	27.9%		29.8%	19.3%	1.9%	8.7%
Norway	36.9%		31.2%	28.2%	-5.7%	8.7%
Poland	19.8%		22.4%	20.4%	2.6%	-0.6%
Portugal*	15.5%		19.9%	15.5%	4.4%	0.1%
Romania	23.7%		25.2%	25.0%	1.5%	-1.2%
Russia	27.2%		30.6%	22.1%	3.4%	5.1%
Spain*	21.4%		26.6%	20.1%	5.1%	1.4%
Sweden	28.9%		28.7%	24.2%	-0.2%	4.7%
Switzerland	34.5%		34.5%	23.0%	0.0%	11.5%
Turkey	24.7%		26.0%	28.3%	1.2%	-3.7%
Ukraine	15.7%		16.8%	15.9%	1.2%	-0.3%
United Kingdom	13.0%		17.3%	17.2%	4.4%	-4.3%

Data are for 2015
Source: International Monetary Fund, World Economic Outlook Database, April 2017
Notes: * denotes countries belonging to the Euro zone

Variable	S^N / GDP		S^P / GDP	= I / GDP	+ BD / GDP	+ CA / GDP
Americas/Carribean						
Canada	20.4%		21.5%	23.8%	1.1%	-3.4%
Mexico	20.0%		24.0%	22.9%	4.0%	-2.9%
United States	19.1%		22.6%	20.3%	3.5%	-2.6%
Cuba	NA		NA	NA	NA	NA
Dominican Republic	21.4%		21.6%	23.5%	0.2%	-2.0%
Haiti	29.3%		31.8%	32.4%	2.5%	-3.1%
Guatemala	13.1%		14.6%	13.4%	1.4%	-0.3%
Argentina	14.1%		19.7%	16.9%	5.6%	-2.7%
Bolivia	13.3%		20.2%	19.2%	6.9%	-5.6%
Brazil	15.9%		26.1%	19.1%	10.3%	-3.3%
Chile	21.3%		23.4%	23.3%	2.1%	-1.9%
Colombia	20.2%		23.7%	26.7%	3.5%	-6.4%
Ecuador	24.7%		29.9%	26.9%	5.2%	-2.2%
Peru	19.7%		21.9%	24.6%	2.2%	-4.9%
Venezuela	31.8%		49.4%	42.1%	17.6%	-7.8%

Data are for 2015

Source: International Monetary Fund, World Economic Outlook Database, April 2017

Notes: *Italics indicate a country where due to data errors the decomposition does not satisfy the sectoral balance equation.*

Variable	S^N / GDP		S^P / GDP	= I / GDP	+ BD / GDP	+ CA / GDP
Oceania/Asia						
Australia	22.1%		24.8%	26.3%	2.7%	-4.7%
New Guinea	0.0%		5.1%	0.0%	5.1%	19.6%
New Zealand	20.1%		19.5%	22.7%	-0.6%	-3.4%
Bangladesh	29.7%		*33.6%*	29.1%	3.9%	1.9%
China	47.5%		50.2%	44.7%	2.8%	2.7%
Hong Kong	24.9%		24.3%	21.5%	-0.6%	3.3%
India	31.7%		38.8%	32.7%	7.1%	-1.1%
Indonesia	32.1%		34.6%	34.2%	2.5%	-2.0%
Japan	27.0%		30.5%	23.9%	3.5%	3.1%
Korea(South)	36.6%		36.2%	28.9%	-0.3%	7.7%
Myanmar	19.3%		*23.7%*	24.5%	4.4%	-5.2%
Pakistan	14.5%		19.7%	15.5%	5.2%	-1.0%
Philippines	23.0%		22.4%	20.6%	-0.6%	2.5%
Singapore	44.9%		41.2%	26.8%	-3.7%	18.1%
Thailand	30.3%		30.2%	22.2%	-0.1%	8.1%
Vietnam	28.1%		34.3%	27.6%	6.2%	0.5%

Data are for 2015
Source: International Monetary Fund, World Economic Outlook Database, April 2017
Notes: *Italics indicate a country where due to data errors the decomposition does not satisfy the sectoral balance equation.*

Variable	S^N / GDP		S^P / GDP	= I / GDP	+ BD / GDP	+ CA / GDP
Middle East/Africa						
Iran	34.5%		36.3%	32.1%	1.8%	2.4%
Iraq	18.0%		30.3%	0.0%	12.3%	-6.5%
Israel	24.3%		27.0%	19.9%	2.7%	4.3%
Saudi Arabia	26.2%		42.0%	34.9%	15.8%	-8.7%
Syria	NA		NA	NA	NA	NA
United Arab Emirates	34.1%		36.2%	27.5%	2.1%	3.3%
Yemen	-3.7%		6.9%	1.8%	10.6%	-5.5%
Dem Rep Congo	16.5%		16.6%	20.4%	0.1%	-3.9%
Egypt	10.6%		22.1%	14.3%	11.4%	-3.7%
Ethiopia	31.3%		33.2%	39.4%	1.9%	-11.6%
Kenya	14.4%		22.6%	21.2%	8.2%	-6.8%
Mozambique	14.2%		21.6%	53.6%	7.4%	-39.4%
Nigeria	12.3%		15.8%	15.5%	3.5%	-3.2%
South Africa	16.5%		20.0%	20.9%	3.6%	-4.4%
Tanzania	24.1%		*27.4%*	27.9%	3.3%	-8.0%
Uganda	17.9%		20.6%	24.5%	2.7%	-6.6%

Data are for 2015

Source: International Monetary Fund, World Economic Outlook Database, April 2017

Notes: I*talics indicate a country where due to data errors the decomposition does not satisfy the sectoral balance equation.*

I.10 The Calculation of Real GDP and Inflation

	Year 1 = Base Year			Year 2			
	Price P_1	Quantity Q_1	Nominal GDP P_1Q_1	Price P_2	Quantity Q_2	Nominal GDP P_2Q_2	Real GDP P_BQ_2 $=P_1Q_2$
Tickets	$5.00	100	$500	$6.00	140	$840	$700
Beer	$2.00	1000	$2000	$3.50	1050	$3675	$2100
			$2500			$4515	$2800

Real GDP Growth = (2800-2500)/2500 = .12 = 12%

Note: Ticket growth is (140-100)/100 = .40 = 40%
Beer growth is (1050-1000)/1000 = .05 = 5%
Share of Tickets in Base Year GDP is 1/5
Share of Beer in Base Year GDP is 4/5
(1/5)*40% + (4/5)*5% = 8% + 4% = 12%
Fixed Weight Index - Weights given by Base Year share of GDP

Real GDP also called constant dollar GDP, fixed dollar GDP, or GDP in $1998

Year 1 GDP Deflator = (Nominal GDP/Real GDP) * 100 = (2500/2500)*100 = 100
Year 2 GDP Deflator = (Nominal GDP/Real GDP) * 100 = (4515/2800)*100 = 161.25

Inflation = % change in GDP deflator; intuition is that the GDP deflator = P*Q / Q = P and the % change in P is inflation.

