1 Introduction

This set of notes describes the construction and properties of some basic macroeconomic data and statistics. Included are discussions of GDP and its components, the consumer price index, and a variety of labor market indicators.

2 Calculating GDP

Gross domestic product (GDP) is the current dollar value of all final goods and services that are produced within a country within a given period of time. “Goods” are physical things that we consume (like a shirt) while “services” are intangible things that we consume but which are not necessarily physical (like education). “Final” means that intermediate goods are excluded from the calculation. For example, rubber is used to produce tires, which are used to produce cars. We don’t count the rubber or the tires in GDP, as these are not final goods – people do not use the tires independently of the car. The value of the tires is subsumed in the value of the car – counting both the value of the tires and the value of the car would “double count” the tires, so we only look at “final” goods. “Current” means that the goods are valued at their current period market prices (more on this below in the discussion of the distinction between “real” and “nominal”).

GDP is frequently used as a measure of the standard of living in an economy. There are many obvious problems with using GDP as a measure of well-being – as defined, it does not take into account movements in prices versus quantities (see below); the true value to society of some goods or services may differ from their market prices; GDP does not measure non-market activities, like leisure (or things that are illegal); it does not say anything about the distribution of resources among society; etc. Nevertheless, other measures of well-being have issues as well, so we’ll focus on GDP.

Let there be \( n \) total goods and services in the economy – for example, candy bars (a good), haircuts (a service), etc. Denote the quantities of each good produced in year \( t \) by \( y_{i,t} \) for \( i = 1, 2, \ldots, n \) and prices by \( p_{i,t} \) for \( i = 1, 2, \ldots, n \). GDP in year \( t \) is the sum of prices times quantities:
\[ GDP_t = p_1 y_{1,t} + p_2 y_{2,t} + \cdots + p_n y_{n,t} = \sum_{i=1}^{n} p_i y_{i,t} \]

As defined, GDP is a measure of total production in a given period (say a year). It must also be equal to total income in a given period. The intuition for this is that the sale price of a good must be distributed as income to the different factors of production that went into producing that good – i.e. wages to labor, profits to entrepreneurship, interest to capital (capital is some factor of production that has to itself be produced and is not used up in the production process), etc. For example, suppose that an entrepreneur has a company that uses workers and chain-saws to produce firewood. Suppose that the company produces 1000 logs at $1 per log; pays its workers $10 per hour and the workers work 50 hours; and pays $100 to the bank, from which it got a loan to purchase the chain-saw. Total payments to labor are $500, interest is $100, and the entrepreneur keeps the remaining $400 as profit. The logs contribute $1000 to GDP, $500 to wages, $100 to interest payments, and $400 to profits, with $500 + $100 + $400 = $1000.

The so-called “expenditure” approach to GDP measures GDP as the sum of consumption, investment, government expenditure, and net exports (exports, stuff we produce and sell to foreigners, minus imports, stuff produced by foreigners and bought by us). Formally:

\[ GDP_t = C_t + I_t + G_t + (X_t - IM_t) \]  

(1)

Loosely speaking, there are four broad actors in an aggregate economy: households, firms, government (federal, state, and local), and the rest of the world. Stuff that households purchase – food, gas, cars, etc. – counts as consumption. Firms produce stuff. Their expenditures on new capital, which is stuff that is used to produce new goods (like a bulldozer in the example above), is what we call investment. Government expenditures (or sometimes government spending) includes all stuff government spends on either buying goods produced (like bulldozers, machine guns, etc.) or money it spends to provide goods or services (paying workers to build roads, paying soldiers to provide defense, etc.). The latter half – basically counting government payments to workers as expenditure – is making use of the fact that income = expenditure from above, as there is no other feasible way to “value” some government activities (like providing defense). This number does not include transfer payments (social security, Medicaid, etc.) and interest payments on debt from the government (which together amount to a lot). Finally, we add in net exports (more on this in a minute). In summary, what this identity says is that the value of all stuff produced, GDP$_t$, must be equal the sum of the expenditures by the different actors in the economy. In other words, the total value of production must equal the total value of expenditure. So we’ll use the words production, income, and expenditure somewhat interchangeably.

