Macro Data with the FRED Excel Add-in

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Abstract: This working paper is intended to be a chapter in a forthcoming book, tentatively titled *Macroeconomics with Excel*. The printed book will be a manual for professors, while the Excel workbooks are freely available to students. See www.depauw.edu/learn/macroexcel for more information on this project.

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> Teaching economics is a very big responsibility these days. Right now is an especially difficult time to do a good job—particularly in teaching macroeconomics. That's partly because the subject itself is in a somewhat unsettled state and partly because there's always pressure to conform to current ideologies whether left or right, whether liberal or conservative.
> Robert M. Solow

There will always be controversy about content and delivery in teaching economics, but one thing we can all agree on is that we need to incorporate the latest data into a modern macroeconomics course. It is obvious that we want our students to be aware of historical trends and the current economic environment. The days of presenting a time series that has not been updated for several years are long gone. Computers and the internet have removed the constraint on obtaining and processing the latest data. We want examples that use current, real-world information so students acquire an understanding of and familiarity with measures of economic performance and financial statistics.

The internet offers an embarrassment of riches from which to obtain data. Many professors have favorite sources from blogs, aggregator sites, and government portals, such as BLS.gov, WorldBank.org, Penn World Tables, IMF.org, and GapMinder.org. We bookmark our favored sites and return to them to stay up-to-date on world affairs and build examples for lectures and assignments. We share these sites with our students and sometimes create detailed instructions on how to use them.

One major problem with teaching students how to access data from a particular website is that it will not remain constant over time. Web redesigns and changing URLs guarantee that our instructions and handouts will be obsolete almost as fast as they are created. This constant evolution of the web can also make updating an example or lecture handout a chore.

If several different sites are used, there is something to be said for exposing students to various interfaces, but the fixed costs of learning each site (especially if only occasionally accessed) can be quite high. For the professor who visits a site once a semester, it can be frustrating to have to remember how

to navigate a site or figure out a new interface. For the student who has never downloaded data, the process can be challenging and time-consuming.

While advanced statistical analysis is not appropriate for the typical intermediate macroeconomics course, we often want students to perform rudimentary computations (such as averaging or differencing) and plot variables over time. Some websites offer such capabilities, but often the data are downloaded and imported into Excel for further processing. Fortunately, many websites offer data packaged into Excel files or readable formats (e.g., comma- or tab-delimited), but it is inefficient to begin the process with a browser when the ending point will be Excel since Excel is perfectly capable of directly accessing the web.

The FRED Excel add-in offers an approach to data access that is both easy and powerful. Instead of learning how to use a variety of websites and then importing data into Excel, the add-in allows for direct access to the Federal Reserve Economic Data (FRED) website (research.stlouisfed.org) from within Excel, without using a browser. Once the basic functionality of the FRED add-in is mastered, the student can access variables from many different sources without having to learn each site's interface.

FRED's coverage is impressive. The add-in accesses a continually growing list of variables (over 100,000 as of this writing) in the FRED database, including all major macroeconomic variables on output, prices, employment, interest, and money for a variety of countries. Once your students learn how to use this add-in, a whole world of information is made available from within Excel.

Using FRED is also advantageous for instructors. Updating data for a lecture or handout, long the bane of a harried professor rushing off to class, requires a single click. In addition, there is no need to constantly review instructions and test last semester's URLs to make sure they still work.

While FRED contains data from a wide variety of sources, it does not carry every single variable in the source. For example, only headline items from the National Income and Product Accounts (NIPA) are available. It is possible, however, and demonstrated in the section on inflation, to merge data from an outside source into a spreadsheet with data downloaded from FRED.

This chapter shows how the FRED add-in can be used to access commonly used macro variables from several different sites. For each variable, the first screencast is the easiest, with basic downloads and analyses, and then more advanced work follows. While definitions and concepts are mentioned in the screencasts, it is expected that some kind of background source (e.g., a lecture, book, or handout) is being used to provide basic information.

The actual installation of the add-in is done once and should take no more than 15 minutes or so, including watching the five minute introductory video at research.stlouisfed.org/fred-addin. After the FRED add-in is installed, the *Quick Start* button in the FRED tab offers a brief summary of commands. The complete user's guide (for Windows computers) is available at research.stlouisfed.org/fred-addin/FRED_PC_Users_Guide.pdf. For a quick introduction to the FRED add-in, visit www.depauw.edu/learn/macroexcel/exceladdins/index.htm#FRED. Housing starts are used as an example to show how the FRED add-in works. This link can be sent to students unfamiliar with the add-in and they should be up and running fairly quickly.

The screencasts are created with a Windows computer, but there is a Mac version of the FRED Excel add-in. It is not as smooth as the Windows version, but it works and it is fairly easy to replicate the screencasts using Mac Excel.

The variables and screencasts in this chapter merely scratch the surface of the ways in which current economic conditions can be conveyed using FRED data. Instead of a static body of material that must be memorized, a better pedagogical strategy is to provide students with a tool that can be used to access and analyze information about the world around us. Developing data acquisition and critical thinking skills is vastly superior to the traditional textbook approach with dated tables and graphs.

Once the basic operation of the FRED add-in is mastered, downloading and analyzing data becomes routine. FRED's frequency aggregation button enables quick conversion to and from daily, monthly, quarterly, and annual data; and the data manipulation button makes it easy to compute percentage change year-on-year or at a compound annualized rate. Tasks which were incredibly time-consuming and error prone are made trivial. This may sound impossible, but students will use the FRED add-in to explore variables and answer questions on their own—without supervision or to fulfill a course

assignment. It absolutely invites search and inquiry. This alone is sufficient to include the FRED add-in throughout the economics curriculum.

Sources and Further Reading

The epigraph is from p. 65 of Solow, R. (1983). Teaching economics in the 1980s. *The Journal of Economic Education, 14*(2), pp. 65-68. Stable URL: http://www.jstor.org/stable/1182796. Solow's stress on the importance and difficulty of teaching economics, especially macroeconomics, applies today as well as it did in 1983. There is no reason to believe this will change in the foreseeable future.

A video series of short tutorials for using the FRED Excel add-in is available at fredqa.stlouisfed.org/2013/06/07/fred-video-series-from-nyu-stern.

"Okun's Law and FRED," at fredqa.stlouisfed.org/2012/03/28/okuns-law-and-fred shows how to download data from FRED to estimate Okun's famous relationship between unemployment and real GDP.

Help with FRED is here: research.stlouisfed.org/fred2/help-faq. Email stlsFRED@stls.frb.org for support. They respond quickly (usually in a few hours and at most within one business day).

The NIPAs trace their origin back to the 1930s, when the lack of comprehensive economic data hampered efforts to develop policies to combat the Great Depression. In response to this need, the U.S. Department of Commerce commissioned future Nobel Laureate Simon Kuznets to develop estimates of national income.

BEA Documentation

4.1 GDP

Quick Summary

To access *GDP.xls*, visit:
www.depauw.edu/learn/macroexcel/excelworkbooks/Data/GDP.xls.