= (161.25-100)/100 = .6125 = 61.25%

Note: Ticket inflation is (6-5)/5 = .20 = 20%
Beer inflation is (3.5-2)/2 = .75 = 75%
Share of Tickets in year 2 real GDP is 1/4
Share of Beer in year 2 real GDP is 3/4
(1/4)*20% + (3/4)*75% = 5% + 56.25% = 61.25%
Variable Weight Index - Weights given by Current Year share of real GDP

Note: There are also deflators for each component of GDP, i.e. a Consumption Deflator, an Investment Deflator, a Government Purchases Deflator . . .

In the U.S., the Fed uses the Consumption deflator measure of inflation, also known as the PCE (Personal Consumption Expenditure) Deflator measure of inflation, as its target measure. It does not use inflation based on the CPI.

Chain Weighting: (a way to calculate real growth and get around the fixed weight index problem)

				Year 1		Year 2	
	Price P_1	Price P_2	Price P_A	Quantity Q_1	GDP $P_A Q_1$	Quantity Q_2	GDP $P_A Q_2$
Tickets	\$5.00	\$6.00	\$5.50	100	\$550	140	\$770.0
Beer	\$2.00	\$3.50	\$2.75	1000	\$2750	1050	\$2887.5
					\$3300		\$3657.5

Chain Weight Real GDP Growth = (3657.5-3300)/3300 = .1083 = 10.83%
Fixed Weight Real GDP Growth = 12%

Why is the Chain Weight Real GDP growth lower? The key here is that the high growth industry (tickets) has a falling relative price, i.e. the price of tickets divided by the price of beer in period 2 (5.5/2,75 = 2) is lower than in period 1 (5/2 = 2.5).

The weight that is being used for tickets in the chain weight procedure is the share of tickets in year 1 GDP using P_A, while the weight being used for tickets in the fixed weight procedure is the share of tickets in year 1 GDP using P_1. With the relative price of tickets falling, ticket's share in the calculation of real GDP growth falls from 500/2500 = 1/5 using P_1 to 550/3300 = 1/6 using P_A.

As a check: (1/6)*40% + (5/6)*5% = (40/6)% + (25/6)% = (65/6)% = 10.83%

Is it generally true that high growth industries have relative prices that are falling? The answer is yes. Why? Patricia Pollard (See **Introducing Chain-Weight GDP Data**, National Economic Trends, Federal Reserve Bank of St. Louis, October 1, 1995) gives the following explanation:

"As prices change, people and businesses alter their purchases, substituting away from goods whose prices are rising relative to others and toward goods whose relative prices are declining. Thus, output increases most for goods whose relative prices are falling."

This basically says it is because demand curves slope down. A better answer is that demand curves slope down AND SUPPLY SHOCKS ARE MORE IMPORTANT THAN DEMAND SHOCKS. This is clearly true for computers, though it is not true for health care.

Additional points on Chain Weighting:

1. To get a level of real chain-weighted GDP (as opposed to a growth rate), pick a base year in which real and nominal are the same, and then use the calculated growth rates to determine the levels in other years. For example, applying the 10.83% growth rate from Period 1 to Period 2 gives a real chain-weighted GNP in Period 2 of $2770.8.

2. If relative prices are falling in high growth industries, chain-weighted real GDP growth is lower than simple real GDP growth after the base year, but is higher before the base year. See the article by Patricia Pollard referenced above for actual data on this point.

3. The percentage change in nominal GDP is unaffected by how real GDP is calculated, so if real GDP growth goes down, inflation must rise. Remember, since the

   Deflator = Nominal GDP / Real GDP

   Inflation = % Δ Deflator = %Δ Nominal GDP - %Δ Real GDP

   For this example, inflation based on the chain-weighted deflator is 42%, rather than the 40% calculated using the standard deflator.

4. Unfortunately, when using chain weighted data components no longer add up. That is, Y is no longer equal C + I + G + NX when things are expressed in real terms! This makes use of chain weighted data suspect for the purposes of computing shares of GDP. On the other hand, use of nominal data also has problems if the relative prices of the components of GDP are shifting. A good example of this is when the price of investment goods was falling rapidly relative to the price of consumption goods. In this case taking the ratio of nominal investment to nominal GDP as a measure of the share of GDP being devoted to investment gave an underestimate of the truth.

The CPI: The cost of purchasing a fixed bundle of consumption goods now relative to the cost in a base year.

Define the consumption bundle to be actual base year consumption

Period 1 CPI = (Current Cost/Base Year Cost) * 100 = (2500/2500)*100 = 100
Period 2 CPI = (Current Cost/Base Year Cost) * 100 = (4100/2500)*100 = 164
Note: 4100 = P_2 Q_1 = (6 x 100) + (3.5 x 1000)

Inflation = % change in CPI = (164-100)/100 = .64 = 64%
Note: Ticket inflation is (6-5)/5 = .20 = 20%
Beer inflation is (3.5-2)/2 = .75 = 75%
Share of Tickets in period 1 real GDP is 1/5
Share of Beer in period 1 real GDP is 4/5
(1/5)*20% + (4/5)*75% = 4% + 60% = 64%
CPI is Fixed Weight Index - Weights given by Base Year share of GDP!

Recall % change in Deflator = (161.25-100)/100 = .6125 = 61.25%
Variable Weight Index - Weights given by Current Year share of real GDP

Measuring inflation with the change in CPI overstates inflation because consumers shift away from goods whose relative prices rise and this is not captured by a fixed weight index.

CPI inflation may also be overstated or understated due to improperly accounting for quality improvements in goods and the introduction of new goods (whose previous ; however, this bias also applies to inflation measured by a variable weight deflator.

Other Factors which Cause CPI Inflation to Differ from GDP Deflator Inflation:
Investment goods are not in CPI, are in GDP Deflator
Government Purchased goods are not in CPI, are in GDP Deflator
Imported Consumer goods are not in GDP Deflator, are in CPI

Using the change in the PCE deflator to measure inflation has the shortcoming that it will not include the cost of housing and will include goods that may be better defined as investment goods, such as education. Even if housing were counted as a consumption good, there is an issue of whether the cost of consuming housing is best captured by the cost of newly produced housing. The cost is presumably the rental cost, which is no doubt tied to the cost of new produced housing but could deviate from it at times.