If we want to sum up expenditure to get the total value of production, why do we subtract off imports (IM in the notation above)? After all, GDP is a measure of production in a country in a given period of time, while imports measure production from other countries. The reason is because our notion of GDP is the value of stuff produced in a country; the expenditure categories
on the right hand side do not discriminate on where the good being purchased was produced. So, for example, suppose you purchase an imported Mercedes for $50,000. This causes $C$ to go up, but should not affect GDP. Since this was produced somewhere else, $IM$ goes up by exactly $50,000, leaving GDP unaffected. Similarly, you could imagine a firm purchasing a Canadian made bulldozer – $I$ and $IM$ would both go up in equal amounts, leaving GDP unaffected. You could also imagine the government purchasing foreign-produced warplanes ($G$ and $IM$ go up in equal amounts, leaving GDP unaffected).

There are a couple of other caveats that one needs to mention, both of which involve how investment is calculated. In addition to business purchases of new capital (again, capital is stuff used to produce stuff), investment also includes new residential construction and inventory accumulation. New residential construction is new houses. Even though households are purchasing the houses, we count this as investment. Why? At a fundamental level investment is expenditure on stuff that helps you produce stuff later in the future. A house is just like that – you purchase a house today (a “stock”), and it provides “flow” benefits for many years going forward into the future. There are many other goods that have a similar feature – we call these “durable” goods, things like cars, televisions, appliances, etc. At some level we ought to classify these as investment too, but for the purposes of national income accounting, they count as consumption. From an economic perspective they are really more like investment; it is the distinction between “firm” and “household” that leads us to put new durable goods expenditures into consumption. Inventory “investment” is the second slightly odd category. Inventory investment is the accumulation (or dis-accumulation) of unsold, newly produced goods. For example, suppose that a company produced a car in 1999 but did not sell it in that year. It needs to count in 1999 GDP since it was produced in 1999, but cannot count in 1999 consumption because it has not been bought yet. Hence, we put it in $I$ in 1999 – it counts as positive inventory investment. When the car is sold (say in 2000), consumption goes up, but GDP should not go up. Here inventory investment would go down in exactly the same amount of the increase in consumption, leaving GDP unaffected.

Below I plot the natural log of GDP across time, as well as the ratios of consumption, investment, government expenditure, and net exports to GDP. These data are quarterly and begin in 1947; you can download them for yourselves from the Bureau of Economic Analysis webpage (www.bea.gov). The data are also seasonally adjusted – unless otherwise noted, we want to look at seasonally adjusted data when making comparisons across time. The reason for this is that there are predictable, seasonal components to expenditure that would make comparisons between quarters difficult (and would introduce some systematic “choppiness” into the plots – download the data and see for yourself). For example, there are predictable spikes in consumer spending around the holidays, or increases in residential investment in the warm summer months.

When looking at aggregate series it is common to plot series in the natural log. This is nice because it means that we can interpret differences in the log across time as (approximately) percentage differences – reading off the vertical difference between two points in time is approximately the percentage difference of the variable over that period. For reasons we’ll discuss more in detail below, plotting GDP without making a “correction” for inflation makes the series look smoother.
than the “real” series actually is. To the eye, one observes that GDP appeared to grow at a fast rate in the 1970s than it did later in the 1980s and 1990s. This is at least partially driven by higher inflation in the 1970s (again, more on this below).

Figure 1: GDP and Its Components

Turning to the components of GDP, we see that consumption expenditures account for somewhere between 60-70 percent of total GDP, making consumption by far the biggest component of aggregate spending. This series has trended up a little bit over time; this upward trend is largely mirrored by a downward trend in net exports. At the beginning of the post-war sample we exported more than we imported, so that net exports were positive (but nevertheless still a small fraction of overall GDP). As we’ve moved forward into the future net exports have trended down, so that we now import more than we export. Investment is about 15 percent of total GDP. Even though this is a small component, visually you can see that it appears quite volatile relative to the other components. This is an important point to which we shall return later. Finally, government spending has been fairly stable at around 20 percent of total GDP. The large increase very early
in the sample has to do with the Korean War and the start of the Cold War.