GDP.xls explains how to use the FRED Excel add-in to access GDP data and offers several simple analyses using GDP. The focus is on understanding basic national income accounting and becoming aware of a few facts about GDP, including the current state of the economy. Investment is highlighted as the most volatile of the major aggregate expenditure categories and it is decomposed in two ways: (1) as replacement and net investment and (2) into its three main components, fixed nonresidential, residential, and changes in business inventories.

Screencasts

- vimeo.com/econexcel/gdpshares: download US GDP data and show that GDP = C + I + G + NX. It also computes shares of GDP for C, I, and G, showing that C is the largest of the three.

- vimeo.com/econexcel/gdpfluctuations: download Real and Potential GDP and the FRED add-in's graphing tool plots the two series. Percentage change data are used to better illustrate fluctuations and the fact that I is volatile and primarily responsible for variability in GDP.

- vimeo.com/econexcel/gdpinvcomponents: download three components of investment: 1) tools, plant, and equipment; 2) housing; and 3) changes in business inventories in an attempt to find the source of volatility in investment. In addition to simply plotting the three over time, they are converted into standard units.

Introduction

Every macro book has definitions of various categories of aggregate spending, along with graphics of circular flows and descriptions of the system of national accounts used to produce familiar statistics on income and output. None of this is repeated here. Instead, the focus is on obtaining GDP and its components from FRED and gaining familiarity with the current state of the economy.

Common Problems for Students

The biggest hurdle for students is inadequate understanding of fundamental concepts. It is tempting to get bogged down in the minutiae of national income accounting to get definitions exactly right, but the opportunity cost of this approach can be quite high because there is so much other important information to cover. Taking inventory of core concepts before deciding what to include will help emphasize what is truly important. Here is my short list, a version of which is included in the GDP.xls workbook:

- Gross Domestic Product (GDP) is the market value of all final goods and services produced within a country in a given period of time.
- GDP is a flow not a stock—it measures output per time period, not a total accumulated at a point in time. This crucial idea (along with a rejection of bullion as the source of the wealth of nations)

was the basis of Adam Smith's attack on mercantilism and forms the basis of his famous opening sentence:

> The annual* labour of every nation is the fund which originally supplies it with all the necessaries and conveniencies of life which it annually consumes, and which consist always either in the immediate produce of that labour, or in what is purchased with that produce from other nations. (Smith, 1776)
>
> *[This word, with 'annually' just below, at once marks the transition from the older British economists' ordinary practice of regarding the wealth of a nation as an accumulated fund. Following the physiocrats, Smith sees that the important thing is how much can be produced in a given time.] {Note that this is Edwin Cannan's explanatory note and not included in Smith's original work.}

- GDP = C + I + G + NX. This fundamental equation expresses the fact that GDP can be computed as the sum of Consumption (C), Investment (I), Government spending (G), and Net Exports (NX).
- There are two other ways to compute GDP: (1) the income approach, i.e., sum the payments received by every factor of production, and (2) the product approach, i.e., count every final good and service produced, multiply by its price, and sum. The product approach is usually implemented as a value-added computation at each stage of the production process.
- The three ways are equivalent in theory, but there are statistical discrepancies in practice. See Landefeld, Seskin, and Fraumeni (2008) for details.
- A circular flow diagram shows that GDP can be interpreted as both output and income; these are two sides of the same coin. This concept will play an important role in income-expenditure models.
- C, I, and G are expenditures (purchased final goods and services) made by consumers, firms, and governments, respectively. A computer purchase can be C, I, or G, depending on who bought it.
- It is easy to forget that G does not include transfer payments (such as Social Security benefits). *Government spending* in the macroeconomic sense means the purchase of final goods and services by governments, e.g., roads, schools, and military gear.
- It is even harder to remember and really understand that Investment does not represent investing in stocks or other speculative activity.

- While the core meaning of I is the purchase of new tools, plant, and equipment by firms, it also includes residential investment (new housing construction) and changes in business inventories.
- Inventories (produced, but unsold output) are a critical part of I. Pointing out that inventories can be interpreted as self-purchasing goes a long way toward explaining how changes in inventories are included in I.
- Expenditures on some goods and services have to be imputed because they are not directly observed. For example, the rental value of owner-occupied housing has to be estimated (if not, GDP would fall if a renter bought the house).
- Sales of existing homes (or cars or anything used) are not expenditures on goods produced during the given time period so they are not counted as part of GDP.
- Computing GDP in practice is unbelievably complicated. There are many weaknesses and missing data, so much so that the actual number for GDP is not especially important. The focus is on the percentage change in Real GDP, based on the argument that the mismeasurement remains relatively constant over time. The *Intro* sheet has a stylized graph to support this argument.

Perhaps this list will serve as a useful starting point in creating your own GDP highlights. There are undoubtedly many more ways (especially once we move to international accounting and balance of payments) that students fail to grasp the meaning behind the letters representing macro aggregates. Mentioning these while working with the data is a good strategy. This gives the student another way to connect the dots and remember basic information about GDP and its components.

Brief Screencast Descriptions

1. Components and Shares of GDP: The first screencast goes slowly and uses the FRED add-in's search tool to find data on GDP and its categories. It shows how GDP is composed of expenditures by consumers, firms, and governments, with an adjustment for net exports. Selecting *Gross Domestic Product* under *Browse Popular Data Releases* reveals the structure of the system of national accounts. Shares of GDP are computed revealing that consumption is by

far the largest share, about 2/3 of GDP, while I and G are much smaller, with NX making up the small remainder.

The screencast shows how to get more information on a variable by clicking its hyperlink in the fifth row of the spreadsheet. This provides access to the variable in the FRED website and it can then be traced further to its source, e.g., bea.gov in the case of GDP aggregates.

Given that this is an introduction to using FRED, the first task associated with the screencast simply asks for a replication of the screencast, using the most up-to-date figures. There is a hidden sheet in the workbook, *GDPScreencast1*, which contains the data downloaded and analyzed in the screencast.

The screencast mentions that we are interested in Real, not Nominal GDP, but does not compare them. To highlight that the GDP Deflator is an important by-product of Nominal and Real GDP, assign the second task which illustrates the relationship between these two measures. The student downloads quarterly Real GDP (GDPC96), Nominal GDP (GDP), and the GDP Deflator (GDPDEF). The data are used to verify that GDPC96 = GDP/GDPDEF. A chart of Real and Nominal GDP over time shows that the latter grows much faster because it includes rising prices.

2. Fluctuations in GDP and the Volatility of Investment: This screencast explains the phenomenon of economic fluctuations by charting real and potential GDP. Over a long time period, the changes in GDP are difficult to see. Displaying the percentage change over time clearly shows the variability in real GDP. Which of the three aggregate expenditures is driving the ups and downs in GDP? Plotting the percentage change of C, I, and G (including being careful to make the axes the same) reveals that I is markedly more volatile than C and G. Reveal the hidden *GDPScreencast2* sheet to see the data and analysis produced during the screencast. Finally, this screencast shows how to use the add-in's *Build Graph* to make a chart. Note that the chart format is Line, instead of the usual Scatter type.