The Core CPI: The Core CPI omits food and energy prices, which are more volatile than other prices in the CPI. The rationale for this is to isolate the “permanent” or “trend” component of inflation.

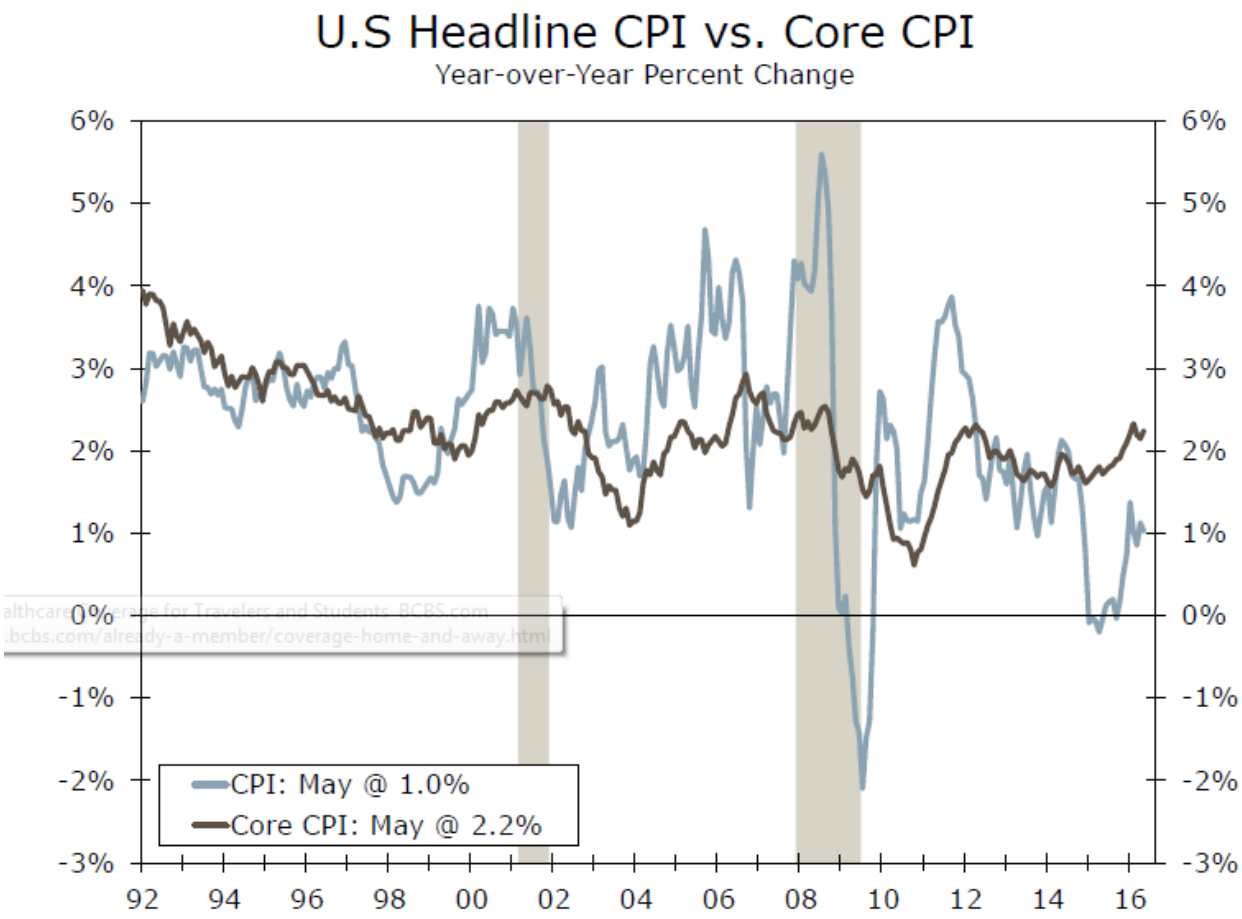
The graphs below show the behavior of inflation in the U.S., the U.K., the Euro Zone and Mexico, using both the Core CPI and CPI.

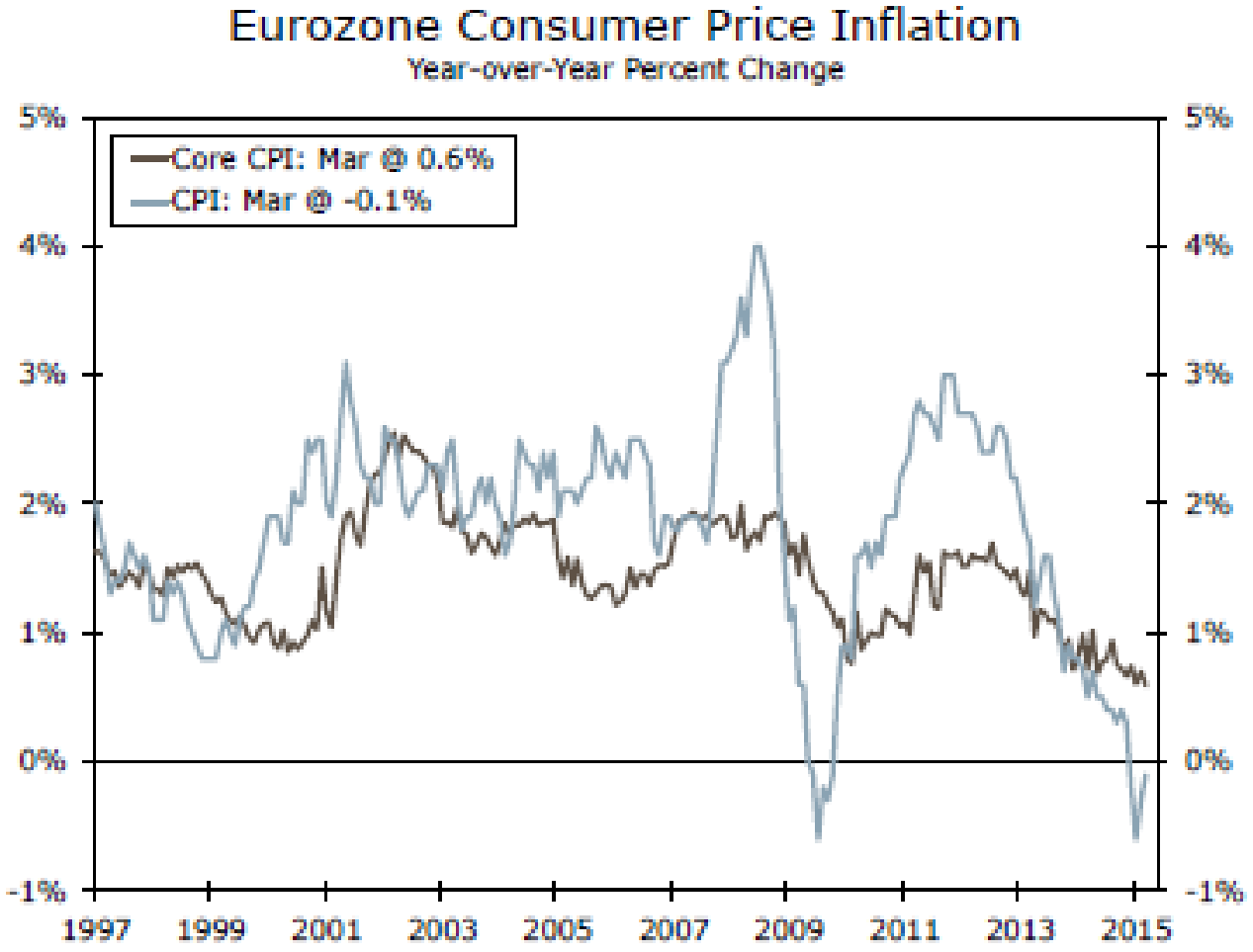
In all cases, inflation measured using the Core CPI is noticeably more stable.