3 Real versus Nominal

Subject to the caveat of GDP calculation below, in principle real prices are denominated in units of goods, whereas nominal prices are denominated in units of money. Money is anything which serves as a unit of account. As we’ll see later in the course, money solves a bartering problem and hence makes exchange much more efficient.

To make things clear, let’s take a very simple example. Suppose you only have one good, call it \( y \). People trade this good using money, call it \( M \). We’re going to set money to be the *numeraire*: it serves as a standard by which value is measured. Let \( p \) be the price of goods relative to money – \( p \) tells you how many units of \( M \) you need to buy one unit of \( y \). So, if \( p = 1.50 \), it says that it takes 1.50 units of money (say dollars) to buy a good. Suppose an economy produces 10 units of \( y \), e.g. \( y = 10 \), and the price of goods in terms of money is \( p = 1.50 \). This means that nominal output is 15 units of money (e.g. 1.50 \( \times 10 \), or \( py \)). It is nominal because it is denominated in units of \( M \) – it says how many units of \( M \) the quantity of \( y \) is worth. The real value is of course just \( y \) – that’s the quantity of goods, denominated in units of goods. To get the real from the nominal we just divide by the price level:

\[
\text{Real} = \frac{\text{Nominal}}{\text{Price}} = \frac{py}{p} = y
\]

Ultimately, we are concerned with real variables, not nominal variables. What we get utility from is how many apples we eat, not whether we denominate one apple as one dollar, 100 lira, or 1.5 euros.

Going from nominal to real becomes a little more difficult when we go to a multi-good world. You can immediately see why – if there are multiple goods, and real variables are denominated in units of goods, which good should we use to do the denominated? Suppose you have two goods, \( y_1 \) and \( y_2 \). Suppose that the price measured in units of money of the first good is \( p_1 \) and the price of good 2 is \( p_2 \). The nominal quantity of goods is:

\[
\text{Nominal} = p_1y_1 + p_2y_2
\]

Now, the real relative price between \( y_1 \) and \( y_2 \) is just the ratio of nominal prices, \( p_1/p_2 \). \( p_1 \) is “dollars per unit of good 1” and \( p_2 \) is “dollars per unit of good 2”, so the ratio of the prices is “units of good 2 per units of good 1”. In other words, the price ratio tells you how many units of good 2 you can get with one unit of good 1. For example, suppose the price of apples is \$5 and the price of oranges is \$1. The relative price is 5 – you can get five oranges by giving up one apple. You can, of course, define the relative price the other way as 1/5 – you can buy 1/5 of an apple with one orange.

We could define real output (or GDP) in one of two ways: in units of good 1 or units of good 2:
Real_1 = y_1 + \frac{p_2}{p_1} y_2 \quad \text{(Units are good 1)}

Real_2 = \frac{p_1}{p_2} y_1 + y_2 \quad \text{(Units are good 2)}

As you can imagine, this might become a little unwieldy, particularly if there are many goods. It would be like walking around saying that real GDP is 14 units of diet coke, or 6 cheeseburgers, or whatever. As such, we’ve adopted the convention that we use money as the numeraire and report GDP in nominal terms as dollars of output (or euros or lira or whatever).

But that raises the issue of how to track changes in GDP across time. In the example above, what if both \( p_1 \) and \( p_2 \) doubled between two periods, but \( y_1 \) and \( y_2 \) stay the same? Then nominal GDP would double as well, but we’d still have the same quantity of stuff. Hence, we want a measure of GDP that can account for this, but which is still measured in dollars (as opposed to units of one particular good). What we typically call “real” GDP in the National Income and Products Accounts is what is called “constant dollar GDP.” Basically, you arbitrarily pick a year as a baseline. Then in subsequent years you multiply quantities by base year prices. If year \( t \) is the base year, then what we call real GDP in year \( t + s \) is equal to the sum of quantities of stuff produced in year \( t + s \) weighted by the prices from year \( t \). This differs from nominal GDP in that base year prices are used instead of current year prices. Let \( Y_{t+s} \) denote real GDP in year \( t + s \), \( s = 0, 1, 2, \ldots \). Let there be \( n \) distinct goods produced. For quantities of goods \( y_{1,t+s}, y_{2,t+s}, \ldots, y_{n,t+s} \), we have:

\[
Y_t = p_{1,t} y_{1,t} + p_{2,t} y_{2,t} + \cdots + p_{n,t} y_{n,t}
\]

\[
Y_{t+1} = p_{1,t+1} y_{1,t+1} + p_{2,t+1} y_{2,t+1} + \cdots + p_{n,t} y_{n,t+1}
\]

\[
Y_{t+2} = p_{1,t+2} y_{1,t+2} + p_{2,t+2} y_{2,t+2} + \cdots + p_{n,t} y_{n,t+2}
\]

From this we can implicitly define a price index (an implicit price index) as the ratio of nominal to real GDP in a given year:

\[
P_t = \frac{p_{1,t} y_{1,t} + p_{2,t} y_{2,t} + \cdots + p_{n,t} y_{n,t}}{p_{1,t} y_{1,t} + p_{2,t} y_{2,t} + \cdots + p_{n,t} y_{n,t}} = 1
\]

\[
P_{t+1} = \frac{p_{1,t+1} y_{1,t+1} + p_{2,t+1} y_{2,t+1} + \cdots + p_{n,t+1} y_{n,t+1}}{p_{1,t} y_{1,t+1} + p_{2,t} y_{2,t+1} + \cdots + p_{n,t} y_{n,t+1}}
\]

\[
P_{t+2} = \frac{p_{1,t+2} y_{1,t+2} + p_{2,t+2} y_{2,t+2} + \cdots + p_{n,t+2} y_{n,t+2}}{p_{1,t} y_{1,t+2} + p_{2,t} y_{2,t+2} + \cdots + p_{n,t} y_{n,t+2}}
\]

A couple of things are evident here. First, we have normalized real and nominal GDP to be the
same in the base year (which we are taking as year \( t \)). This also means that we are normalizing
the price level to be one in the base year (what you usually see presented in national accounts is
the price level multiplied by 100). Second, there is an identity here that nominal GDP divided by
the price level equals real GDP. If prices on average are rising, then nominal GDP will go up faster
than real GDP, so that the price level will rise.

A problem with this approach is that the choice of the base year is arbitrary, and it matters to
the extent to which the relative prices of goods vary over time. To deal with this issue, statisticians
have come up with a solution that they call chain-weighting. Essentially they calculate real GDP
in any two consecutive years (say, 1989 and 1990) two different ways: once using 1989 as the base
year, once using 1990 as the base year. Then they calculate the growth rate of real GDP between
the two years using both base years and take the average of the two growth rates. They then
assume that real GDP grew by the average of the two growth rates between the periods. Taking
one of the two years as the base year (say, 1990), they compute real GDP in 1989 by solving for the
level of real GDP in 1989 that would equal nominal GDP in 1990 if it grew by the average growth
rate of real GDP defined using both years as base years. Chain-weighting is a technical detail that
we need not concern ourselves with much in this course, but it does matter in practice, as relative
prices of goods have changed a lot over time. For example, computers are far cheaper in relative
terms now than they were 10 or 20 years ago.

For this course we will be dealing with models in which there is only one good – we’ll often
refer to it as fruit, but it could be anything. This is obviously an abstraction, but it’s a useful one.
With just one good, real GDP is just the amount of that good produced. Hence, as a practical
matter we won’t be returning to these issues of how to measure real GDP in a multi-good world.