The task has the student replicate the analysis for another country, focusing especially on the volatility of investment. The *Browse Popular International Data* button in the ribbon lists eight countries, but other countries can be found by using the search tool. In a class setting, each student can be assigned a country and asked to present the results. To compare volatility across countries, a table of averages and standard deviations of the percentage changes in GDP, C, I, and G, would be a good group assignment or independent study project.

3. Components of Investment: The final screencast breaks down real gross domestic investment into tools, plant, and equipment purchased by firms (real private nonresidential fixed investment, *PNFIC1*), housing (real private residential fixed investment, *PRFIC1*), and changes in business inventories (*CBI*). The hope is to identify volatility in one of the components as the driving force in the volatility of gross investment, but this does not happen. All three sub-categories seem to contribute in differing ways.

   Given the different magnitudes of the series, the screencast shows how to standardize each variable and then plots each of the components with gross investment. This produces a different view of the complicated relationships, but still does not reveal a monocausal explanation of the volatility of I. Reveal the hidden *GDPScreencast3* sheet to see the data and analysis produced during the screencast.

   This screencast uses the FRED add-in's *Build Graph* to make a chart and then extends it by adding a fourth series by copying and pasting the SERIES formula. This makes clear that the add-in is creating an Excel chart that can be manipulated by the usual methods.

   The task breaks down gross investment along different lines, into replacement and net investment. The student is asked to create a chart like Figure 1 and identify a source for the volatility of I. Unlike the screencast, it is clear that net investment is driving the volatility of gross investment. Replacement investment seems to rise steadily over time (as the economy grows), but pronounced swings in net investment match the variation in I.

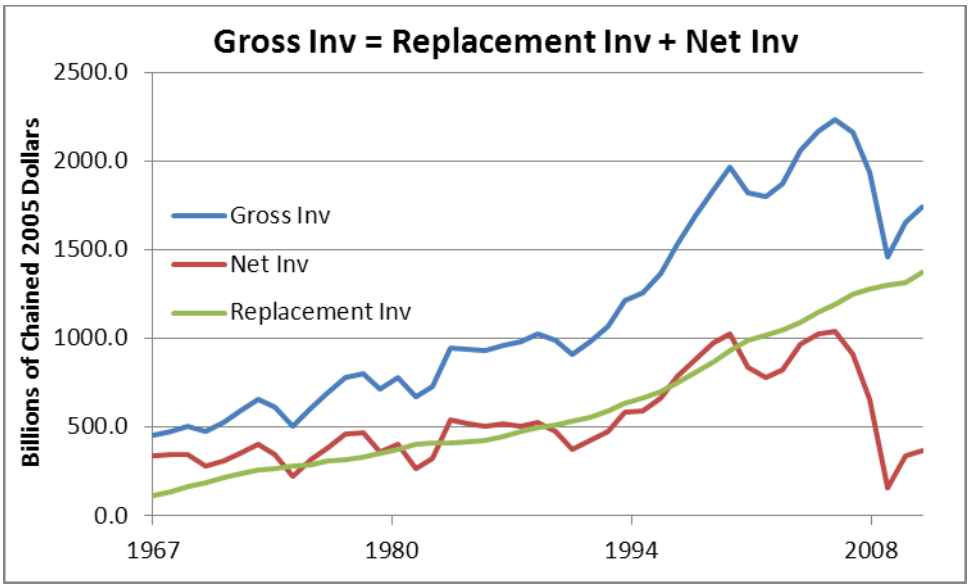


Figure 4.1.1: Net investment as the source of volatility in gross investment.

Source: Hidden *GDPT4* sheet in *GDP.xls*.

2013 NIPA Revisions

On July 31, 2013, the BEA rolled out a major, comprehensive revision of NIPA data back to 1929. Attempts to improve measurement of business investment by including research and development of intellectual property such as software and movies received widespread media attention. In addition, the base year for chained, real GDP was updated to 2009.

The screencasts and hidden sheets in the *GDP.xls* workbook are based on data before the revision date. While a perfect replication of the numbers in the screencasts and hidden sheets is no longer possible through FRED, the fundamental ideas (such as the volatility of investment) remain unchanged. One side-benefit of this major revision is easy detection of cheating by using the hidden sheets in the workbook—real GDP is now measured in billions of chained 2009 (not 2005) dollars. Data in 2005 dollars is a definite red flag that should be investigated.

If old data are needed, consider these two options. ALFRED, the archival economic database at alfred.stlouisfed.org maintains vintage data available at specific dates in history. A more general

solution (useful for any website) is the Wayback Machine at the Internet Archive project, archive.org/web/web.php, which constantly crawls the web and stores it. Simply enter the desired web site (e.g., bea.gov) and a calendar is displayed with dates when the site was saved. Click on a date to see the website at that time.

Conclusion

The FRED Excel add-in provides a complement to the standard exposition of tables and definitions in the textbook and lecture. This section focused on three fundamental concepts that are sure to be covered: (1) GDP can be measured as the sum of expenditures by consumers, firms, and governments (plus NX, of course), (2) GDP fluctuates, with investment being especially volatile, and (3) macro aggregates such as investment are comprised of sub-categories which can be examined. Unfortunately, there does not appear to be a single source for the volatility of investment.

Although the emphasis of this section is on data, the *LRvSR* sheet does present a brief overview of macroeconomics, highlighting short versus long run perspectives. A stylized graph of trend and actual GDP (see also Figure 2.1 in the chapter on economic growth) is used to convey how GDP can be studied in terms of its cyclical or trend behavior. *Money.xls* (section 4.4) has an HP filter function and a task asks the student to separate trend from cycle in GDP.

Further data exploration with the FRED Excel add-in can go in many directions. For example, search for PPP to access Penn World Tables data and make international comparisons in living standards. There is a wealth of federal budget data if deficit and debt to GDP ratios over time are desired. Drilling down into sub-categories such as new home construction, motor vehicle production, energy, and health aggregates is also an instructive way to develop awareness of current economic conditions.

Sources and Further Reading

The epigraph is from p. 1-2 of "Concepts and Methods of the U.S. national income and product accounts" (November 2012, available at www.bea.gov/methodologies/index.htm#national_meth) and answers the question, How did the NIPAs originate? It is noteworthy that the person instrumental in setting up British national income accounts, Richard Stone, also received a Nobel Prize in Economic Sciences. Establishing a coherent, reliable methodology for aggregate measures of economic performance is not trivial.

There are many sources that explain categories and computation of GDP, but an especially clear exposition can be found in Landefeld, J., Seskin, E., and Fraumeni B. (2008). Taking the pulse of the economy: Measuring GDP. *Journal of Economic Perspectives 22*(2), pp. 193–216.

Smith, A. (1776, 1904). *An Inquiry into the Nature and Causes of the Wealth of Nations*. Methuen & Co., Ltd. Full text at www.econlib.org/library/Smith/smWN.html.