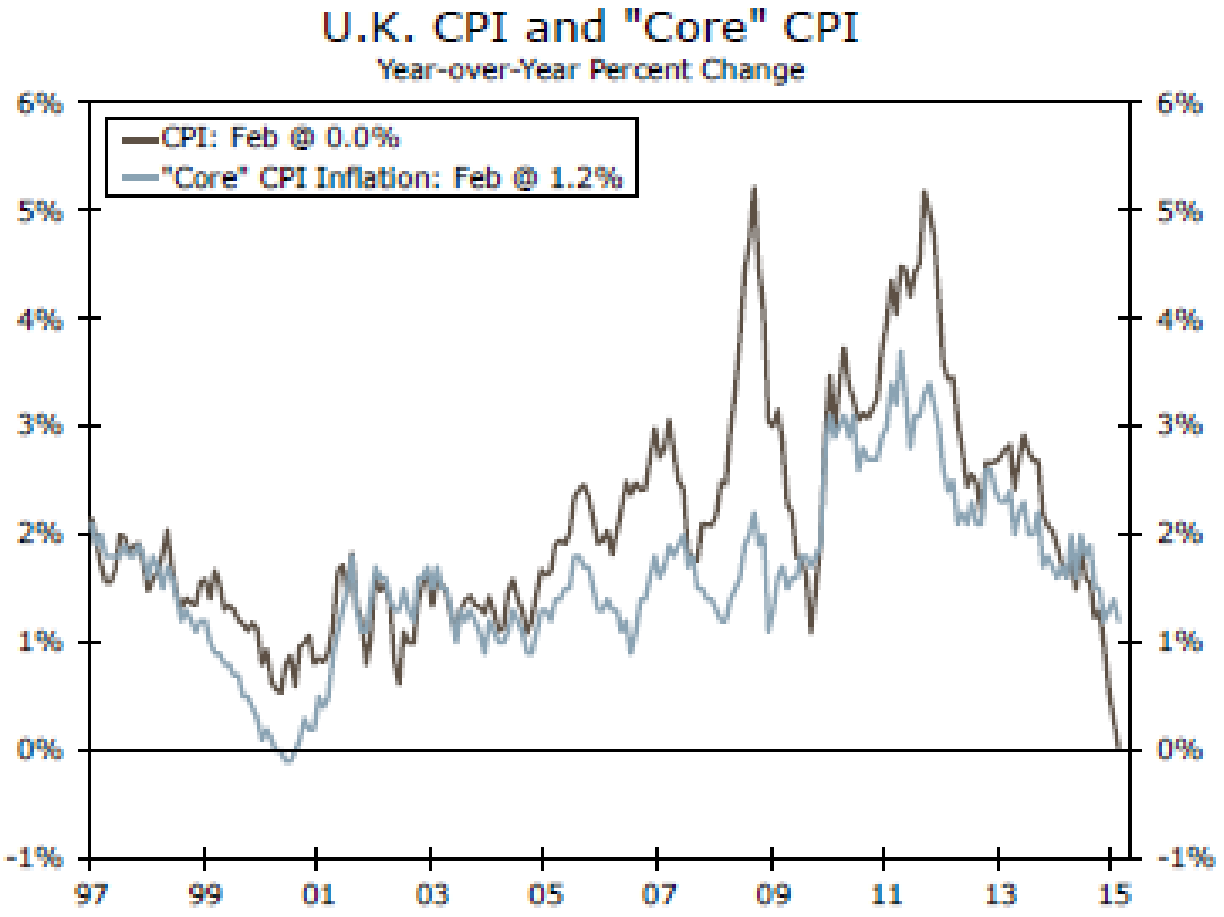
Note: It is completely annoying that the graphs for the U.K. and Mexico are the reverse of the graphs for the U.S. and Eurozone, i.e. they reverse the black and blue lines.

