



Food in the Macroeconomy: The Whole is More Than the Sum of its Parts

9.1 NATIONAL INCOME AND THE CIRCULAR FLOW OF GOODS AND SERVICES

9.1.1 *Motivation and Guiding Questions*

This section introduces *macroeconomics*. Previous chapters were ‘micro’-economics, not because they focused on small things but because the analysis in Chapters 2–8 concerns individual decision-making and its consequences. In contrast, ‘macro’-economics is the study of an entire economy, with its given population in a fixed geographic area.

The toolkit in this chapter allows us to measure and compare economic activity in each country, revealing much greater disparities between countries than within them. Why are some societies so much richer than others? How does the role of agriculture and food systems evolve as countries grow and develop? And what can be done about the economy’s occasional slowdowns, when waves of simultaneous job loss across the entire society cause a spike in unemployment and potentially several years of higher food insecurity?

Both macro- and microeconomics concern the flow of goods and services among people, produced using natural resources plus human inputs used to obtain the living standards we observe, including individual and public health. Microeconomics studies one activity at a time, while macroeconomics puts all activities together in a circular flow among all the people in a country, plus their trade and investment flows with the rest of the world. The sum of all activities is a closed system spanning the whole world, and each country is a subset of that global circular flow.

The diagrams in previous chapters used money only as a unit of measure, comparing the cost of each thing to all other goods and services. In microeconomics, many questions involve activity in which no money changes hands. For macroeconomics, however, money plays a central role. Money is a lubricant determining how easily goods and services circulate between buyers and sellers, and managing the supply of money allows a government's central bank to limit the downturns when people stop buying from each other.

Because macroeconomics is about the circular flow of goods and services, the field makes a clear distinction between 'the economy' and everything else in society. The economy in this sense is the sum of all transactions among households, businesses or the government. Activities that are not measured transactions, such as meal preparation within the home, could still be studied with economics but are not measured as part of the circular flow of goods and services studied in macroeconomics. The economy grows and fluctuates in relation to the money supply and other influences, and macroeconomists pay close attention to how that circular flow relates to both underlying natural resources and the nonmarket goals of people and their governments.

By the end of this section, you will be able to:

1. Show how a country's economy can be described using a circular flow diagram of transactions among people within the country plus their trade with others;
2. Define and explain national accounting for value added, national income and GDP, and describe some of the nonmarket activities not included in GDP;
3. Define and explain the money supply, inflation and the use of a CPI to measure real income over time;
4. Define and explain how government enters national accounts, and the potential influence of fiscal and monetary policy on the economic activities of a country's population.

9.1.2 *Analytical Tools*

Macroeconomics is about how each market affects other markets. While the models in Chapters 2–6 could be drawn using two-dimensional analytical diagrams, macroeconomics involves a wider range of simultaneous interactions. These relationships can best be shown using a circular flow diagram and the accounting principles that allow us to measure and describe the sum total of all activity in the economy.

The Economy Is a Circular Flow of Goods and Services

In macroeconomics, 'the economy' is defined and measured as the sum of all observed transactions between individuals, households and enterprises of all kinds, including government agencies. This definition allows us to understand

how each part of the economy interacts with all other parts, how the economy as a whole interacts with the natural environment, and how governments can steer economic activity towards sustained improvements in human health and wellbeing.

To measure the economy and see how governments influence its growth and development, we can draw distinct kinds of economic activity interacting with each other in a circular flow diagram such as Fig. 9.1.

The elements of Fig. 9.1 refer to a specific country, showing transactions between their national government, households, firms and foreigners, each at the center of the diagram with different kinds of transactions flowing among them. For the world as a whole, the global economy is the sum of all countries' transactions, for which data collection and some degree of coordination is performed through the United Nations and other international organizations. There is no global government corresponding to the top row of Fig. 9.1, but the World Bank and its sister organization the International Monetary fund play some of the same roles for the world that each country's own central bank does for their national economy.

On the left side of Fig. 9.1 is the set of all goods and services exchanged between people each year. That element of the diagram is shown as a stack of two-dimensional sheets to illustrate that each thing is exchanged in a market like those drawn in Chapters 2–6.

On the right side of Fig. 9.1 is the set of all natural resources and other factors of production, and the financial assets that people hold from year to year, with arrows showing how each thing is used in the economy. Each of those is similarly shown as a stack of many different layers, one for each kind of wealth including land and other natural resources, human resources in terms

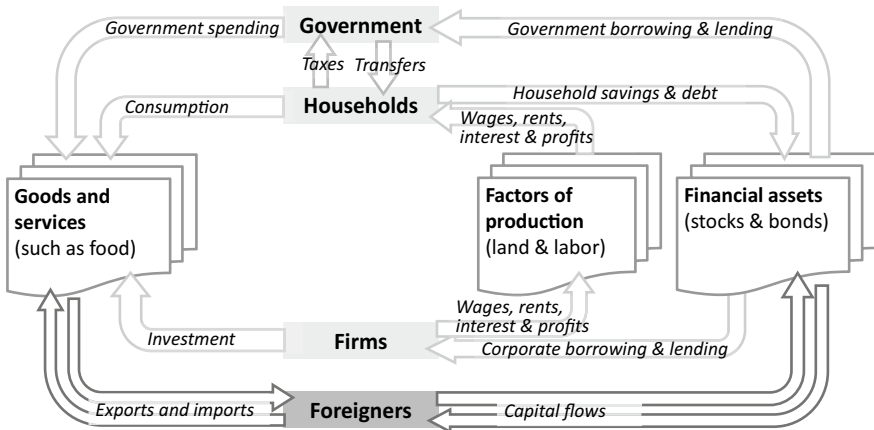


Fig. 9.1 The macroeconomy is a circular flow of income and expenditure

of public health and productive skills, the built environment with its infrastructure and facilities, and financial assets used by individuals, organizations and the government.

Arrows between elements show transactions. These are flows between people in different roles, drawn in the central column of the diagram around the households where people live, and the firms in which people work, as well as the country's own government agencies and the country's interactions with foreigners outside the country whose economy is shown in the diagram.