The outstanding faults of the economic society in which we live are its failure to provide for full employment and its arbitrary and inequitable distribution of wealth and incomes.
John Maynard Keynes

4.2 Unemployment

Quick Summary

To access *Unem.xls*, visit:
www.depauw.edu/learn/macroexcel/excelworkbooks/Data/Unem.xls.

Unem.xls explains how to use the FRED Excel add-in to access labor market data. The focus is on understanding basic concepts (such as the unemployment rate and the labor force participation rate) and becoming aware of a few labor market facts, including the current state of the economy. Additional topics include seasonal adjustment, sampling, and a simple job search model.

Screencasts

- vimeo.com/econexcel/unemintro: download data on the unemployment rate and plot it (with recession bars). Other variables are downloaded and basic definitions are illustrated with the data.

- vimeo.com/econexcel/unemgroups: download unemployment data on various sub-groups and illustrate that the impact of unemployment on particular categories of people is extremely variable.

- vimeo.com/econexcel/unemseasonaladj: Excel's Pivot Table tool is used to find the monthly average in seasonally adjusted and not seasonally adjusted unemployment rates to show the seasonal pattern in the data.

- vimeo.com/econexcel/unemlfpr: download data on the labor force participation rate and show the striking difference in men's and women's LFPR since WWII.

- vimeo.com/econexcel/unemsampling: explains the idea of sampling variability by sampling from a hypothetical population in Excel and using simulation to show the results from many samples.

- vimeo.com/econexcel/unemsearch: implements and solves a fixed sample search model with Monte Carlo simulation.

Introduction

FRED provides access to data from the Current Population Survey (CPS), which is the source of labor market measures such as unemployment and labor force participation rates. It also includes international measures of unemployment rates, harmonized for equivalent definitions of job search, from the Organisation for Economic Co-operation and Development (OECD). Although not covered here, FRED also serves up data from Current Employment Statistics (CES), which is also known as the Establishment survey, and the Job Openings and Labor Turnover Survey (JOLTS). Thus, the FRED Excel add-in offers easily available, timely information on a wide variety of labor market indicators.

Definitions of variables and details on household surveys are left to textbooks and lecture notes. The *Intro* sheet contains a minimal review, including a layout of the framework used to organize various states of labor market activity and a few basic definitions. This should not replace, however, a more comprehensive presentation of labor market surveys and how they work.

Although the focus is on downloading data, the screencasts show how to create charts with the FRED add-in’s graphing tools and Excel’s own scatter plot. For the latter, the default origin of zero forces

explanation of dates in Excel and how to adjust the *x* axis. More sophisticated analysis is adopted for seasonal adjustment where Excel's PivotTable tool is used to find monthly averages.

The *Unem.xls* workbook includes two sheets (accessible from button in the *ToDo* sheet) that are much more advanced than the usual fare. The *Sampling* sheet sets up a mock survey and enables random sampling from a population. Simulation is used to make clear the variability in sample outcomes. The *JobSearch* sheet also uses simulation to present a job search model. It can be used to show that frictional unemployment will rise if search costs fall. Both of these applications are far from the mainstream curriculum, but they demonstrate the powerful pedagogy of concrete, visual exposition.

Common Problems for Students

Most students grasp the key idea behind the definition of unemployment—jobless but seeking work, as opposed to being out of the labor force—but they seem to forget that the denominator is the labor force. In fact, conceptual difficulties with ratios, in general, may be the source of confusion with many labor market measures, which rely heavily on proportions.

One obvious strategy is to always present a rate with its numerator and denominator clearly displayed. Repetition is a good way to develop familiarity and understanding. The *Intro* sheet's visual display of various categories provides an overall view that may help some students grasp the logic underlying the unemployment rate.

Tasks and Answers

The resulting spreadsheet at the end of each screencast and accompanying answers for tasks are saved inside *Unem.xls*. These sheets are not merely hidden and cannot be accessed by unhiding them. They can be revealed by running the *ToggleHideUnhide* macro (with keyboard shortcut *Ctrl-Shift-u*). They are organized in sequential order, with each screencast followed by its task answer. Run the *ToggleHideUnhide* macro again to conceal the sheets.

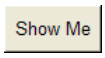
Brief Screencast Descriptions

1. Introduction to the Unemployment Rate: The first screencast downloads the unemployment rate at an annual frequency since 1948 and uses FRED's graphing tool to make a chart with recession bars. The voiceover emphasizes the variability in the unemployment rate and its association with recessions. Next, data on civilian working age population, labor force, out of the labor force, and unemployed are downloaded. Adding those in and out of the labor force equals the civilian population 16 and over and dividing the number of employed by the labor force yields the unemployment rate. This reinforces definitions of these labor market statistics.

   This screencast has two tasks: (1) compare the harmonized unemployment rate of two other countries to the United States and (2) compare the unemployment rate and employment ratio (number employed divided by working age population). Both tasks offer interesting perspectives and the first one can be used in a group setting, with each student reporting on several countries. Note that searching for "harmonized unemployment rate" provides data on many more countries that those listed in the *Browse Popular International Data* button. Also, broader measures of unemployment (such as the increasingly popular *U6*, with FRED ID U6RATE) are available.

2. The Unemployment Rate by Group: This screencast is devoted to the lesson that unemployment hits different groups unevenly. Unemployment rates for men 20 and over, women 20 and over, and 16 to 19 year olds are downloaded. A graph shows that teenagers have a much higher unemployment rate than older men and women. A comparison of men and women reveals that the Great Recession produced much higher unemployment rates for men than women. The screencast shows how to work with dates in Excel and change the minimum *x* axis value to the date of the first observation.

   The task has students download unemployment rate by educational attainment. They will produce a chart that makes clear that unemployment rates are lower for more educated groups.

This chart is in the *T2* sheet, which is visible after running the *ToggleHideUnhide* macro (with keyboard shortcut *Ctrl-Shift-u*). This task also includes a 

button that reveals a comparison of unemployment rates for men and women without high school degrees. These data are not available within FRED and were downloaded from the BLS website.

Of course, the unemployment rate can be viewed from the perspective of many other groups. Click the FRED add-in's *Browse Popular Data Releases* and select *Household Survey* to get unemployment rates by race and ethnicity. Use the search tool to get unemployment rates for specific geographic regions such as states or major metropolitan areas.

3. Seasonal Adjustment: This screencast use Excel's PivotTable feature to explain seasonal adjustment. Adjusted and raw unemployment monthly rates since 1948 are downloaded and Excel's TEXT function is used to create two new columns, MONTH and YEAR. A PivotTable of average unemployment rate by month is created and it shows the pattern in the unadjusted series and how it has been removed from the seasonally adjusted data.

   The task has the student replicate the procedure for U6, a much broader measure of unemployment that includes discouraged and marginally attached workers. Running the *ToggleHideUnhide* macro (with keyboard shortcut *Ctrl-Shift-u*) reveals the PivotTables sheets along with the screencast and task sheets.

4. The Labor Force Participation Rate: this short screencast shows the amazing changes in the labor force participation rate (LFPR) for men and women in the United States since World War II. While men's LFPR steadily fell, women's rapidly rose after the mid-1960s. The overall LFPR masks these two opposing trends.