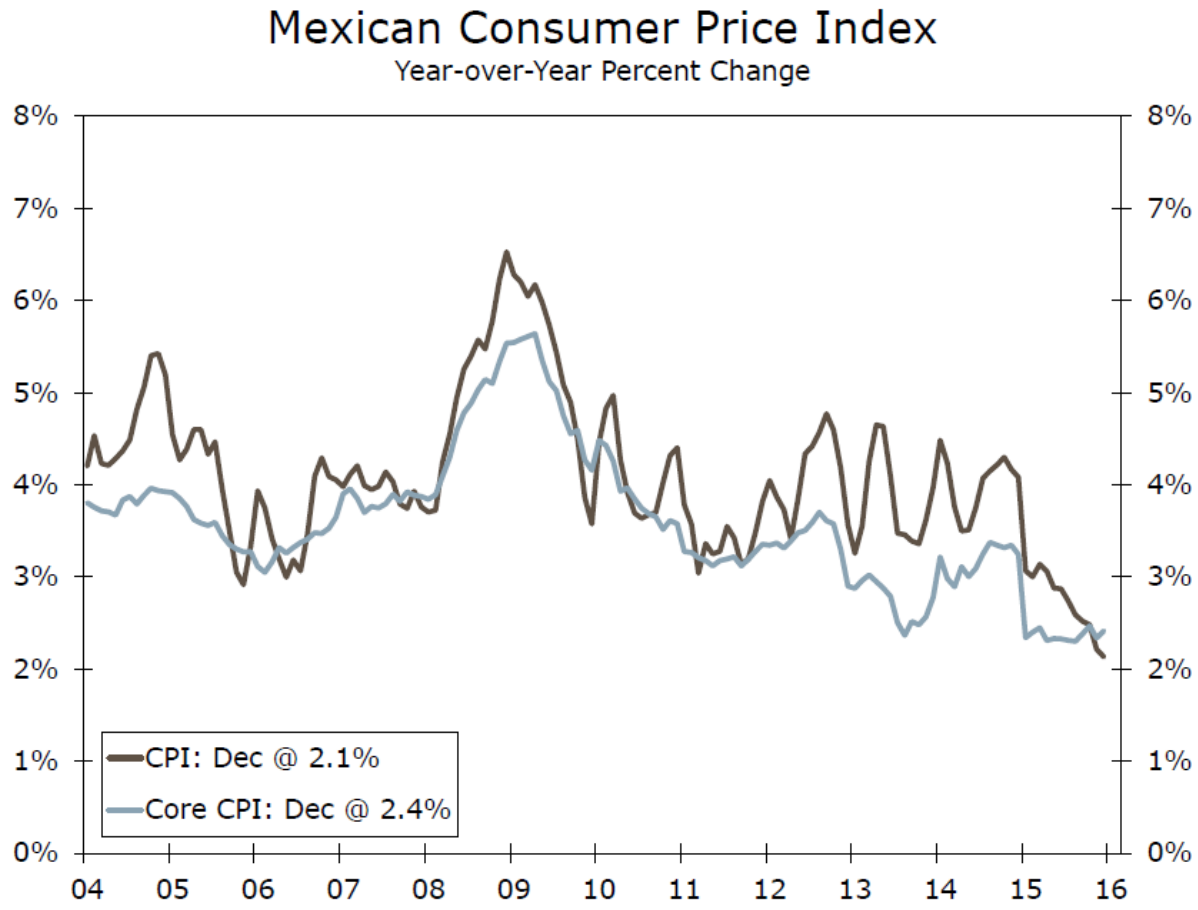
However, careful examination of the graphs for Mexico and the U.K. reveals the following important concern: While the Core CPI measure of inflation does appear more stable, and therefore may be a better measure of trend or permanent inflation, it also appears that it may understate inflation; i.e. in both countries the black line (CPI inflation) is almost always above the blue line.

A better measure of the permanent component of inflation would reduce the variability of inflation while maintaining the same mean.


U.S Headline CPI vs. Core CPI
Year-over-Year Percent Change
6%
5%
4%
3%
2%
1%
0%
-1%
-2%
-3%
92
94
96
98
00
02
04
06
08
10
12
14
16
CPI: May @ 1.0%
Core CPI: May @ 2.2%


Eurozone Consumer Price Inflation
Year-over-Year Percent Change
Core CPI: Mar @ 0.6%
CPI: Mar @ -0.1%
5%
4%
3%
2%
1%
0%
-1%
1997
1999
2001
2003
2005
2007
2009
2011
2013
2015


U.K. CPI and "Core" CPI
Year-over-Year Percent Change
CPI: Feb @ 0.0%
"Core" CPI Inflation: Feb @ 1.2%
6%
5%
4%
3%
2%
1%
0%
-1%
97
99
01
03
05
07
09
11
13
15


Mexican Consumer Price Index
Year-over-Year Percent Change
8%
7%
6%
5%
4%
3%
2%
1%
0%
CPI: Dec @ 2.1%
Core CPI: Dec @ 2.4%
04
05
06
07
08
09
10
11
12
13
14
15
16

I.11 Real and Nominal Interest Rates

To understand nominal and real interest rates we will focus on a simple asset: a one-period discount bond that pays one dollar for sure.

With a one-period bond, the nominal (real) return is the same as the nominal (real) interest rate, there are no capital gains or losses.

The goals of this analysis are (i) measure the nominal return on holding that bond (both actual and expected); (ii) measure the real return on holding that bond (both actual and expected); (iii) show the relationship between the bond price and the nominal interest rate.

Notation:

q_t = price of a one-period discount bond in period t

P_t = price level in period t

π_t = actual inflation rate from period t to period t+1

= $(P_{t+1} - P_t) / P_t = (P_{t+1}/P_t) - 1$

i_t = actual nominal return from period t to period t+1

r_t = actual real return from period t to period t+1

P^e_{t+1} = price level in period t+1, expected in period t

π^e_t = inflation rate from period t to period t+1, expected at period t

= $(P^e_{t+1} - P_t) / P_t = P^e_{t+1}/P_t - 1$

i^e_t = nominal return from period t to period t+1, expected at period t

r^e_t = real return from period t to period t+1, expected at period t

In what follows, the following simplifications are used; they follow directly from the above definitions of actual and expected inflation

$1+ \pi_t = P_{t+1}/P_t$ so that $1/(1+ \pi_t) = P_t/P_{t+1}$ and

$1+\pi^e_t = P^e_{t+1}/P_t$ so that $1/(1+\pi^e_t) = P_t/P^e_{t+1}$

Actual Nominal Return: the rate at which money is transferred across time

$1 period t $\Rightarrow (1/q_t)$ bonds period t $\Rightarrow \$(1/q_t)$ period t+1

$i_t = [(1/q_t) - 1]/1 = 1/q_t - 1$

$1+ i_t = 1/q_t$ (1)

The nominal interest rate and bond prices move in opposite directions.

Actual Real Return: the rate at which goods are transferred across time

1 good period t $\Rightarrow \$P_t$ period t $\Rightarrow (P_t/q_t)$ bonds period t $\Rightarrow \$(P_t/q_t)$ period t+1

$\Rightarrow P_t/(q_tP_{t+1})$ goods period t+1 $= (1/q_t)(P_t/P_{t+1}) = (1+ i_t)/(1+ \pi_t)$ goods period t+1

$r_t = [(1+ i_t)/(1+ \pi_t) - 1]/1.$

Adding 1 to each side yields,

$(1+ r_t) = (1+ i_t)/(1+ \pi_t)$ or

$(1+ i_t) = (1+ r_t)(1+ \pi_t).$ (2)

Sometimes this is expressed as

$i_t = r_t + \pi_t.$ (3)

or equivalently,

$r_t = i_t - \pi_t.$ (3')

Equations (3) and (3') can be thought of as an approximation to (2), since $r_t \pi_t$ (which is the term included in equation (2) and excluded in equation (3)) will likely be a small number.

Alternatively, equations (3) and (3') can be viewed as an exact relation when interest rates and inflation rates are expressed as "continuously compounded" rates, as opposed to "simple" rates.

Simple rates are calculated as (end-start)/start). Continuously compounded are calculated as ln (end/start), where ln represents the natural log. Thus, continuously compounded inflation is defined as ln (P_{t+1}/P_t), the continuously compounded, actual, nominal interest rate is ln $(1/q_t)$, and the continuously compounded, actual real interest rate is ln $[(1/q_t) (P_t/P_{t+1})]$.