Figure 2 below plots the log of real GDP across time in the left panel. Though considerably
less smooth than the plot of log nominal GDP in Figure 1, the thing that sticks out most from
this figure is the trend growth – you can approximate log real GDP pretty well across time with a
straight line, which, since we are looking at the natural log, means roughly constant trend growth
across time. I do this with the straight dashed line, which I call “trend.” The average growth rate
(log first difference) of nominal GDP from 1947-2011 was 0.016, or 1.6 percent. This translates into
an annualized rate (what is most often reported) of about 6 percent (approximately 1.6 × 4). The average growth rate of real GDP, in contrast, is significantly lower at about 0.008, or 0.8 percent
per quarter, translating into about 3.2 percent at an annualized rate. From the identities above,
we know that nominal GDP is equal to the price level times real GDP. From the math facts, we
know that the growth rate of a product is approximately equal to the sum of the growth rates.
This means that growth in nominal GDP should approximately equal growth in prices (inflation)
plus growth in real GDP. Figure 2 plots the log GDP deflator and inflation (the growth rate or log
first difference) in the right panel. On average inflation has been about 0.008, or 0.8 percent per
quarter, which itself translates to about 3 percent per year. Note that 0.008 + 0.008 = 0.016, so the
identity appears to work. Put differently, about half of the growth in nominal GDP is coming from
prices, and half is coming from increases in real output. It is worth pointing out that there has
been substantial heterogeneity across time in the behavior of inflation – inflation was quite high
and volatile in the 1970s but has been fairly low and stable since then.

Figure 2: Real GDP

![Real GDP and Trend](image)

Figure 3: GDP Deflator

![GDP Deflator and Inflation](image)

Turning our focus back to the real GDP graph, note that the blips are very minor in comparison to the trend growth. The right panel plots “detrended” real GDP, which is defined as actual log real GDP minus its trend (the straight line). The vertical gray shaded areas are “recessions” as defined by the National Bureau of Economic Research. There is no formal definition of a recession, but loosely speaking they define a recession as two or more quarters of a sustained slowdown in overall economic activity. For most of the recession periods, in the left plot we can see GDP declining if we look hard enough. But even in the most recent recession (official dates 2007q4 - 2009q2), the decline is fairly small in relation to the impressive trend growth. You can see the “blips” much...
more clearly in the right plot. During most of the observed recessions, real GDP falls by about 5 percent relative to trend (e.g. 0.05 points). The most recent recession really stands out in this respect, where we see GDP falling by more than 10 percent relative to trend.

A final thing to mention before moving on is that at least part of the increase in real GDP over time is due to population growth. With more people working, it is natural that we will produce more stuff. The question from a welfare perspective is whether there is more stuff per person. For this reason, it is also quite common to look at “per capita” measures, which are series divided by the total population (usually measured as the number of working age adults, e.g. 18-64). Population growth has been pretty smooth over time. Since the end of WW2 it has averaged about 0.003 per quarter, or 0.3 percent, which translates to about 1.2 percent per year. Because population growth is so smooth, plotting real GDP per capita will produce a similar looking figure to that shown in Figure 2, but it won’t grow as fast. Across time, the average growth rate of real GDP per capita has been 0.0045, 0.45 percent, or close to 2 percent per year. Doing a quick decomposition, we can approximate the growth rate of nominal GDP as the sum of the growth rates of prices, population, and real GDP per capita. This works out to 0.008 + 0.003 + 0.0045 = 0.0155 ≈ 0.016 per quarter, so again the approximation works out well. At an annualized rate, we’ve had population growth of about 1.2 percent per year, price growth of about 3.2 percent per year, and real GDP per capita growth of about 2 percent per year. Hence, if you look at the amount of stuff we produce per person, this has grown by about 2 percent per year since 1947. There are not many short run movements in population growth, so a plot of detrended GDP would look virtually the same whether you detrended actual real GDP or real GDP per capita.

4 The Consumer Price Index

The consumer price index (CPI) is another popular macro variable that gets mentioned a lot in the news. When news commentators talk about “inflation” they are usually referencing the CPI.

The CPI is trying to measure the same thing as the GDP deflator (the average level of prices), but does so in a conceptually different way. The building block of the CPI is a “market basket of goods.” The Bureau of Labor Statistics (BLS) studies buying habits and comes up with a “basket” of goods that the average household consumes each month. The basket includes both different kinds of goods and different quantities. The basket may include 12 gallons of milk, 40 gallons of gasoline, etc.