   The task has students compare LFPR for Japan, Italy, and the United States. The assignment is more challenging because specific series IDs are not provided. They are JPNLFPWNA, ITALFPWNA, and USALFPWNA. Exploration of LFPR in other countries is enlightening and interesting, and, therefore, ideal for group presentations or independent study projects.

5. Sampling Variability: this topic is ambitious, but simulation makes it accessible to good students. The basic point is not difficult to understand: since the unemployment rate is based on a sample survey, it is a random variable with a sampling distribution. The standard error (SE) for the overall, official unemployment rate (U3) is about 0.1 percent. Sampling variability is shown via Monte Carlo simulation of sampling from a fixed population.

   Clicking the MC Sim button is powerful yet user-friendly. Any cell that changes when the sheet is recalculated is a candidate for analysis via simulation. In this example, we track the sample unemployment rate and the results are displayed in a new sheet. Comparative statics properties can be explored by changing a parameter and comparing simulation results.

   The task is straightforward: replicate the screencast using LFPR instead of the unemployment rate. As expected, when the sample size increases, the SE falls. It is easy to verify that a student did his or her own work because the simulation results will be different for every student.

   To access the *Sampling* sheet, click the Show Sampling button in the *ToDo* sheet. Although it is explained in the screencast and clearly stated on the spreadsheet, the DRAWSAMPLE function is an array function and the keyboard combination *Ctrl-Shift-Enter* is required. Hit the *Esc* (escape) key to return to the spreadsheet.

   The *Sampling* sheet has a variety of cell formulas for the superpopulation that are not explained in the screencast. Excel's RAND() function, which is uniformly distributed on [0, 1], is used in a variety of ways to draw gender, age, and whether the person works (if 16 or older) or is in the labor force (if not working). Neither the employment nor unemployment probability depends on age in this hypothetical data generation process.

6. Job Search: this final screencast is rather advanced and not part of the conventional intermediate macroeconomics curriculum, but Excel's ability to simulate chance processes makes it an attractive topic. A fixed sample search model is implemented and solved via simulation.

Lowering the cost of search leads to an increase in the number of jobs sampled and a higher unemployment rate.

The screencast focuses solely on simulation, but the mathematical solution is also presented starting in row 100. The reduced-form expression makes clear that the optimal number of jobs sampled is an increasing function of the highest paying job and a decreasing function of the cost of search.

This topic has two tasks. The first is easier. It has the student finish the argument made in the screencast that the optimal number of jobs to sample increases from 3 to 4 when the cost of search falls from 0.0625 to 0.04.

The second task is essentially a comparative statics analysis of the maximum pay parameter. The student is asked to explore the effect of increasing maximum pay from 1 to 1.5625. This parameter value was chosen so that the optimal number of offers increases from 3 to 4. The student should be able to use simulation to determine that sampling four jobs is the optimal solution. As noted in the description of the previous screencast, simulation results will be different for every student. Identical results are a sure sign of cheating.

Conclusion

Unem.xls uses the FRED add-in to download labor market data for the United States from the CPS and internationally harmonized unemployment and labor force participation rates. The workbook supposes basic understanding of concepts and uses data to reinforce definitions. The primary goal is awareness of historical trends and current labor market conditions.

Excel highlights in the topics covered in this section include using PivotTables to explain seasonal adjustment and use of simulation to illustrate sampling variability and solve a job search model. Both PivotTables and simulation have much wider applicability, but they may require additional teaching resources and time.

As mentioned in the introduction, FRED provides access to JOLTS and CES data. Use JOLTS to explore job openings, hires, and separations; while wages and employment from the firm's point of view is available through the CES. Duration of unemployment is an important topic that was not covered in the screencasts, but can be easily accessed through FRED. Finally, the family of series on productivity and costs (click the *Browse Popular Data Releases* button) is another resource for expanding the student's familiarity with current economic conditions and measures of economic performance.

Sources and Further Reading

The epigraph is from the opening sentence of the last chapter of Keynes, J. M. (1936). *The General Theory of Employment, Interest and Money*. Full text online at www.marxists.org/reference/subject/economics/keynes/general-theory.

An overview of seasonal adjustment is in a BLS technical bulletin, "Seasonal Adjustment," (February 2004) Employment and Earnings and available online at www.bls.gov/cps/eetech_seas.pdf. The BLS maintains a list of resources on seasonal adjustment here: www.bls.gov/cps/documentation.htm#sa.

Simulation in Excel is the foundation of Barreto, H. and Howland, F. (2008). *Introductory Econometrics with Microsoft Excel using Monte Carlo Simulation*, Cambridge University Press. Implementing chance processes in Excel, repeating the process many times, and directly observing the results is a powerful way to teach and learn.

After a long period in which the desired direction for inflation was always downward, we are now in a situation in which risks to the inflation rate can be either upward, toward excessive inflation, or downward, toward too-low inflation or deflation.
Ben Bernanke

4.3 Inflation

Quick Summary

To access *Inflation.xls*, visit:
www.depauw.edu/learn/macroexcel/excelworkbooks/Data/Inflation.xls

Inflation.xls explains how to use the FRED Excel add-in to review the historical record of inflation in the United States and to gain familiarity with inflation rate performance across countries. There is emphasis on computation in calculating the inflation rate as the percentage change in the price index and in using the price index to deflate nominal series. Four indexes, CPI, GDP deflator, the Fed's core inflation (PCE less food and energy), and chained CPI are examined.

Screencasts

- vimeo.com/econexcel/inflationusahistory: examines the historical record of price variability since World War II, as measured by the CPI, in the United States. The last episode of severe inflation occurred in the 1970s. Since then, the United States has enjoyed relative price stability.

- vimeo.com/econexcel/inflationcollegetuition: downloads data from the BLS on the college tuition price index and compares it to the overall CPI. The results are dramatic—college tuition has risen twice as fast as overall prices. It also makes clear that data from other sources can be merged in a spreadsheet with FRED downloads. This is a simple, but powerful point.

- vimeo.com/econexcel/inflationrealvalues: shows how to deflate a nominal series of postage stamp prices with a price index to create a series of real postage stamp prices in 2012 dollars; task uses data for minimum wage; long CPI series back to 1790.

- vimeo.com/econexcel/inflationcomparing: downloads the CPI, GDP deflator, core inflation, and chained CPI. It compares them and explains why we have competing price indexes.

Introduction

As with GDP and unemployment, this section assumes a book or other background reading is providing definitions and explanations of price index theory. The *Intro* sheet provides a brief review via a listing of important concepts (which might form the basis of a lecture on inflation) and the *CPI* sheet describes the weights for the eight major categories in the CPI-U market basket, but the focus of the screencasts is primarily on practical computations and empirical data.

No mention is made of seasonal adjustment, which is covered in the previous section on unemployment. The effect of inflation on nominal interest rates is also absent, deferred until the section on interest rates. Finally, causal explanations of inflation are not discussed. For now, the goal is simply to observe inflation patterns and learn how to use a price index to deflate a nominal variable.