Equations (1) - (3) involve actual returns and inflation, however economic behavior is often governed by expected returns and inflation.

Expected Nominal Return: rate at which money is expected to be transferred across time

$1 period t $\Rightarrow (1/q_t)$ bonds period t $\Rightarrow$ expect $\$(1/q_t)$ period t+1

$$i^e_t = [(1/q_t) - 1]/1 = 1/q_t - 1 = i_t \qquad (4)$$

Since the bond is riskless in its dollar payoff, the expected nominal return is the same as the actual nominal return.

Expected Real Return: rate at which goods are expected to be transferred across time

1 good period t $\Rightarrow \$P_t$ period t $\Rightarrow (P_t/q_t)$ bonds period t $\Rightarrow$ expect $\$(P_t/q_t)$ period t+1
$\Rightarrow$ expect $P_t/(q_t P^e_{t+1})$ goods period t+1 = expect $(1/q_t)/(1+\pi^e_t)$ goods period t+1

$r^e_t = [(1/q_t)/(1+\pi^e_t) - 1]/1.$

Adding 1 to each side, using (4) to substitute for $(1/q_t)$, and multiplying both sides by $(1+\pi^e_t)$ yields,

$$(1+i^e_t) = (1+r^e_t)(1+\pi^e_t). \qquad (5)$$

This is often approximated by

$$i^e_t = r^e_t + \pi^e_t. \qquad (6)$$

or equivalently,

$$r^e_t = i^e_t - \pi^e_t. \qquad (6')$$

Thus, the relation between expected returns and expected inflation takes the same form as the relation between actual returns and actual inflation derived in equations (2), (3) and (3').

Equations (2), (4), and (5) can be used to relate expected and actual real returns. Namely,

$$(1+ r_t)(1+ \pi_t) = (1+r^e_t)(1+\pi^e_t)$$

so that $r_t = r^e_t + (\pi^e_t - \pi_t) + r^e_t \pi^e_t - r_t \pi_t$

or as an approximation

$$r_t = r^e_t + (\pi^e_t - \pi_t) \qquad (7)$$

If inflation turns out to be just what people expected, expected and actual real returns are the same. When inflation turns out to be higher than expected, actual real returns are forced below expected real returns.

If the nominal return was also uncertain, equation (7) would generalize to

$$r_t = r^e_t + (\pi^e_t - \pi_t) + (i_t - i^e_t) \qquad (8)$$

We have discussed measuring actual inflation. How one measure does expected inflation?

1. Survey people to see what they say they expect. *The Economist* publishes inflation forecasts from professional forecasters. A major concern with survey data is, do respondents take the surveys seriously enough to answer accurately?

2. Tie inflation to economic fundamentals. Use the past history of actual inflation, core inflation, or median inflation; augment this information with past history of money growth or possibly output growth. A major concern with this approach is, are people smart enough to build a reliable, stable forecasting equation?

3. Use the spread on nominal vs. inflation indexed securities (watch out for risk premia and liquidity premia) or CPI futures. See Simon Kwan, **Inflation Expectations: How the Market Speaks**, *Federal Reserve Bank of San Francisco – Economic Letter*, October 3, August 2005 and Jens Christensen, **TIPS and the Risk of Deflation**, *Federal Reserve Bank of San Francisco – Economic Letter*, October 25, August 2010. A major concern with this approach is, do people who actively participate in financial markets have the same expected inflation as people who do not participate?

Key Point: The expected real interest rate (r^e) is the expected relative price of consumption today in terms of consumption tomorrow. When r^e increases, buying one unit of consumption today means expecting to give up more consumption in the future. Thus, a higher r^e means consumption today is expected to be more expensive relative to consumption tomorrow.

Great Exam Question: True, False or Uncertain - An increase in expected inflation means people should buy now when things are cheap, buy before prices rise. They should shift consumption forward in time, consume more now and less in the future.

Great Exam Answer: Uncertain. It depends on what happens to the nominal interest rate.

If the nominal interest rate rises one-for-one with expected inflation, then the expected real interest rate doesn't change and the price of current consumption relative to future consumption is unaffected; there is no incentive to shift consumption.

If the nominal interest rate does not rise by this much then real interest rates fall, current consumption is cheaper and there is an incentive to buy now.

If the nominal interest rate rises by more than expected inflation rises then the expected real rate rises, current consumption is more expensive, and there is an incentive to delay consumption.

Also, a change in the expected real interest rate is a change in a relative price. That means there are two effects on demand when the expected real interest rate changes.

What are they? An income effect and a substitution effect.

The analysis in the question only covers the substitution effect; it ignores the income effect.

I.12 The Calculation of Real and Nominal Budget Deficits

Often, the discussion of budget deficits contains no explicit role for interest payments on government debt; they are simply included in transfer payments. Making interest payments explicit can be important because standard national income account measures of budget deficits can be quite misleading.

In what follows, the nature of the bonds we consider changes slightly. Rather than a bond selling for $\$q_t$ in period t and paying \$1 in period t+1, the bond will sell for \$1 in period t and pay $\$(1+i_t)$ in period t+1. Note that the nominal return on this bond is still i_t. For the purposes of exposition, I will assume no uncertainty so that expected and actual inflation are equal, as are expected and actual nominal and real interest rates.

Notation:

B_t = number of government bonds issued/outstanding at end of period t

i_t = nominal return earned by holding B_t

r_t = real return earned by holding B_t

P_t = price of goods in period t

π_t = $(P_{t+1} - P_t)/P_t$ is inflation rate from period t to period t+1

TR_t = nominal transfers by the government in period t, net of interest payments

G_t = nominal purchases by the government in period t

TA_t = nominal tax revenues for the government in period t

The government faces the following budget constraint, expressed in nominal terms:

$$G_t + TR_t + (1+i_{t-1})B_{t-1} = TA_t + B_t \qquad (\#1)$$

This budget constraint is unambiguously true and must be satisfied at all times.

The standard national income accounts version of the nominal government budget deficit is

$$G_t + TR_t - TA_t + i_{t-1}B_{t-1} , \qquad (\#2)$$

which, from equation (#1), is just $B_t - B_{t-1}$. In other words, the standard national income accounts measure of the nominal budget deficit is how much the nominal stock of debt increased.