The organizations shown in the central column of Fig. 9.1 are defined in terms of what they do, not who they are. The distinction between 'households' and 'firms' concerns their activities: households use goods and services for consumption, while firms use goods and services for production. Family farms are both a household and a firm, and firms can be organized in many ways ranging from self-employed individuals to partnerships, businesses and nonprofit enterprises.

The economy consists of both stocks and flows. Stocks are the country's wealth, allowing its people to draw on land and natural resources as well as financial assets, while flows are income and expenditure each year. Arrows illustrate the flow of transactions using resources and assets to produce goods and services. Agricultural commodities and many other things can also be stored from one year to the next, and that kind of stockholding is closely linked to macroeconomics including food price spikes when stockholding nears zero, and longer periods of lower food prices when stocks are abundant.

Measurement of the circular flow in Fig. 9.1 focuses on things that are bought and sold with money. That focus allows economists to distinguish the market economy from nonmarket activities, and help governments manage the economy in pursuit of sustained improvements in wellbeing. Some people pursue money for its own sake, especially when financial data are compared and used in rankings. Some people like to compete for more money in the same way that many people like to compete in sports or other ways and harnessing that competitive spirit can be useful to achieve social goals, but for most people the purpose of money and competition is to deliver more of the real goods and services that people need for environmental sustainability, human health and wellbeing.

Macroeconomic Data Tracks the Level and Change in Economic Activity

The stocks of wealth and flows of income shown in Fig. 9.1 can be measured in various ways, none of which capture everything at once. Measurement methods discussed in this chapter advanced rapidly after World War II when the United Nations sought to standardize recordkeeping, and they continue to evolve in response to changes in what we want to measure and innovations in how economic data are collected and transformed into national accounts.

Data about the economy originate from individual market transactions, such as each person's grocery purchases. Those transactions are then added up

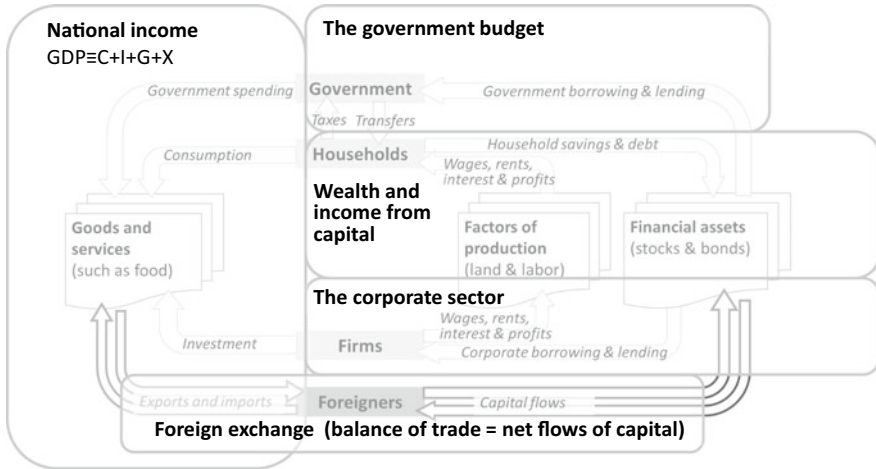


Fig. 9.2 The macroeconomy can be described and measured in multiple ways

and reported to national statistical agencies in a variety of ways and reported in summary statistics about each part of the macroeconomy shown in Fig. 9.2.

On the left of Fig. 9.2 is *national income*, capturing the sum of all goods and services flowing through the economy. This is the *real economy*, adding up all income and expenditure in monetary terms. In national income, each country's currency is used only as a unit of account. Goods and services are added up in proportion to their monetary value in part by necessity, because the quantity and quality of things often cannot be measured in any way other than its price. For example, health care and food services are recorded in economic data based not only on the number of things or hours spent, but also the skill and quality that helps determine its market price. Market failures such as monopolies and externalities create gaps between market prices and social opportunity costs, and where data on those values are available, they are used to augment the basic economic statistics shown in Fig. 9.2.

National income at market values is shown at the top left of Fig. 9.2 as using the accounting identity $GDP \equiv C + I + G + X$. In that equation, the triple equals sign indicates a definition, as the system of national accounts defines each country's gross domestic product (GDP) to be the sum of consumption spending by households (C), investment spending by firms (I), government expenditure and investment (G), plus net exports (X) of things sent or brought from abroad, counting all exports minus all imports. The sum of all economic activity in a country is called its 'gross domestic product', providing useful terminology to contrast how GDP is measured with the other things we all care about.

The G in GDP refers to measurement of 'gross' flows each year, in contrast to 'net' flows that might account for changes in a society's stock of natural or human resources. Many attempts to measure net flows have been introduced

over the years, aiming primarily to count the depreciation of physical assets like infrastructure and buildings, and the degradation of natural resources like depletion of water supplies and mineral reserves. A measure of net flows would also include the costs of climate change, and changes in the health, education and skill level of the population. Due to uncertainty about how to value resource stocks and interest in each one, national statistics report data on each aspect of the environment and human capabilities separately.

Keeping GDP as gross flows then allows the stock of environmental resources, public health and human welfare to be measured as the objectives or purpose of economic activity. The most important such targets were the Millennium Development Goals (MDGs) adopted by 191 governments through the United Nations in 2000, followed by the Sustainable Development Goals (SDGs) adopted by 193 governments through the UN in 2015. These goals specified a variety of indicators to measure progress from 2000 to 2015 through the MDGs, and then 2015 to 2030 through the SDGs. Individual governments also specify their own short- or long-term goals beyond annual GDP and use international agreements to coordinate efforts such as the Paris Accord on climate change adopted in 2015.

The DP in GDP is for ‘domestic production’, aiming to count all economic activity within the country’s borders. That definition is useful partly by necessity, in situations where national statistical agencies can obtain consistent data only about transactions that occurred among entities physically located in the country. But many populations conduct a significant fraction of their economic activity outside their home country, leading to the development of gross national product (GNP), more recently known as gross national income (GNI). These refer to the population’s total income and expenditure in the country, including remittances and wages earned abroad as well as net returns on assets owned in other countries.

Both GDP and GNI are in current use for different purposes. GDP is still used for basic national income accounting as in Fig. 9.2, while GNI is a preferred but more complicated way to measure the income of populations available to be spent on goods and services. For most countries there is little difference between GDP and GNI, because their flows of labor earnings and asset returns offset each other, but when GNI is available it can be very useful for countries with large flows of remittances or other payments to and from other places.