Common Problems for Students

With respect to inflation, it is understandable that the bewildering array of options for measuring inflation is terribly confusing to students. How can there be so many different inflation rates, sometimes wildly different from each other? As usual, the best approach is to tackle this head on with a clear, organized presentation that directly answers this question.

Any introduction of inflation should begin by separating the theoretical abstraction of the price level from how the price level is measured via a price index. By stressing the fact that the price level is a

theoretical ideal that runs into immediate problems when it is operationalized, the student has a way to understand why various measures of inflation exist.

The explanation of the presence of multiple measures of inflation is strengthened by pointing out the impossible nature of the task: to reduce a variety of individual price movements to a single number. This is known as the index number problem. Since there are many ways to construct a price index which compresses individual variation into an overall average and no unambiguously best approach, this explains why we have different inflation rates from the same data.

The standard presentation of inflation that begins by defining fixed-price and fixed-quantity indexes via formulas and providing hypothetical examples of price and quantity for two goods over two years is tedious and ineffective. Instead of starting in the middle of a complicated story, mired in perplexing detail, consider framing the material around the question of why we have so many ways to measure inflation. The computation itself, the percentage change in the price index, is always the same—we get different measures of inflation because we use different price indexes.

Tasks and Answers

The resulting spreadsheet at the end of each screencast and accompanying answers for tasks are saved inside *Inflation.xls*. These sheets are not merely hidden and cannot be accessed by unhiding them. They can be revealed by running the *ToggleHideUnhide* macro (with keyboard shortcut *Ctrl-Shift-u*). They are organized in sequential order, with each screencast followed by its task answer. Run the *ToggleHideUnhide* macro again to conceal the sheets.

Brief Screencast Descriptions

1. Inflation Performance in the United States via the CPI: The first screencast downloads CPI-U all items (series ID *CPIAUCSL*), which is the usual inflation measure reported by mainstream media. The voiceover stresses that inflation is the percentage change in the price index, not the

price index itself, and uses the *pca* option to produce annualized percentage changes from monthly data. Unfortunately, monthly data obscure trend patterns so the frequency is changed to annual and the conventional story of high inflation in the 1970s and early 1980s followed by moderate price variability is made clear. Mention is made of deflation. The screencast concludes with an international comparison with France, which has a similar inflation record. The third screencast offers a much longer series, from 1790, of inflation in the United States with the annual CPI available in column B of sheet *3*.

The associated task is to replicate the screencast with the latest available data and compare the inflation performance of another country to the United States. Results can be presented in a group setting, with each student reporting on a particular country. Of course, several countries could be assigned to each student or group. Note that searching for "harmonized cpi" provides data on many more countries than those listed in the *Browse Popular International Data* button.

2. Inflation in a Specific Group: This screencast is devoted to the lesson that the overall inflation rate masks substantial variability in sub-groups of goods and services. College tuition is chosen, but it is unavailable from within FRED. Fortunately, the bls.gov website is reasonably user-friendly and it is used to download the desired data. The college tuition price index is copied and pasted next to the all items price index and the two series are plotted. The result is stunning, with college tuition sporting double the monthly percentage of CPI-U—although the screencast does end with a warning that the sticker price may not be a good measure of actual prices paid and displays a chart of tuition, financial aid, and loans over time.

   The associated task is to compare prescription drug prices to the overall CPI. Run the *ToggleHideUnhide* macro (with keyboard shortcut *Ctrl-Shift-u*) to reveal the answer sheet *T2*. If using bls.gov is deemed too difficult, substitute the group *Medical Care* or search FRED for a medical category. Again, assigning different specific items to each student or group and sharing results is informative and often energizes the classroom.

3. Using a Price Index to Create a Real Variable: This screencast shows how to create a real value by dividing a nominal value by a price index. Sheet *3* has annual CPI all the way back to 1790.

Using data on postage stamps, first sold in 1885 for two cents, the stamp price series is deflated both in the original 1982-84 base year and in 2012 dollars.

The task repeats the procedure for the minimum wage. First instituted in 1938 at 25 cents per hour, the minimum wage was $7.25/hour in 2013. The student is asked to create a chart of nominal and real minimum wage and determine whether or not the current minimum wage is high by historical standards. Run the *ToggleHideUnhide* macro (with keyboard shortcut *Ctrl-Shift-u*) to reveal the answer sheet *T3*.

4. Comparing Prices Indexes: This screencast compares CPI, GDP deflator, core inflation (PCE less food and energy), and chained CPI (C-CPI). Each of the other three is compared (in three separate charts) with the CPI with a general description of the index. The voiceover points out that the CPI is the most volatile and overshoots inflation by roughly a percentage point. The average annualized rates of inflation of the four indexes are compared and examples for when you would use each one are given. The screencast concludes with a reminder that measuring the price level, a theoretical abstraction, is not easy and this explains why we have so many competing price indexes.

   The task utilizes the *Browse Popular International Data* button to have the student compare CPI all items to CPI less food and energy in a country other than the United States. Sharing results in class is an option.

Conclusion

Inflation.xls uses FRED to download CPI and other price indexes. Emphasis is placed on percentage change as a measure of inflation and using the price index to deflate nominal values. Definitions and formulas are left to background reading, although the links in the *Intro* sheet are excellent summaries of how the CPI works and its weaknesses.

A highlight is a simple, yet powerful idea: one can download data outside of FRED and merge it with FRED data. This is demonstrated in the second screencast on college tuition. Students need to be aware of FRED as a resource for empirical papers and projects. Just because FRED cannot access every variable needed does not imply it should be abandoned. Use the convenience of FRED to get available variables, and then augment the spreadsheet with data from other sources.

The long series on CPI in sheet *3* (back to 1790) is a handy resource for creating real values for classroom lectures or handouts. In fact, this screencast alone could be used in other courses. Hiding or deleting other sheets in the workbook and renaming sheet *3* will not impair the workbook in any way.

Sources and Further Reading

The epigraph is from "An Unwelcome Fall in Inflation?" Remarks by Governor Ben S. Bernanke before the Economics Roundtable, University of California, San Diego, La Jolla, California, July 23, 2003; available at www.federalreserve.gov/boarddocs/speeches/2003/20030723. In this talk, Bernanke explains the dangers associated with deflation and explains how the Fed would combat it, foreshadowing future policy.

The *Intro* sheet in the *Inflation.xls* has recommended background sources on inflation.

Inflation is always and everywhere a monetary phenomenon
in the sense that it is and can be produced only by a more
rapid increase in the quantity of money than in output.
Milton Friedman

4.4 Money

Quick Summary

To access *Money.xls*, visit:
www.depauw.edu/learn/macroexcel/excelworkbooks/Data/Money.xls

Money.xls explains how to use the FRED Excel add-in to examine a variety of measures of the money supply and explore their relationship with inflation. *Money.xls* contains a Hodrick-Prescott (HP) filter function to separate trend from cycle in macro aggregates. The workbook has data from the International Financial Statistics (IFS) on a subset of countries from which seigniorage rates can be computed. The screencasts show how to download and examine data on interest rates (including the Fisher effect) and exchange rates.