An alternative version of the government budget deficit, done in real terms, is the change in the real net indebtedness of the government: $(B_t/P_t) - (B_{t-1}/P_{t-1})$. Using equation (#1), this can be rewritten as

$$(B_t/P_t) - (B_{t-1}/P_{t-1}) =$$
$$[G_t + TR_t - TA_t + (1+i_{t-1})B_{t-1}]/P_t - (B_{t-1}/P_{t-1}) =$$
$$(G_t + TR_t - TA_t)/P_t + B_{t-1}\,[(1+i_{t-1})/P_t - (1/P_{t-1})] =$$
$$(G_t + TR_t - TA_t)/P_t + (B_{t-1}/P_{t-1})\,[(1+i_{t-1})P_{t-1}/P_t - 1] =$$

$$(G_t + TR_t - TA_t)/P_t + r_{t-1}(B_{t-1}/P_{t-1}) \qquad (\#3)$$

Equation (#3) implies that the alternative version of the nominal budget deficit, computed by multiplying the real deficit by the price level, is,

$$G_t + TR_t - TA_t + P_t r_{t-1}(B_{t-1}/P_{t-1}) =$$
$$G_t + TR_t - TA_t + r_{t-1}(1+\pi_{t-1})B_{t-1} =$$

$$G_t + TR_t - TA_t + i_{t-1}B_{t-1} - \pi_{t-1}B_{t-1} \qquad (\#4)$$

What is the difference between the standard measure of the nominal budget deficit and the alternative measure? A comparison of equations (#2) and (#4) shows that the alternative measure includes all the terms of the standard measure plus "the inflation adjustment". This inflation adjustment can be interpreted as the change in the value of government debt due to inflation. In times of positive inflation and for a government that has a positive stock of debt outstanding, this leads the standard measure of the nominal government budget to overstate the size of the budget deficit or understate the size of the budget surplus.

Put another way, in times of positive inflation, a country whose government has a positive stock of outstanding debt can continually run a nominal budget deficit according to the standard definitions and yet may actually be reducing its debt in real terms!

According to Table B87 in the 2013 Economic Report of the President, at the end of 2010 the U.S. Treasury had $12.968 trillion of non-inflation protected debt outstanding. Table B89 reports that at the end of 2010 the Fed and Intergovernmental Agencies were holding $5.656 trillion of U.S. Treasury debt. Assuming all the debt held by the Fed and Intergovernmental Agencies was non-inflation protected, implies that there was $7.312 trillion of non-inflation indexed U.S. Treasury debt privately held at the end of 2010.

The GDP implicit price deflator rose by 1.97% in 2011. Thus, the inflation adjustment for the 2011 federal budget is .0197 * $7.312 trillion = $144 billion.

This compares to a reported federal deficit of $1.237 trillion for 2011. In other words, the inflation adjustment is over 10% (11.6% to be exact) of the reported 2011 federal budget deficit.

Homework Problem 1:

A. Consider a closed economy (one that does not trade with the rest of the world) that has two firms and the following information:

Orange Inc			**Juice Inc**	
Outlays	$20,000		Outlays	$37,000
Wages	$15,000		Wages	$10,000
Taxes	$5,000		Taxes	$2,000
			Oranges	$25,000
Revenues	$35,000		Revenues	$40,000
Sales to Public	$10,000		Sales to Public	$40,000
Sales to Juice Inc	$25,000			

i) Calculate GDP using the Value Added method, showing each component
ii) Calculate GDP using the Final Sales method, showing each component
iii) Calculate income, showing each component and that income equals GDP
iv) Calculate spending, showing each component and that spending equals GDP

B. Consider an open economy (one that does trade with the rest of the world) that has two firms and the following information:

Orange Inc			**Juice Inc**	
Outlays	$20,000		Outlays	$52,000
Wages	$15,000		Wages	$12,000
Taxes	$5,000		Taxes	$3,000
			Oranges	$25,000
			Cranberries	$12,000
Revenues	$35,000		Revenues	$60,000
Sales to Public	$10,000		Sales to Public	$60,000
Sales to Juice Inc	$25,000			
Cranberry Inc (Foreign)				
Outlays	£21,000			
Wages	£20,000			
Taxes	£1,000			
Revenues	£30,000			
Sales to Public (Foreign)	£10,000			
Sales to Public	£12,000			
Sales to Juice Inc	£8,000			
Sales to Public ($)	$18,000			
Sales to Juice Inc ($)	$12,000			

i) Calculate GDP using the Value Added method, showing each component
ii) Calculate GDP using the Final Sales method, showing each component
iii) Calculate income, showing each component and that income equals GDP
iv) Calculate spending, showing each component and that spending equals GDP

C. Consider an open economy (one that does trade with the rest of the world) that has three firms and the following information:

Orange Inc			**Juice Inc**	
Outlays	$20,000		Outlays	$52,000
Wages	$15,000		Wages	$12,000
Taxes	$5,000		Taxes	$3,000
			Oranges	$25,000
			Cranberries	$12,000
Revenues	$35,000		Revenues	$60,000
Sales to Public	$10,000		Sales to Public	$60,000
Sales to Juice Inc	$25,000			
Cranberry Inc (Foreign)			**Tangerine Inc**	
Outlays	£21,000		Outlays	$6,000
Wages	£20,000		Wages	$5,000
Taxes	£1,000		Taxes	$1,000
Revenues	£30,000		Revenues	$35,000
Sales to Public (Foreign)	£10,000		Sales to Public (Foreign)	$10,000
Sales to Public	£12,000		Sales to Jugo Inc (Foreign)	$25,000
Sales to Juice Inc	£8,000			
Sales to Public ($)	$18,000			
Sales to Juice Inc ($)	$12,000			

i) Calculate GDP using the Value Added method, showing each component
ii) Calculate GDP using the Final Sales method, showing each component
iii) Calculate income, showing each component and that income equals GDP
iv) Calculate spending, showing each component and that spending equal GDP

Homework Problem 2:

Consider a closed economy (one that does not trade with the rest of the world) that has two firms and the following information:

Orange Inc			**Juice Inc**	
Outlays	$20,000		Outlays	$37,000
Wages - Non R&D	$11,000		Wages - Non R&D	$8,000
Wages - R&D	$4,000		Wages - R&D	$2,000
Taxes	$5,000		Taxes	$2,000
			Oranges	$25,000
Revenues	$35,000		Revenues	$40,000
Sales to Public	$10,000		Sales to Public	$40,000
Sales to Juice Inc	$25,000			

(i) Calculate GDP using the value added method, first the old way in which in R&D was treated as a cost of production and then the new way in which R&D expenditures add to the stock of knowledge.

(ii) Calculate income by component, first the old way in which in R&D was treated as a cost of production and then the new way in which R&D expenditures add to the stock of knowledge.

(iii) Calculate spending by component, first the old way in which in R&D was treated as a cost of production and then the new way in which R&D expenditures add to the stock of knowledge.

Homework Problem 3:

Consider the following data for two economies,

	Economy 1	**Economy 2**
Government Spending Without Interest (G_t)	100	100
Initial Debt (B_{t-1})	1000	1000
Inflation Rate (π_{t-1})	.00	.10
Nominal Interest Rate (i_{t-1})	.02	.12
Taxes (TA_t)	120	120
Price Level (P_t)	1.0	1.0

(i) What is the standard measure of the nominal deficit for period t in each country?