Suppose that there are $N$ total goods in the basket, and let $x_i$ denote the amount of good $i$ ($i = 1, \ldots, N$) that the average household consumes. The total price of the basket in any year $t$ is just the sum of the prices in that year times the quantities. Note that the quantities are held fixed and hence do not get time subscripts – the idea is to have the basket not change over time:

$$\text{Cost}_t = p_{1,t}x_1 + p_{2,t}x_2 + \cdots + p_{N,t}x_N$$

The CPI in year $t$, call it $P_t^{\text{cpi}}$, is the ratio of the cost of the basket in that year relative to the
cost of the basket in some arbitrary base year, \( b \):

\[
p_t^{\text{cpi}} = \frac{\text{Cost}_t}{\text{Cost}_b} = \frac{p_{1,t}x_1 + p_{2,t}x_2 + \cdots + p_{N,t}x_N}{p_{1,b}x_1 + p_{2,b}x_2 + \cdots + p_{N,b}x_N}
\]

As in the case of the GDP deflator, the choice of the base year is arbitrary, and the price level will be normalized to 1 in that year (in practice they multiply the number by 100 when presenting the number). The key thing here is that the basket – both the goods in the basket and the quantities – are held fixed across time (of course in practice the basket is periodically redefined). The idea is to see how the total cost of consuming a fixed set of goods changes over time. If prices are rising on average, the CPI will be greater than 1 in years after the base year and less than 1 prior to the base year (as with the implicit price deflator it is common to see the CPI multiplied by 100).

**Figure 4: CPI**

![Graph of CPI and CPI Inflation](image)

The figure above plots the log level of the CPI across time. It broadly looks similar to the GDP deflator – trending up over time, with an acceleration in the trend in the 1970s and something of a flattening in the early 1980s. There are some differences, though. For example, at the end of 2008 inflation as measured by the CPI went quite negative, whereas it only dropped to about zero for the GDP deflator. On average, the CPI gives a higher measure of inflation relative to the deflator and it is more volatile. For the entire sample, the average inflation by the GDP deflator is 0.8 percent per quarter (about 3.2 percent annualized); for the CPI it is 0.9 percent per quarter (about 3.6 percent annualized). The standard deviation (a measure of volatility) of deflator inflation is 0.6 percent, while it is 0.8 percent for the CPI.

The reason for these differences gets to the basics of how the two indices are constructed and what they are intended to measure. A simple way to remember the main difference is that the CPI fixes base year quantities and uses updated prices, whereas the deflator fixes base year prices and uses updated quantities. The fixing of quantities is one of the principal reasons why the CPI gives a higher measure of inflation. From micro we know that when relative prices change, people will
tend to substitute away from relatively more expensive goods and into relatively cheaper goods. By fixing quantities, the CPI does not allow for this substitution away from relatively expensive goods. To the extent to which relative prices vary across time, the CPI will tend to overstate changes in the price of the basket. It is this substitution bias that accounts for much of the difference between inflation as measured by the CPI and the deflator. There are other obvious differences – the CPI does not include all goods produced in a country, and the CPI can include goods produced in other countries. For getting a sense of overall price inflation in US produced goods, the GDP deflator is thus preferred. For getting a sense of nominal changes in the cost of living for the average household, the CPI is a good measure.

Chain weighting can also be applied to the CPI. As described above in the context of the GDP deflator, chain-weighting attempts to limit the influence of the base year. This is an attempt to deal with substitution biases in a sense because relative price changes will result in the basket of goods that the typical household consumes changing. Whether to chain-weight or not, and what kind of price index to use to index government transfer payments like Social Security is a potentially important political issue.

5 Measuring the Labor Market

One of the key statistics on which the financial press is focused is the labor market. This usually takes the form of talking about the unemployment rate, but there are other ways to measure the “strength” or “health” of the aggregate labor market.

What is relevant for how much an economy produces is how much total labor input there is. There are two dimensions along which we can measure labor input – the extensive margin (bodies) and the intensive margin (amount of time spent working per body). Define $L$ as the total population, $E$ as the number of people working (note that $E \leq L$), and $h$ as the average number of hours each working person works (we’ll measure the unit of time as an hour, but could do this differently, of course). Total hours worked, $N$, in an economy are then given by:

$$N = h \times E$$

Total hours worked is the most comprehensive measure of labor input in an economy. Because of differences and time trends in population, we typically divide this by $L$ to express this as total hours worked per capita (implicitly per unit of time, e.g. a year or a quarter). This measure represents movements in two margins – average hours per worker and number of workers per population. Denote hours per capita as $n = \frac{N}{L}$:

$$n = \frac{h \times E}{L}$$

Of course the most popular metric of the labor market in the press is the unemployment rate. To define the unemployment rate we need to introduce some new concepts. Define the labor force, $LF$, as everyone who is either (i) working or (ii) actively seeking for work. Define $U$ as the number
of people who are in the second category – looking for work but not currently working. Then:

\[ LF = E + U \]