Screencasts

- vimeo.com/econexcel/moneyinflation: downloads various monetary aggregates (M1, M2, and MZM) and tries (and fails) to show how inflation depends on the money supply (including a 10-year moving average).

- vimeo.com/econexcel/moneymsi: covers the rather advanced topic of Divisia monetary services indexes (MSI).

- vimeo.com/econexcel/moneyseigniorage: downloads data on base money and nominal GDP to compute seigniorage rates; has data from IFS for a small subset of countries.

- vimeo.com/econexcel/moneyfftaylor: explains how the Taylor Rule versus the federal funds rate offers a window into how the Fed views the economy. It evaluates the tenures of Fed chairs since 1970.

- vimeo.com/econexcel/moneyfisher: downloads data on interest and inflation rates, showing that they move roughly together and then explains the relationship via the Fisher Effect.

- vimeo.com/econexcel/moneyxrates: downloads data on real effective exchange rates produced by the Fed and the OECD. It looks at the trade share weights for the United States and comments on the relationship between money supply and exchange rates.

- vimeo.com/econexcel/moneyhpfilter: shows how to use the HP array function in Excel to separate a variable into its trend and cyclical components using the Hodrick-Prescott algorithm.

Introduction

As with GDP, unemployment, and inflation, the primary focus of this section is on awareness of historical trends and current economic conditions with respect to money, interest rates, and exchange rates. The task is complicated by the fact that the money supply is not easily measured and a core theoretical result, that inflation depends on the rate of change of the money supply, is difficult to show with data.

As with other variables in this chapter, the workbook assumes a background reading or supplemental text of some sort. Nothing is said, for example, about the history and meaning of the quantity theory of money. A brief list of definitions and core ideas is included in the *Intro* sheet, but this is intended as a review.

Not surprisingly, the FRED database has a wealth of data on financial statistics, of which only a few are presented in the screencasts. Pull down the *Browse Popular Data Releases* menu item to reveal Federal Reserve balance sheet information, banking data, and much more.

The screencasts should be considered more in the nature of topics than principles that must be covered. The HP filter function, in particular, is provided as a way to enable easy construction of charts for presentations and student papers. Regardless of the user's favorite monetary aggregate or compelling specific issue, FRED is likely to have the data and the FRED Excel add-in will be a convenient way to download the data.

Common Problems for Students

What could be simpler than money? Everybody needs and uses money so surely we know what it is. This, of course, is the core of the problem for students because, in fact, money is a vague concept. By simply saying that money is not binary, but actually a continuum, you may get an "Aha!" moment. At the very least, the many measures of money, starting from currency and including ever broader categories, will make a little more sense. Careful explanation of money as a sum of various types of financial assets will prove helpful when students are exposed to the familiar litany of monetary aggregates, M1, M2, and so on.

A second potential area of confusion, which should also be tackled head on, is the notion of money demand. Money supply is relatively simple—the stock of money (however measured) at any point in time. Money demand is, at least superficially, trickier. Money demand requires understanding that there is an underlying optimization problem. The question is not "How much money do you want?" (to which the answer would seem to be "As much as I can get"), but "How much of your wealth do you want to allocate to money versus your other assets?" A classic illustration is to point out that a millionaire (perhaps now it should be billionaire) may have a few thousand dollars in money holdings and the rest of the portfolio in stocks, bonds, and other non-monetary assets.

Students are often completely unfamiliar with some terms, such as seigniorage, and building vocabulary requires effort, but money and money demand are especially confusing because they are so common. It takes repetition to really understand what these terms mean in a macroeconomics context. Blanchard and Johnson (2013, p. 65) offer a "Focus Box" on "Semantic Traps: Money, Income, and Wealth." They conclude with two directives:

> Learn how to be economically correct:
> Do not say "Mary is making a lot of money"; say "Mary has a high income."
> Do not say "Joe has a lot of money"; say "Joe is very wealthy."

Semantic traps are everywhere in economics and they really are traps for students and professors alike.

Tasks and Answers

The resulting spreadsheet at the end of each screencast and accompanying answers for tasks are saved inside *Money.xls*. These sheets are not merely hidden and cannot be accessed by unhiding them. They can be revealed by running the *ToggleHideUnhide* macro (with keyboard shortcut *Ctrl-Shift-u*). They are organized in sequential order, with each screencast followed by its task answer. Run the *ToggleHideUnhide* macro again to conceal the sheets.

Brief Screencast Descriptions

1. Monetary Aggregates and Inflation: This introductory screencast downloads and shows M1, M2, and money with zero maturity (MZM). The primary point is that there are many measures of the money supply and they behave differently. Innovation in financial instruments has created a challenging measurement problem. While economists believe that money growth produces inflation, it is not easy to see this in the data. The screencast shows M2 with annual inflation, and then repeats the comparison with 10-year moving average rates of growth. Both fail to show a clear relationship between money growth and inflation. It concludes by showing two scatter plots from Mishkin (2011, p. 114), one has decade-averages of money growth and inflation for the

United States and the other displays an international comparison of money growth and inflation. Both graphs support the claim that inflation is driven by money growth.

The task has the student construct a 10-year moving average comparison of inflation and MZM. This is no better at revealing a relationship between money growth and inflation than the M2 aggregate used in the screencast.

2. Measuring Money: This screencast is about the use of Divisia index numbers in measuring money. This topic is admittedly advanced and the only textbook I found that even mentioned Divisia versions of monetary aggregates was Fisher (2001), but measurement of money really is an open scandal:

> Is there any reason at all to prefer the disreputable simple-sum monetary aggregates to the state-of-the-art Divisia monetary aggregates? The answer to both questions is one simple unequivocal word—*no*! In measurement, central banks should do the best they can, not the worst they can. It doesn't get any worse than simple-sum aggregation. (Barnett, 2011, Kindle Locations 1398-1401).

The screencast keeps things uncomplicated by downloading Divisia M2 and comparing it to simple-sum M2. The explosive growth in simple-sum M2 in January 1983 is due to the arrival of money market funds. Other spikes (with dates revealed by conditional formatting), such as 9/11, are real. The remainder of the screencast is devoted to the monetarist experiment of 1979-1982. Tracking simple-sum M2 (and other conventional aggregates) severely overstates the growth rate of money during that time. While inflation was brought under control, it seems the Fed was unaware of how restrictive monetary policy had become. Students will enjoy learning about this episode.

An Excel highlight of this screencast is its use of the *EconChart.xla* add-in (available at www.depauw.edu/learn/macroexcel/exceladdins) to zoom in on specific time intervals. The *Zoomer* control will work on any spreadsheet with scatter type charts. The only restriction is that panes must be unfrozen. Zooming is helpful while exploring data and for presentation.

The task involves replication of the 1979-1982 episode with Divisia MZM (FRED series ID *MSIMZMP*) instead of *MSIM2*. The results are stronger in that money growth during Oct-79 to Sep-82 was even lower with the MSI version of MZM than the simple-sum aggregate. Instead of money growth averaging 3.2% per year (as shown in the screencast using *MSIM2*), growth in Divisia MZM averaged only 1.2% per year.

