

## Problem Set #1: Macroeconomic Data

Revised: February 27, 2013

*You may do this assignment in a group. Whatever you hand in should be the work of your group and include the names of all of the contributors.*

1. National accounts in Margaritaville (40 points). Jimmy Buffett has decided to apply for membership in the European Union on behalf of his newly sovereign nation, Margaritaville. As part of his application, he must provide the EU technocrats with a complete set of national accounts. You have been hired as the Chief National Accountant. Your first day on the job, you receive an official Coral Reefer Crew<sup>TM</sup> t-shirt and the following information about local economic activity:

- Local Cheeseburger in Paradise<sup>TM</sup> cafes sold \$55,000 worth of cheeseburgers to local consumers. Their expenses were: imported beef and sesame seeds (\$10,000), locally produced catsup (\$10,000), wages and benefits (\$22,000), and rent (\$3,000). Hint: you will need to compute the profit earned by the cafes.
- Local tomato growers sold \$8,000 worth of tomatoes to domestic catsup producers and exported another \$3,000 to the US. They paid land rent (\$1,000) and wages (\$9,000).
- Local producers of the Margaritaville Frozen Concoction Maker<sup>TM</sup> sold \$100,000 worth of blenders; 40% were exported to Europe, the remainder to local consumers. Their expenses were \$15,000 worth of imported metal, \$15,000 for a new CNC machine imported from Germany, and \$70,000 in wages.
- The domestic catsup industry sold \$10,000 worth of product to local cafes. They purchased \$8,000 worth of tomatoes from domestic growers and paid \$2,000 in wages.
- The newly-formed government collected \$10,000 in taxes from its citizens and paid \$10,000 to government regulators, who oversee food and beverage safety.

Your mission is to use this raw data to construct national income and product accounts for Margaritaville. Specifically:

- (a) Compute the value-added of each production unit. What is GDP? (10 points)

- (b) Compute GDP and its expenditure components (consumption, investment, government purchases of goods and services, exports, and imports). (10 points)
- (c) What are saving and investment? Why are they different? Where does the difference go? (10 points)
- (d) Jimmy looks over your calculation in (a) and is worried that you made a mistake. Over a couple Land Shark Lagers<sup>TM</sup> you explain to him that GDP can be computed three different ways: the sum of value-added across production units (Gross Domestic Product), the sum of expenditure components (Gross Domestic Expenditure), and the sum of payments to labor and capital (Gross Domestic Income). You do the remaining one, payments to labor and capital, and show him that you get the same answer. He buys you a margarita to show his appreciation. (10 points)

**Solution:** It's easiest to do the whole thing on a spreadsheet — see the link on the course website. The idea is to calculate value added, income, and final sales, as we did in class. It includes government production, which is valued at cost (income = value added), investment, which is not counted as an expense, and imports.

(a) Here's a quick overview of value added by producer:

- Cafes: Value added comes from sales of 55 minus intermediate goods of 20, which gives you value-added of 35. On the income side this corresponds to 22 to labor, 3 in rent, and 10 of profit to the owner.
- Tomatoes: Value added is 11, which equals income of 11 (9 to labor, 1 to rent, 1 of profit).
- MFCM: Value added is sales of 100 minus the 15 of metal, for a total of 85. By convention, we do not include the 15 of new machines as an expense, because it's an investment in new plant and equipment. On the income side, that consists of wages of 70 and profit of 15.
- Catsup: Revenue of 10 minus intermediate inputs of 8 gives us value-added of 2, which is paid as wages.
- Government. Wages of 10 count (by convention) as value added of 10, all of it income to government workers.

Adding it all up gives us GDP of 143.

(b) Expenditures are

- Cafes: All of the sales revenue is final sales to consumers. How do we handle the input of imported beef and seeds? One approach is

to put a 10 in imports, which therefore makes a negative contribution to expenditures on (our) GDP. The approach we follow in the spreadsheet is to introduce an extra production unit which sells beef and seeds to us. They give us the same answer.

- Tomatoes: Only the exports of 3 counts as final sales, the rest is an input to the catsup producer.
- MFCM: Final sales includes consumption of 60, exports of 40, imports of 30, and investment of 15. The investment really goes with the foreign machine producer, which is how it's listed in the spreadsheet: an investment of 15 and an import of 15. As with the seed producer, we note this with a separate column.
- Catsup: None of it counts as final sales, since it's sold to cafes and used by them as an intermediate product (an input).
- Government. Government purchases are 10: by convention, it "purchases" what it produces.

Add it all up gives us the expenditure identity:

$$Y(\text{GDP} = 143) = C(115) + I(15) + G(10) + NX(43 - 407).$$

- (c) From above,  $S = Y - C - G = 18$  and  $I = 15$ . Net exports  $NX = 3$  accounts for the difference:  $S = I + NX$ . In this case, it means we are contributing 3 to foreign capital markets: domestic saving is more than we need to finance domestic investment, so we send the rest abroad.

- (d) Value added by production unit, in the order they appear in the question:

$$\text{Value added} = 33 + 10 + 85 + 2 + 10 = 140.$$

- (e) The only one we're missing is income, which (of course) is the same as value added. Summing again across production units in order of appearance:

$$\text{Gross Domestic Income} = 35 + 11 + 85 + 2 + 10 = 143.$$

Thus we have three ways to get the same number: value added, income, and expenditures. The numbers are all the same, so we can drink our margarita in peace.