The government budget, at the top right of Fig. 9.2, is of specific interest. That shows the government’s ‘fiscal’ accounts, adding up its net budget deficit (revenues minus expenditures) which is always equal to net lending (lending minus borrowing). The fiscal role of government is important first because its expenditures enter GDP directly with the provision of public goods and services. In most countries a large part of GDP consists of public-sector activity, including health care provision and support for agriculture. Those expenditures are funded by taxation which is itself an important policy instrument, and by government borrowing and lending which can help stabilize (or

destabilize) the banking system. A small fraction is also funded by expansion of the money supply. That kind of government revenue is known as ‘seigniorage’, and is managed by the central bank as part of the country’s monetary policy.

The total wealth of society, in the middle right of Fig. 9.2, is not generally added up to a single total. Each form of ‘capital’ is counted separately, in part because of differences in accounting frameworks, ownership and valuation. The term capital in this context refers to any kind of valuable resource used for production and consumption, using that word to denote a stock that could be built up or drawn down. Natural capital is the stock of land, water, air and ecosystem services on which society relies. Human capital is the health and education or skill level of the population. Improving outcomes in both of those domains is often a goal for governments, to the extent that they can be measured and used in politically feasible ways. Land and facilities, including both public infrastructure and private real estate, are also important underpinnings of the economy, as are the financial instruments such as stocks, bonds and bank accounts used by people and enterprises to save for the future and invest in productive activities.

The corporate sector at the lower right of Fig. 9.2 includes private-sector organizations of all kinds, from small partnerships to nonprofit and for-profit enterprises. Each individual in society can belong to multiple organizations, and many organizations have complex legal structures with multiple entities, so data usually report the sum of all private-sector activity as a single total, often broken out by functional categories such as farm production, grocery retailing or health care services. Each of those subsectors would have a mix of organizations, sometimes including the work of a single person.

The foreign sector along the bottom of Fig. 9.2 shows net trade (exports minus imports) which always equals net capital flows (lending minus borrowing). These equal each other because anyone who wants to import or export actual goods and services must make a corresponding exchange through the banking system, for example exchanging dollars for pesos when trading between the U.S. and Mexico. All the individual transactions are pooled in banks, creating supply and demand for currency exchanges between every pair of currencies such as U.S. dollars to Mexican pesos, and also U.S. dollars to Canadian dollars, and also Mexican pesos to Canadian dollars. As each country’s net trade balance evolves, demand and supply for lending and borrowing must keep up to provide that currency, which is done like any market equilibrium by bids and offers that lead to a different exchange rate between currencies or interest rate when holding that currency.

Macroeconomic Variables and the Definition of GDP

The different kinds of macroeconomic variables shown in Figs. 9.1 and 9.2 can be very confusing and are summarized in Table 9.1.

The columns of Table 9.1 indicate whether the data refer to a ‘real’ variable adding up the quantities of goods and services for which money is just the unit

Table 9.1 Types of macroeconomic variables

<i>Type</i>	<i>Real</i>	<i>Monetary</i>
Domestic	Private consumption, private investment, government expenditure (consumption and investment), private savings	Inflation, interest rates
International	Exports, imports, capital flows and remittances	Exchange rates

of account, or a ‘monetary’ variable which tracks the role of money in the economy. The rows track whether the data track a domestic variable affecting transactions within the country, or transactions that involve foreign exchange.

Every variable in the economy involves both a quantity and a price. The monetary variables are ‘macro’-prices that are defined in terms of the macro-economy itself. One set of macro-prices is the cost of things now versus later, measured as the rate of inflation in average prices from year to year, and the interest rate on savings held from year to year. Another set of macro-prices is the cost of things in this country’s currency versus all other currencies. These currency exchange rates link the market for each country’s exports and imports to the capital flows in or out of that country, which in turn relates to its inflation and interest rate.

For agriculture and food systems, we use macro-variables primarily to convert the cost of things in different countries and different years into real terms, by adjusting for inflation and purchasing power parity exchange rates. Monetary variables are also important influences on agricultural commodity and food markets, as traders hold on to commodities in storage when they expect inflation to rise, which can contribute to food price spikes. Most of the time, however, our focus is on the real variables used to calculate national income itself in the definition $GDP \equiv C + I + G + X$.

Consumption (the C in the definition of national income) typically accounts for more than half of GDP. It is measured as the total value of goods and services sold by businesses to households each year. This is relatively straightforward for many goods and services, but creates the apparent anomaly that GDP goes up when people switch to buying from a business instead of doing for themselves at home. Some of the growth and difference in GDP we observe is purely due to that transition from household work to paid employment for cooking, cleaning, caring for dependents and so forth. That aspect of national accounting is intentional because the goal of GDP is to monitor market activity. The only home-produced product that is counted in GDP is farmers’ consumption of food, for which an estimate is included in countries where that is a significant part of economic activity each year.

Investment (the I in the definition) is the total value of businesses’ purchase of equipment and facilities intended to last more than one year, plus their accumulation of inventories. This is a smaller fraction of GDP than consumption

but plays a crucial role in growth and development because each year's investment can use new technologies to replace previous ways of doing business. The most important of these technology transitions is to replace fossil fuel use with electricity powered by renewables, but many other improvements are possible in terms of productivity and working conditions, as well as the quality of products sold.

Government activity (the G in the definition) is its actual provision of goods and services, which includes both physical infrastructure like road construction and also services such as education or health care. The government's transfer payments such as social safety nets or pension payments enter GDP when they are spent in the private sector, either by households for consumption or by businesses for investment.

Net exports (the X in the definition) are the total flow of goods and services from any given example country that is sent elsewhere in exchange for money. This is the sum of all exports minus all imports. Often the same thing is both exported and imported over a year, including many food products. Exports are added to GDP because they are income not counted elsewhere, and imports are subtracted to avoid double counting the thing when used for C, I or G.

The relative size of the four components in the U.S. economy is shown in Fig. 9.3.