Note that \( LF \leq L \). We define the labor force participation rate, \( lf \), as the labor force divided by the total population:

\[ lf = \frac{LF}{L} \]

Define the unemployment rate as the ratio of people who are unemployed divided by the labor force:

\[ u = \frac{U}{LF} = \frac{U}{U + E} \]

The figure below plot these different measures of the labor market: (i) log hours worked per capita in the US, \( n \); (ii) the unemployment rate; (iii) the labor force participation rate; (iv) average hours worked per person, \( h \); and (v) the employment-population ratio, \( \frac{E}{L} \). To get an idea for how these series vary with output movements, I have included NBER “recession dates” as indicated by the shaded gray bars.
A couple of observations are in order. First, hours worked per capita fluctuates around a roughly constant mean – in other words, there is no obvious trend up or down. This means that people are on average working about as much now as they did 50 years ago. But the measure of hours worked per capita masks two trends evident in its components. The labor force participation rate (and the employment-population ratio) have both trended up since 1950. This is largely driven by women entering the labor force. In contrast, average hours per worker has declined over time – this means that, conditional on working, most people work a shorter work week now than 50 years ago (the units in the figure are log points, but the average workweek itself has gone from something like 40 hours per week to 36). So the lack of a trend in total hours worked occurs because the extra bodies in the labor force have made up for the fact that those working are working less on average.

In terms of movements over the business cycle, these series display some of the properties you might expect. Hours worked per capita tends to decline during a recession. For example, from the end of 2007 (when the most recent recession began) to the end of 2009, hours worked per capita fell by about 10 percent. The unemployment rate tends to increase during recessions – in the most
recent one, it increased by about 5-6 percentage points, from around 5 percent to a maximum of 10 percent. Average hours worked tends to also decline during recessions, but this movement is small and does not stand out relative to the trend. The employment to population ratio falls during recessions, much more markedly than average hours. The labor force participation rate tends to fall during recessions (the discouraged worker phenomenon, to which we will return below), with this effect being particularly pronounced (and highly persistent) around the most recent recession.

In spite of its popularity, the unemployment rate is a highly imperfect measure of labor input. For a variety of reasons economists most often focus on hours worked per capita. The unemployment rate can move because (i) the number of unemployed changes or (ii) the number of employed changes, where (i) does not necessarily imply (ii). For example, the number of unemployed could fall if some who were officially unemployed quit looking for work, and are therefore counted as leaving the labor force, without any change in employment and hours. We typically call such workers “discouraged workers” – this outcome is not considered a “good” thing, but it leads to the unemployment rate falling. Another problem is that the unemployment rate does not say anything about intensity of work or part time work. For example, if all of the employed persons in an economy are switched to part time, there would be no change in the unemployment rate, but most people would not view this change as a “good thing” either. In either of these hypothetical scenarios, hours worked per capita is probably a better measure of what is going on in the aggregate labor market. In the case of a worker becoming “discouraged,” the unemployment rate dropping would be illusory, whereas hours worked per capita would be unchanged. In the case of a movement from full time to part time, the unemployment rate wouldn’t move, but hours per capita would reflect the downward movement in labor input. For these reasons unemployment is a difficult statistic to interpret. As a measure of total labor input, hours per capita is a preferred measure. As a measure of the extensive margin, the employment-population ratio is probably a better statistic than the unemployment rate.

For the most part in this class we are going to abstract from unemployment. We typically model the economy as consisting of “one” household, and we model this household as choosing how much it works. This is a simplifying assumption. Unemployment is also a “disequilibrium” phenomenon (people want to work but can’t for some reason), and so it requires some assumptions as to what prevents markets from clearing. For these reasons we will typically focus on average hours per capita as a measure of labor market strength.

References