Another assignment could be the replication of Table 1 in Barnett (1984), which offers a complete list of monthly growth rates at annualized rates during the monetarist experiment. The results with data from FRED come close, but do not exactly coincide with the data Barnett used in 1984.

3. Seigniorage: This screencast shows how to use the list box with different countries in the *IFS* sheet to get data on nominal GDP and base money from the International Financial Statistics. Clicking on a country inserts a new sheet in the workbook with data for the selected country. The student then computes the change in base money and divides it by nominal GDP to get the seigniorage rate. The screencast does this for the United States and also computes the seigniorage rate using data from FRED. Not surprisingly, the two are very close.

   The task is to select a country and report the seigniorage rate, along with an explanation of the extent to which the government used its power to issue money to finance its expenditures. Starting in cell CD100 of the *IFS* sheet, the average seigniorage rate for each country is computed to enable easy checking of student answers. If each student is assigned a country, the task can be made into an in-class presentation exercise.

   The *IFS* sheet includes a brief description of seigniorage and a link to Fischer (1982). An additional assignment would be to compare a country's use of seigniorage in Fischer's dataset and its performance since that time. A more ambitious project would entail updating Fischer's results for all of the countries in his sample.

4. The Federal Funds Rate and the Taylor Rule: This screencast downloads data on the federal funds rate and then explains the Taylor Rule. The emphasis is less on computation (the formulas

are provided) and more on the logic of the Taylor Rule and how it responds to inflationary pressure and the GDP gap. The zero interest rate lower bound is obviously apparent when the federal funds rate is graphed and when the Taylor Rule yields a negative target interest rate.

The task is fairly straightforward and should be easily completed because the screencast covers the Burns and Bernanke tenures and the answer depends on whether the fed funds rate is above or below its target rate. For the others, it is clear that Miller was more accommodating than the Taylor Rule suggests, while Volcker's monetary policy was more restrictive (which agrees with the second screencast on the monetarist experiment). Greenspan gets mixed reviews on this score—he began like Volcker, but ended like Burns, with the federal funds rate substantially below the target during his last four years.

The inspiration for this screencast is from Cahill (2006) who has a step-by-step Excel lab version of the Taylor Rule. The *Taylor* sheet can be used in a lecture format to review the historical record of nominal interest rates in the United States for recent Fed chairs. It has excellent teaching potential going forward as more data comes in. Use FRED's Update button and fill down the formulas in columns I, J, and K for each additional quarter. Of course, this also would be a straightforward additional assignment for students.

5. Interest Rates and the Fisher Effect: This screencast compares bank prime lending rates and inflation. The relationship is not exact, but it is discernible from simple comparisons over time and on a scatter diagram. The explanation of why nominal interest and inflation rates move together relies on the Fisher effect. The screencast explains how inflation erodes the value of money paid back and, therefore, the real interest rate can be approximated by subtracting the inflation rate from the nominal interest rate. Once this is understood, we can see how expected inflation must be incorporated into the nominal interest rate. The screencast concludes with the core lesson that it is unanticipated inflation that harms the economy.

   The task is an open-ended assignment in which the student has to construct various scenarios to demonstrate that it is not inflation *per se* that is dangerous to a lender, but uncertainty in the inflation rate. A good answer should include a scenario showing that high inflation, if correctly

forecasted (so expected inflation in cell M8 equals actual inflation in cell R8), does not affect the lender's real return. Another scenario should show that when M8 < R8, the lender's real return does not hit the target.

6. Exchange Rates: This screencast downloads and plots the Chinese Yuan in terms of the US dollar (which makes it obvious that China does not have a floating exchange rate), but then turns quickly to real effective exchange rates (REER). The primary objective is to convey how an index captures the movement of many prices. Along the way, the weights in the index (a function of the shares of trade with each country) provide an opportunity to show how Japan and China have flipped positions in terms of US trade volume. REERs from the Fed and OECD are compared and shown to be fairly close. The recent history of the US REER is briefly discussed, including the substantial decline in the past decade. The screencast concludes by claiming that central banks pay attention to exchange rates, but like inflation, it is difficult to show a correlation between money and exchange rate movements.

   The task has the student download and plot Canada's REER (series ID *CCRETT01CAA661N*). Since 2002, Canada's rapidly rising dollar (roughly 40%) is markedly different than the experience of the United States. Of course, the OECD provides REERs on many other countries. Series IDs with 01 use CPI to measure inflation, while 02 signals inflation based on unit labor cost. Individual students or groups can be assigned countries and asked to present the results.

7. HP Filter: This final screencast shows how to apply the Hodrick-Prescott (HP) filter to M2. The mechanics of the algorithm are ignored and the focus is on how to use Excel to produce a trend component to a cyclical time series. Care is needed when working with the HP user-defined function (available only when the *Money.xls* workbook is open) because it is an array function. As stressed in the screencast, the *Ctrl-Shift-Enter* simultaneous keystroke combination is needed to properly enter array functions in Excel.

   The task asks the student to apply the HP filter to real GDP. Naturally, any of the countless macro aggregates in FRED are grist for the HP mill. An interesting independent study project would be to replicate and extend Hodrick and Prescott (1997).

Conclusion

Money.xls uses FRED data to explore money supply; seigniorage; and inflation, interest, and exchange rates. The emphasis is on familiarity with historical trends and current conditions. For a Money & Banking course or if further emphasis on banking is needed, FRED has a great deal of information on reserves, balance sheet variables, and interest rates on commercial and Fed banks. For those who regularly visit www.federalreserve.gov and track H.4.1 or other releases, accessing these data via the FRED Excel add-in is a real time-saver.

Since the focus is on data, little was said about monetary policy (although the monetarist experiment does feature prominently in the screencast on measuring money with MSI). See Lengwiler (2004) for an Excel-based monetary policy simulation game. Faced with a stream of stochastic shocks, the player is a central bank governor trying to steer the economy. The link to the files in the published paper no longer works, but the files are available at wwz.unibas.ch/fileadmin/wwz/redaktion/finance/personen/yvan/MoPoS/MoPoS.zip. The *Simulator* menu item in modern versions of Excel is listed in the *Add-Ins* tab.

In summary, while this chapter has downloaded data for a few fundamental macro variables (GDP, unemployment, inflation, and money), the screencasts have not come close to covering the full range of data in FRED. There are data on wages, capacity utilization, productivity, and much, much more.

Because of its coverage and ease of use, the FRED Excel add-in is an excellent vehicle for student papers and projects. Even if some variables are missing, it is easy to augment the dataset with variables from outside FRED. Perhaps best of all, the days of preparing data for students are long gone. They can and will use the FRED Excel add-in to obtain their own data and are then able perform rudimentary analysis from within Excel.

Sources and Further Reading

The epigraph is from p. 24 of Friedman, M. (1970), *The Counter-Revolution in Monetary Theory: First Wincott Memorial Lecture.*

The Visual Basic code for the HP filter array function in *Money.xls* is from Yvan Lengwiler.

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