Percentage shares of the U.S. economy are shown in Fig. 9.3 using a chart from the central bank's online source of Federal Reserve Economic

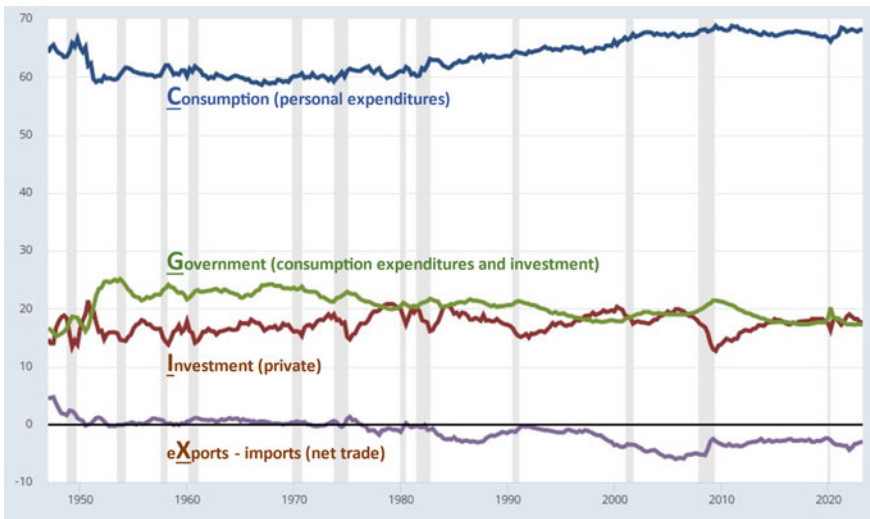


Fig. 9.3 Shares of GDP as $C + I + G + X$ (consumption, investment, government and net exports) *Source:* Reproduced from Federal Reserve Economic Data [FRED] using quarterly data from the Bureau of Economic Analysis, not seasonally adjusted. An updated version of this chart is at <https://fred.stlouisfed.org/graph/?g=19UU2>

Data (FRED). This data-visualization service is designed to track and report economic activity to the public, with detailed explanations for each data series. Later in this section we will use FRED charts to see various aspects of the macroeconomy. Focusing first on percentage shares of the economy in Fig. 9.3 reveals fluctuations over time, before we turn to its size and growth.

The vertical gray lines in this and other charts show periods of downturn in private economic activity known as *recessions*. The start and end of each recession is determined by a committee of academic researchers convened by the National Bureau of Economic Research (NBER), an independent nonprofit organization, based on three criteria: the depth of downturn, its diffusion across multiple sectors of the economy and its duration over several months. The committee's judgments are subjective to some degree, but preferred to other possible definitions of recession in part because each slowdown is unique in some ways.

Starting from the top of Fig. 9.3, spending by households on personal consumption expenditures accounts for about two-thirds of economic activity in the U.S. That share was around 65% immediately after World War II and then dropped to 60% from 1951 through 1981, before rising to a peak of 69% in 2009. Personal consumption as a share of activity fell gradually over a decade to 67% in 2019, dropped to 66% in the COVID recession of 2020 and snapped back up to 68% from 2021 through 2023.

Government spending on consumption and investment shown in Fig. 9.3 rose sharply from a low of 15% in 1947 to 25% in 1952–1954 and then fluctuated around 24% until 1970. After 1970 the share of government activity in the economy fell gradually to 18% in the late 1990s, before rising just above 21% in 2010 and then falling back to 17% in the 2017–2023 period, with a brief spike to 20% in mid-2020 at the start of the COVID pandemic.

Private-sector investment is the category of GDP with the most short-term variation from year to year. Investment, defined here as real expenditure by businesses for inventories, equipment and facilities, drops sharply during the recessions marked by gray vertical bars and rises gradually as a share of activity during each period of recovery and growth. The pace and composition of investment differs as businesses pursue new opportunities in each period of growth.

Trade enters national accounts as exports minus imports, tracing the flow of spending on real goods and services. In 1947 exports exceeded imports by about 5% of GDP, leaving a smaller share of all goods and services available for domestic consumption, investment or government activity. Postwar recovery quickly closed that gap leading to a lengthy period from 1950 to 1982 in which exports roughly equaled imports, with some fluctuations around each period of recession. In the mid-1980s, and then again to an even greater extent after 1997, net trade fell to about -5% of GDP. Having negative net trade allowed the sum of domestic consumption, investment and government expenditure to reach 105% of GDP, as imports exceeded exports which raised the quantity of goods and services available inside the country. Net trade

moved back towards zero in the recession of 2008–2009 and stayed around -3% from 2012 to 2020, before falling to -4% in 2022 and 2023.

The expenditure shares shown in Fig. 9.3 are a helpful starting point for macroeconomics, revealing how household consumption relates to business investment, government activity and international trade. We can then trace where those expenditures come from, in terms of income earned by workers and owners of resources used in production, as they transform and add value to the inputs they buy from other people in the economy.

The Equivalence of Expenditure, Income and Value Added in GDP

Each country's GDP is calculated by national statistical agencies using a variety of data sources, updating each variable monthly, quarterly or annually. Statistical agencies often provide forecasts that may depend on expectations about the size of upcoming harvests, and make revisions of past data when more accurate data become available. Various data sources can be used because GDP is a circular flow, so information can be obtained from any side of the transaction.

The definition of national income in expenditure terms as $GDP \equiv G + C + I + X$ is the most convenient way of introducing analysis of the macroeconomy, by focusing on how money is spent. The circular flow can also be defined and measured as income earned and received, and as value added created when turning inputs into outputs. The three equivalent ways of seeing economic activity are shown in Table 9.2.

Our example economy in Table 9.2 consists only of the food system, with three kinds of enterprises: primary input suppliers such as energy and service providers, farm families that use some of those inputs to grow food and food businesses that use farm produce plus other inputs to make final products for sale to households. This could be an entire toy economy that only consumes food, or a subset of the whole economy, which would require additional

Table 9.2 Accounting for the circular flow of sales, value added and income

	<i>Primary inputs</i>	<i>Farm families</i>	<i>Food businesses</i>	<i>Totals</i>
Final sales (expenditure)	\$200	\$500	\$1000	
– inputs to farms and businesses		\$100		
– farm produce used in food businesses			\$500	
= value added	\$200	\$400	\$400	\$1000
Income (payments for labor and capital)				
wages to employees	\$80	\$50	\$200	
+ rents for land	\$20	\$100	\$50	
+ interest on loans	\$70	\$50	\$100	
+ profits and net farm income	\$30	\$200	\$50	
= total income	\$200	\$400	\$400	\$1000

columns and rows to show the government, nonfood businesses and foreign trade. To make the arithmetic clear, the total amount of market activity in this economy is \$1000.