(ii) Show that the real value of outstanding government debt has not changed from period t-1 to period t in either economy, so that the difference in standard measures of the government budget deficit can be a misleading indicator of fiscal responsibility.

(iii) Using the alternative measure of the nominal deficit, verify that each country is running a balanced budget.

Homework Problem 4: Consider a company that begins the year with $20 million in company debt (all in one-year bonds), is in possession of assets worth $50 million, and during the year generates $100 million in revenues and incurs costs (including interest payments on the debt) of $101 million. During the year the GDP deflator moved from 200 to 212 and there was a 6% nominal appreciation of company's $50 million assets. How profitable was the company during the year in real terms and how does this compare to the difference between revenues and costs?

Answers to Homework Problem 1

A.

GDP	**$50,000**		**GDP**	**$50,000**
Value Added Orange Inc	$35,000		Final Sales - Orange Inc	$10,000
Value Added Juice Inc	$15,000		Final Sales - Juice inc	$40,000
Income	**$50,000**		**Spending**	**$50,000**
Wages Orange Inc	$15,000		Consumption - Oranges	$10,000
Profits Orange Inc	$20,000		Consumption - Juice	$40,000
Wages Juice Inc	$10,000			
Profits Juice Inc	$5,000			

B.

GDP	**$58,000**		**GDP**	**$58,000**
Value Added Orange Inc	$35,000		Final Sales - Orange Inc	$10,000
Value Added Juice Inc	$23,000		Final Sales - Juice inc	$60,000
			- Imports (Intermediate Goods)	-$12,000
Income	**$58,000**		**Spending**	**$58,000**
Wages Orange Inc	$15,000		Consumption - Oranges	$10,000
Profits Orange Inc	$20,000		Consumption - Juice	$60,000
Wages Juice Inc	$12,000		Consumption - Cranberries	$18,000
Profits Juice Inc	$11,000		- Imports (Final Goods)	-$18,000
			- Imports (Intermediate Goods)	-$12,000

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GDP	**$93,000**		**GDP**	**$93,000**
Value Added Orange Inc	$35,000		Final Sales - Orange Inc	$10,000
Value Added Juice Inc	$23,000		Final Sales - Juice inc	$60,000
Value Added Tangerine Inc	$35,000		Final Sales - Tangerine Inc	$10,000
			Exports (Intermediate Goods)	$25,000
			- Imports (Intermediate Goods)	-$12,000
Income	**$93,000**		**Spending**	**$93,000**
Wages Orange Inc	$15,000		Consumption - Oranges	$10,000
Profits Orange Inc	$20,000		Consumption - Juice	$60,000
Wages Juice Inc	$12,000		Consumption - Cranberries	$18,000
Profits Juice Inc	$11,000		Exports (Final Goods)	$10,000
Wages Tangerine Inc	$5,000		Exports (Intermediate Goods)	$25,000
Profits Tangerine Inc	$30,000		- Imports (Final Goods)	-$18,000
			- Imports (Intermediate Goods)	-$12,000

Answers to Homework Problem 2

OLD			**NEW**	
GDP	**$50,000**		**GDP**	**$56,000**
Value Added Orange Inc	$35,000		Value Added Orange Inc	$39,000
Value Added Juice Inc	$15,000		Value Added Juice Inc	$17,000
Spending	**$50,000**		**Spending**	**$56,000**
Consumption - Oranges	$10,000		Consumption - Oranges	$10,000
Consumption - Juice	$40,000		Consumption - Juice	$40,000
			Investment - Orange Inc	$4,000
			Investment - Juice Inc	$2,000
Income	**$50,000**		**Income**	**$56,000**
Wages Orange Inc	$15,000		Wages Orange Inc	$15,000
Profits Orange Inc	$20,000		Profits Orange Inc	$24,000
Wages Juice Inc	$10,000		Wages Juice Inc	$10,000
Profits Juice Inc	$5,000		Profits Juice Inc	$7,000

Answers to Homework Problem 3

(i) For economy 1 we get 100 + .02*1000 - 120 = 0, i.e. no deficit.

For economy 2 we get 100 + .12*1000 - 120 = 100, i.e. a deficit of 100.

(ii) With no inflation, $P_{t-1} = P_t = 1.0$ in economy 1. With no issue of new debt in period t, $B_t = B_{t-1} = 1000$. Thus $B_t/P_t = B_{t-1}/P_{t-1} = 1000$.

With inflation of 10% in economy 2, $P_{t-1} = P_t/1.1 = 1/1.1$. With an issuance of 100 in new debt in economy 2, $B_t = B_{t-1} + 100 = 1100$. Thus $B_t/P_t = 1100/1$ while $B_{t-1}/P_{t-1} = 1000/(1/1.1) = 1100/1 = B_t/P_t$. There is no change in the real value of government debt.

(iii) For economy 1 we get 100 + .02*1000 - 120 - 0*1000 = 0, i.e. no deficit.

For economy 2 we get 100 + .12*1000 - 120 - .10*1000 = 0, i.e. no deficit.

Answer to Homework Problem 4

Based on the approach followed in these notes, let's look at the change in the real net assets of the company. At the beginning of the year the firm has $50 million in assets and $20 million in debt, making the value of net assets $30 million. At the end of the year the firm has assets worth $53 million (6% appreciation on $50 million) and debt of $21 million (assuming the $1 million excess of costs over revenues was covered by issuing $1 million of debt, though if it is financed by selling off assets the analysis is unchanged). This makes nominal net assets of the company $53 - $21 = $32 million, which in real terms (using the previous year as the base year) is $32/1.06 = $30.2 million. As a result, the real net assets of the company rose by $30.2 - $30 = $0.2 million, which equals the company's real profits.

How does this compare to the difference between revenues and costs? With costs $1 million greater than revenues it appears the company had negative profits, not the positive real profits calculated above. The difference, of course, is change in the real value of the company debt. With debt up 5% (from $20 million to $21 million) and inflation of 6% (the deflator went from 200 to 212), the real value of the debt fell. And, furthermore the real value of the debt fell by more than the operating losses, making the company profitable when all things are considered.

Checking the numbers, the corrected profit calculation would be revenues – costs + inflation * outstanding debt = 100 – 101 + .06*20 = -1 + 1.2 = $0.2 million.

Note, the current example abstracted from any real appreciation or depreciation of the company's assets since they appreciated by 6%, the same as the inflation rate. If the value of the company's assets changed by a different amount, that would change the above calculation and the formula for calculating profits would need to be generalized to include for this effect.