2. Inputs and outputs (20 points). Specify the most likely direct impact of each of the following on the components of the production function. Don't make this more complicated than it is: we're concerned here only with the impact on the

components of the production function.

- (a) A new office building in Wuhan, China. (5 points)
- (b) A reduction in the minimum wage that leads more people to work. (5 points)
- (c) A more efficient air-conditioning system to replace the old one in the Kaufman Management Center. (5 points)
- (d) A reduction in tariffs in Brazil on imported computer equipment. (5 points)

**Solution:** You may recall that the production function links output  $Y$  to inputs of capital  $K$  and labor  $L$  and productivity  $A$ :

$$Y = AK^{1/3}L^{2/3}.$$

- (a) An increase in capital, which should raise output, too.
- (b) An increase in labor, which should raise output.
- (c) If it's more efficient, then it will produce the same output with less energy use, so it's an increase in productivity, which should raise output. And it could raise productivity in other ways, too — say, we're more comfortable so we work harder.
- (d) This makes computer equipment cheaper, which should increase the capital stock and thus output. It could also raise productivity by giving Brazilian firms cheaper/better access to the best computer technology.

From a paper by Cole, Ohanian, Riascos, and Schmitz (“Latin America in the rearview mirror”) (rough paraphrase):

In 1977, Brazil embarked on a zero-quota policy that meant that only PCs and minicomputers produced by Brazilian-owned firms could be sold in Brazil. Moreover, the black market was not a practical choice for large firms. The policy insulated Brazilian computer producers from foreign competition and featured entry barriers to new Brazilian producers through a maze of bureaucratic requirements.

When the quota was lifted by President Collor in 1992, productivity in Brazil's computer industry rose dramatically and 6 of the top 10 firms selling in Brazil in the mid-1990s were Brazilian. Productivity of computer users also increased, as firms got access to better equipment at lower prices.

3. Investment and saving in China (40 points). China is well known for its unusually high saving and investment rates. Our mission here is to document both for the period since 1980.

We'll use the data in the spreadsheet linked to the course outline and posted at

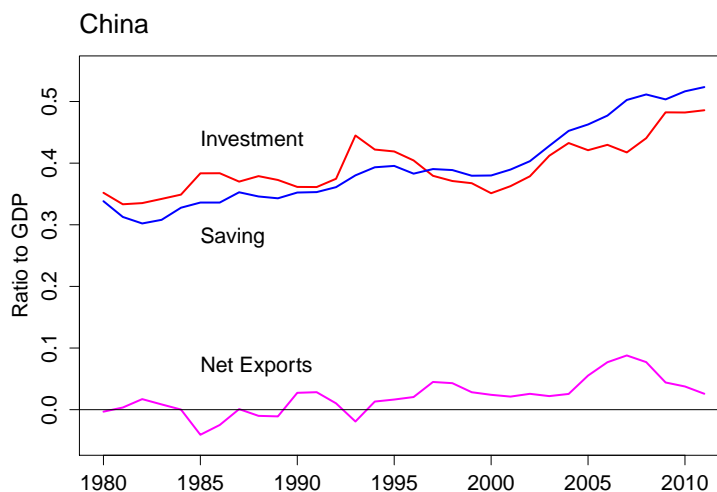
<http://pages.stern.nyu.edu/~dbackus/2303/ps1.q3.s13.xls>

The first sheet, **Data for Q3**, includes everything you need: GDP and its expenditure components at current prices. The second, **OECD source data**, is the data exactly as it comes from the OECD's Annual National Accounts database. It includes more categories and uses official data descriptions, which can be mysterious if you haven't seen them before.

- (a) Is "GDP at current prices" "real" or "nominal"? What does that mean anyway? (10 points)
- (b) Check the expenditure identity,  $Y = C + I + G + NX$ . Why isn't it satisfied here? (10 points)
- (c) Graph saving, investment, and net exports as ratios to GDP. As in class, we define saving as  $S = Y - C - G$ . (10 points)
- (d) Looking at your figure, how important are foreign sources of funds to Chinese investment? How can you tell? (10 points)

**Solution:**

- (a) When we measure something "at current prices" we say it's a nominal magnitude, measured in units of money. When we measure something instead "at constant prices," we say it's a real magnitude. All of the variation over time is in the quantities, because we're using the same prices at all dates. So real GDP measures the quantity of goods and services produced and nominal GDP measures their value (prices times quantity) in units of currency.
- (b) The expenditure identity doesn't quite work in this case, which means the data are internally inconsistent. The inconsistency is captured by a statistical discrepancy in this case, an official admission of the problem.
- (c) Here's the graph:



We're simply reminding ourselves of the connection between GDP and various combinations of expenditures. Specifically, in the notation we've used before:

$$S = Y - C - G = I + NX.$$

- (d) The point here is that net exports reflects international movements of capital. If  $NX > 0$ , as it has been recently, then we have more saving than investment, and the extra funds are invested abroad as a “capital outflow.” That’s the source of the “China is buying the US” talk you hear. Since capital is flowing out, foreign capital plays little role on average in financing Chinese investment. In fact, you can see from the figure that international capital flows (net exports) are small relative to both saving and investment.