The size of the circular flow can be measured simply by total consumption, which in this case is final sales of food worth exactly \$1000. That is the 'expenditure' approach to measuring the economy, with just the one consumer good in this case as the 'C' in $GDP \equiv G + C + I + X$. Additional columns and rows would be needed to show government services, business investments and net exports, and we would then add those to obtain everyone's total spending in the economy.

An alternative way of seeing the circular flow is through *value added*, often described as 'value chains' as goods and services flow from one enterprise to another. Here we see that the initial input suppliers have sold \$200 worth of energy and services, half to farmers and half to food businesses. Farmers used that \$100 of energy and services to make products that they sold for \$500 to food businesses, which used that plus \$100 of energy and services to make the food they sold. The value added by food businesses is \$400 of their \$1000 in sales, and the value added by farmers is also \$400 of their \$500 in sales. The input providers are called 'primary' producers because they use only labor and capital, so their output of \$200 is entirely value added. The sum of value added is their \$200 in primary production, \$400 on the farm and \$400 by food businesses, thereby accounting for all this economy's market activity.

The third way of describing the circular flow is through peoples' income. Individuals and households are shown in the accounting framework as either employees who earn wages, owners of land who are paid rent, lenders of money who are paid interest, the owners of businesses that earn profits and farm families that live on their net farm income. In this simple economy there is no separate real estate or banking sector, but just individual people who are landlords and lend money to others as was commonly done for much of human history.

The four kinds of income (wages, rent, interest and profits) are itemized separately in national accounts because they represent the returns to different kinds of capital or resources. Each kind of income represents payments for a 'factor' of production, using that term to emphasize that these resources are the underlying foundations of market activity. Wages can be seen as returns to human capital, meaning each family's investment in their own health, education and skills. Rent is returns to land and the natural resources on that land, as well as any investments to augment the value of land such as buildings. Interest is the return to financial capital, including each household's savings that are invested in other enterprises, and profits (or net farm income) are returns to the owners and managers of each enterprise.

Our imaginary economy has values that are round numbers, chosen to allow easy comparison of the labor, capital and other resources used in each kind of enterprise, but they represent useful orders of magnitude to see how elements of the macroeconomy all fit together. Starting with food consumers,

in this example, the \$1000 cost of food bought by consumers was spent on \$200 in primary inputs such as energy, \$400 in value added by farmers and \$400 in value added by retailers. Focusing on farmers, their total sales of \$500 were spent on \$100 in primary inputs leaving \$400 in value added, that came from \$50 in wages to employees and \$50 in interest paid to lenders, with the remaining \$100 in land rents plus \$200 in net farm income accruing to the farm families if they own their land.

Macroeconomic accounts are typically presented first using national totals per year, as in Table 9.2, and then compared with the number of people engaged in each activity to see flows per person. As we will see, in low-income countries with few off-farm employment opportunities the available agricultural land is divided among many farm families, so farmers' income per household is extremely low. The primary sector, including the provision of energy and water or other utilities, typically employs relatively few people at high wages. In contrast, food businesses often involve labor-intensive activities that require less training, experience and formal qualifications than other jobs, so it employs a larger number of lower wage workers than other sectors of the economy.

The nature of employment and resource ownership also differs by sector. In the stylized example of Table 9.2, farm families use hired workers and pay wages totaling \$50 per year or 10% of their farm revenue. In a real food system that would typically consist of seasonal or part-time help as well as contract service providers, although some crops and many livestock operations are grown with full-time employees. Farm families in this example also pay a total of \$100 or 20% of revenue to landlords. In the U.S. and many other countries, farmers typically inherited some of the land they farm, and rent land from other people who inherited or bought land as an investment. This stylized example also shows farm families paying interest of \$50 or 10% of revenue, which might apply if they had borrowed money to buy land or large amounts of equipment or had accumulated debts for their own living expenses in years of low farm income. In addition to these factor payments, farm families also purchased inputs worth \$100 or 20% of revenue. This example has those inputs coming only from the primary sector which sells only energy and services, and in real economies with a manufacturing sector there would be fertilizers and crop chemicals, equipment and machinery as well as farm buildings.

National accounts data are collected and reported for the purpose of macroeconomic management, but they can also be used to understand food systems. Agriculture and food businesses account for a large fraction of all activity, especially in lower-income countries and for lower-income workers and consumers within each country, so improving the collection and presentation of these data is an important priority. The United Nations has a Statistical Commission that aims to standardize reporting, with country efforts to improve measurement supported by the World Bank (which lends to governments for public expenditure) as well as the International Monetary

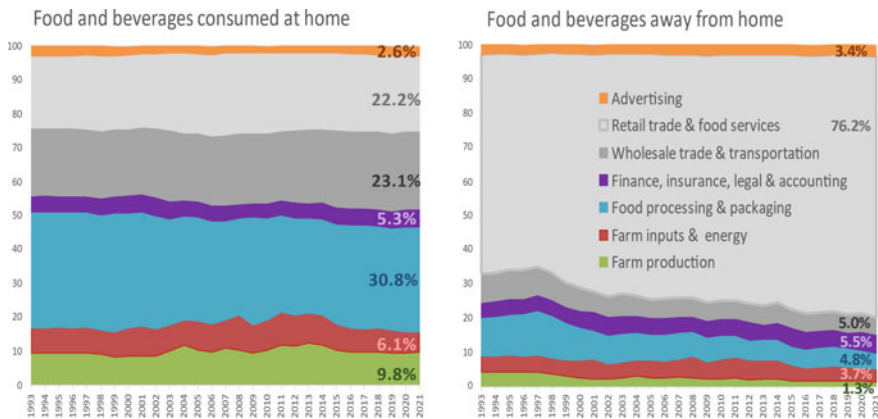


Fig. 9.4 Value added in the U.S. food system, 1993–2021 *Note* Authors’ chart of data from the USDA Economic Research Service (2023), Food Dollar Series, available at <https://www.ers.usda.gov/data-products/food-dollar-series>

Fund (which lends to governments to help stabilize their money supplies, inflation and exchange rates). Within the UN system, the FAO’s statistics division maintains macroeconomic data on agriculture, including efforts to produce global versions of the U.S. data presented in Fig. 9.4.

Value Added in the U.S. Food System

Actual data for the U.S. are used each year by the USDA to monitor the food system, including a real-life version of the value added row in Table 9.2. Their annual publication on this topic is known as the ‘Food Dollar’ series, providing consistent measurement of value added shares accounting for all consumer food expenditure as shown in Fig. 9.4.

Each panel of Fig. 9.4 traces shares of the food dollar in terms of value added since 1993, with the most recent available percentage shares for 2021 on the right. From the bottom up each share is stacked up to 100% of consumer spending. The left panel shows how farmers’ share of the U.S. food dollar hovers around 10%, with primary inputs purchased by farmers adding another 6%. The sum of those two shares rose noticeably in the decade from 2004 to 2014, corresponding to the period of high producer prices for unprocessed foods at that time shown in Chapter 7, Fig. 7.13. Food processing and packaging now accounts for about 31% of retail prices, a slight decline from the 1990s. Interest paid to financial firms by food businesses, together with their insurance premiums paid, and legal or accounting fees adds up to around 5%. About 23% of food prices is the cost of transport and bulk handling of commodities and products, about the same as the 22% that is the cost of retail service provision at the point of sale.

The right panel shows similar data for food away from home. U.S. spending at restaurants and other food service establishments rose from about one-third

of total food spending in the early 1990s to about half in 2019, plummeted during the pandemic in 2020 and recovered quickly to above half since 2021. As shown in the right panel, about 76% of that spending is on value added in the food service sector itself. That share had been as low as 63% in 1997, then expanded to its current level, and a relatively stable 5.5% share of consumer costs is the food service industry's payments for financial, legal, accounting and insurance services. The food service industry's spending on food and beverage ingredients as such averages 15% of total expenditure, adding up the share to farmers (1.3%), farm inputs and energy (3.7%), food processing and packaging (4.8%) and wholesale trade and transport (5.0%).

A notable feature of the Fig. 9.4 is the roughly constant share of spent on advertising, now around 2.6% for food at home and 3.4% for food away from home. Overall food spending in the U.S. is about \$6200 per person, so total food advertising amounts to about \$161 per food consumer each year. The combined total is roughly \$60 billion per year, more than the U.S. government budgets for the National Institutes of Health (NIH) and Centers for Disease Control (CDC) combined. The data shown in Fig. 9.3 correspond to the 'value added' row of Table 9.2, and could also be broken out in other dimensions, for example to break out energy costs regarding contribution to climate change, or employment and wages to address equity in the food system.

Governing the Macroeconomy: Fiscal and Monetary Policy

Our circular flow diagram in Fig. 9.1 reveals a central role for government in shaping the macroeconomy, first through *fiscal policy* by the way it raises and spends tax revenues and borrowing for government operations, and through *monetary policy* by introducing and regulating the supply of money used by businesses.

Fiscal policy shapes the composition of the economy through the ways that government revenue is spent and the rates at which different kinds of wealth and income are taxed. Fiscal policy also drives the fraction of each year's government spending that is raised from taxpayers each year versus borrowed from investors to be paid back in the future. Unlike an individual or a private company, governments can print their own currency and can raise revenue by taxing the entire economy. In the U.S. and most other countries, lending to government offers investors the safest possible place to store savings, which is itself a valuable service, so government pays the lowest available interest rate on its borrowing. That safety arises in part because the overall economy grows over time, providing a larger tax base from which government revenue is raised.

The fact that governments repay loans by taxing their own citizens leads to a fundamental principle of fiscal policy, which is that governments can keep borrowing forever with no change in the tax rate as long as the interest rate it pays (commonly denoted r) is lower than the growth rate (g) of the tax base. For example, government spending might be 40% of total national income

each year, financed by a taxing all that income at an average rate of 30%. They could sustain that indefinitely by borrowing the remaining 10% from investors, without ever raising tax rates as long as the tax base grows as fast or faster than the interest paid. In practice all these variables fluctuate, with variation in both the amount of borrowing and hence accumulated debt on which interest is paid, as well as interest rates and growth rates. An important function of fiscal policy is therefore to complement monetary policy in helping to stabilize the economy, as well as shaping its evolution and growth rate.

Monetary policy consists of issuing physical money (coins and bills) and regulating the banking and credit sector through which people borrow and lend money for future use. Issuing enough money and regulating financial firms in ways that facilitate transactions and maintain trust in the banking system is usually done through a central bank that operates as a politically independent but accountable part of each national government. In the U.S., central banking is done by the Federal Reserve, whose balance of political independence and accountability is maintained by having it be controlled by a seven-member Board of Governors appointed by the President for terms that last for 14 years. This means that a new board member is appointed at least every two years, and the fraction of board members appointed by each party is proportional to their time in office over the previous 14 years.

Like fiscal policy, monetary policy influences both the composition and stability of economic activity over time. The central challenge is to inject and withdraw money and regulate the banking system in ways that accommodate growth and offsets fluctuations in the real economy. If the central bank injects too much, the supply of money grows faster than the supply of goods and services, leading to inflation. If there is too little new money and credit from banks, firms cannot grow leading to less employment. The U.S. and other central banks typically have a 'dual mandate' to keep inflation and unemployment low, so that the real economy can grow to help people achieve their highest potential level of wellbeing over time.

The link between inflation and unemployment arises in part from the downward rigidity of nominal wages or salaries. When revenue declines, businesses typically cut the number of employees instead of reducing the wage or salary paid to each person, and when demand rises, they hire again if necessary, by offering higher wages and salaries. Other kinds of prices are also rarely reduced when demand falls, as sellers prefer to keep prices constant until sales recover, then raise prices when demand increases. Many but not all wages and many prices are sticky in this sense, like a ratchet that sometimes rises but rarely declines. Most importantly for the food system, when demand for farm commodities declines their prices can drop sharply. When that happens, farmers remain on the farm, whereas in nonfarm employment when demand declines people lose their jobs.

Another link between inflation and unemployment arises from the circular nature of each country's economy. Investment and growth opportunities can arise in any sector of the economy, and when enterprises in that sector then

hire people and buy products from others, they in turn hire more people and buy other products which spreads growth to other sectors and regions. When the economy is running smoothly there are attractive opportunities for new value added in many sectors that expand supply and demand at about the same rate, so that gradual economic growth at a few percent per year can proceed with little change in the economy's average price level. Sometimes that growth accelerates into a boom period of even faster growth, during which a rising fraction of the workforce enters paid employment and credit expands to finance new enterprises. The economy's various enterprises are each other's customers, so when the circular flow of activity falters, the slowdown can happen suddenly with contagious job loss throughout the economy.

Economywide slowdowns, known as *recessions*, can occur at any time and originate in any sector. When demand slows for one set of businesses, those enterprises cut jobs and reduce purchases of inputs from others, which leads others to cut jobs and reduce their own purchases. The flywheel of economic growth then goes into reverse, reducing income and employment from month to month. Such downturns can be deep and long-lasting, potentially turning into depressions that last for years with low levels of different goods and services in the economy until growth resumes.

For much of economic history these downturns ran their course until people eventually found work again, sometimes after a period of profound impoverishment. The most recent very deep downturn began in late 1929 and lasted through the 1930s. That 'great depression' led a British economist, John Maynard Keynes, to show how fiscal policy could step in to fill the gap in private-sector demand by buying goods and services for the public sector, and central banks could do the same with monetary policy to provide cash and credit for individuals and businesses. These 'Keynesian' responses have since made recessions shorter and less severe, reducing the hardships they cause for employees who lose their jobs and farmers who face periods of low prices.

The connection between the real economy and monetary policy can be seen in accounting terms, through the 'velocity' at which transactions occur in the economy. Over the course of a given year, the price of each thing in the economy (denoted P) could be multiplied times the quantity (Q) of that thing, to show the total money value of everything in the economy. For prices to remain stable, total activity would need to equal the money supply (M) of cash or credit from banks times the number of times each dollar changes hands, known as its velocity (V). Given those definitions, stable price implies that $P \times Q = M \times V$. When M or V declines at the start of a downturn, for example because banks are issuing fewer loans and people are increasing their savings instead of spending everything they earn, there must be a corresponding decline in $P \times Q$. For farmers it is P that falls, but in other parts of the economy prices are sticky so it is Q that falls, meaning a reduction in the real quantity of things produced and workers employed to do things.

Real Gross Domestic Product per Person

The flow of goods and services through an economy, measured using national accounts as in Table 9.1, allows comparison of total output per person in each population in real terms. The purpose of calculating real GDP per person is to track the total quantity of goods and services available in a country at each point in time, adding up all activity in the private and public sectors.

The value of activity is initially reported in nominal values using current prices and converted to real terms using constant values in a base year. For total output, adjusting for inflation is done using a GDP deflator, multiplying change in each price times its share of national output. That weighted average can use historical shares from a past year known as a Laspeyres index, or current-period weights known as a Paasche index, each named after the nineteenth-century statistician who argued for that approach. To keep up with changes in each item's share of output, including especially the introduction of entirely new items, since the 1990s the U.S. and other countries use chained indexes, for which weights are a continuously updated average of current and immediate past shares. The base year price level used for reporting is arbitrary, and by convention both U.S. and many global data now report real output in terms of prices from 2017.

Data on changes and levels in real output are available for the U.S. since January 1947, as shown in Fig. 9.5.

The left axis of Fig. 9.5 shows percent changes in each quarter relative to that period in the previous year, and the right axis shows the level of GDP each quarter in 2017 dollars. Data are reported quarterly and are seasonally adjusted, combining information from different sources to produce a complete table of national accounts like Table 9.1.

Percent changes in GDP reveal the episodic pattern of economic growth, commonly called the business cycle. From 1947 to 1961 there were four peaks where real GDP reached more than 5% above its level at that time the previous year, and four troughs where real GDP declined to around 2.5% below its level the previous year, all corresponding to recessions as indicated by the NBER. In the 1960s there was a long boom period of continuous growth, followed by four recessions between 1970 and 1983. The slowdown and declines from 1980 to 1983 were particularly important with just one brief quarter of growth above 2.5% and several quarters below -2.5% . That period was followed by two long booms in the 1980s and 1990s punctuated by shallow recessions in 1990 and 2001, before the smaller boom for the 2000s and the very deep and prolonged recession in 2008–2009, followed by sustained growth up to the pandemic recession of 2020 and recovery since then.

The level of GDP per person on the right axis of Fig. 9.5 shows how episodes of growth cumulate over time. The pattern of growth is like a family marking each child's height on a door or wall in their home, with growth spurts cumulating in transformational change and development over time. The total size of the U.S. economy shrinks back slightly after each period

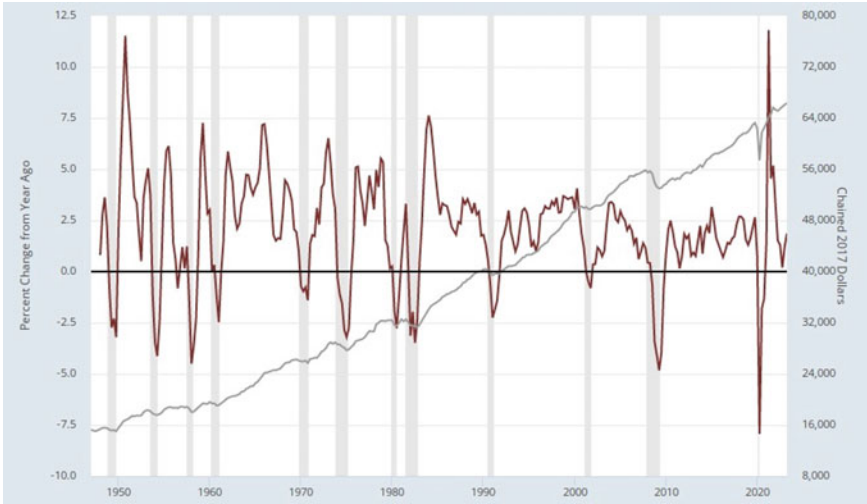


Fig. 9.5 Percentage changes and level of real GDP in the U.S., January 1947–April 2023 *Source:* Reproduced from Federal Reserve Economic Data [FRED] using quarterly, seasonally adjusted real U.S. gross domestic product [GDP] from the Bureau of Economic Analysis. The same data are shown as percent changes from one year earlier in the thin line against the left axis, and as the level of real GDP per person in 2017 U.S. dollars on the right axis. Updated versions of this chart are at <https://fred.stlouisfed.org/graph/?g=19Q7r>

of growth, but the accumulation of new activities has expanded total output per person by a factor of four over this period, from a level of around \$16,000 per person in the late 1940s to over \$64,000 since 1921. The total quantity of goods and services doubled over the 33 years from 1947 to 1980, and then doubled again over the 40 years from 1981 to 2021.

Total output per person is just that, tracking the total monetary value of all goods and services that people provide to each other in a country. In Chapter 10 we will address how growth in GDP and national income over time and differences across countries relate to wellbeing and the composition of activity, especially in the food system. Before that we need to address the purchasing power of income earned in GDP, using a consumer price index.

Inflation and the Purchasing Power of Money

In our discussion of risk and food crises in Chapter 7, Figs. 7.13 and 7.14 showed variation in the cost and price of food relative to the prices of all other goods and services in the U.S., while Fig. 7.17 compared the cost of a healthful diet across countries in purchasing power parity terms. That is consistent with a focus on the real economy, where the price of something is defined in relative terms as the quantity of all else that must be given up to acquire it.

Now in macroeconomics, we are concerned with overall *inflation*, defined as a rise in the average price level of all goods and services in the whole country, or equivalently a decline in quantity of things that a unit of currency can buy. For measuring a country's output in Fig. 9.4 we needed a GDP deflator, which counts all activity including the public sector. To measure purchasing power for households, each country's national statistical organization produces a *Consumer Price Index* (CPI), tracking percentage changes in the average price of goods and services sold to individuals.

The CPI is intended to capture the cost of living for an average person, so each item's weight in the average is its share of total consumer spending from household survey data. For example, in the U.S., the share of food at home in the CPI is 8.7%, and the share of food away from home is 4.8%. Those weights differ from each item's share of national income for the GDP deflator, where total expenditure on food away from home is larger than expenditure on food at home due to food at schools and other institutions.

The CPI refers only to consumer spending and is defined as the price level relative to 100 in a base period. The consumer price index can also be reported in terms of percentage changes from period to period, like GDP growth but for prices. Both the level and growth in CPI are shown in Fig. 9.6.



Fig. 9.6 Percentage changes and level of the U.S. consumer price index, January 1947–August 2023 *Source:* Reproduced from Federal Reserve Economic Data [FRED] using the monthly U.S. consumer price index [CPI] from the Bureau of Labor Statistics. The same data are shown as percent changes from one year earlier in the dark line against the left axis, and as the price level relative to a value of 100 in January 1947 on the right axis. The black horizontal line shows a percentage change of zero. Updated versions of this chart are at <https://fred.stlouisfed.org/graph/?g=19P5E>

The left axis of Fig. 9.6 shows each month's CPI as a percentage change since the same month one year earlier, and the right axis shows its level since a value of 100 in January 1947. When percentage change is above the dark horizontal line at a percent change of zero, the price level has risen over the past year. Monthly fluctuations reveal the volatility of inflation. Commodity prices like food or oil and gas often drop suddenly, while other prices like apartment rents are sticky and rarely decline but may rise sharply during periods of sustained inflation. The chart shows that, after a few short bursts of inflation in 1948, 1951 and 1956–1958, year-to-year changes in the CPI stayed low in the early 1960s and then rose to dramatic peaks in 1974 and 1980. The Federal Reserve then took action to reduce inflation by reducing the money supply, which combined with fiscal policy kept U.S. inflation fluctuating around 2.5% and trending downward from 1983 to the start of the COVID pandemic in 2020, after which inflation spiked in 2021–2022.

The vertical bars indicating periods of recession reveal how inflation typically (but not always) rises during the boom period in the runup to a recession, then falls during and after the recession. Each recession differs in terms of causes and responses to the slowdown, leading to a different time path of prices. Also, inflation here is shown as each month's price level relative to that month in the previous year which helps account for the zig-zag pattern we see, for example in the path of year-on-year inflation during and after the COVID recession of 2020. News of the pandemic starting in January 2020 led people to stay home and cut back on spending, with a massive job losses and decline in GDP shown in Fig. 9.5, but prices did not fall as they had in the previous recession in part because the U.S. government responded with much more generous unemployment insurance and safety net programs, keeping demand up for whatever could be supplied despite people being sick with COVID. Fiscal and monetary policy was much more responsive to the 2020 recession than it had been to the 2008–2009 recession, or the 1981–1983 recession before that, leading economic activity to snap back in 2021 as shown for GDP in Fig. 9.5. In 2021–2022 the sudden return to spending raised demand for goods faster than supply could respond, leading to the spike of inflation that peaked in mid-2022 as shown in Fig. 9.6.

In summary, the rise and fall of inflation traces the degree to which fiscal and monetary policy successfully expands the country's money supply just fast enough to accommodate real growth in economic activity. Governments and central banks around the world differ in their willingness and ability to manage economic development in this way, contributing to the differences in economic development discussed in the next chapter.

9.1.3 Conclusion

This section showed how the whole economy, as measured using the toolkit of macroeconomics, differs from analysis of individual activities using microeconomics. The economy as a whole is a circular flow within each country

involving households, businesses and the government. Because each person's spending is another person's income, the circular flow can accelerate in periods of growth spurred by supply and demand for new things, and then slow or stop during periods of recession when people slow their purchases from each other.

The government plays a distinctive role in the macroeconomy, different from the public sector's role in governing individual markets, due to the need and opportunity for monetary policy to stabilize and support the pace of economic growth by managing the supply of money and credit, and for fiscal policy to offset fluctuations in private demand by managing public-sector activity. As shown in the next section, downturns have severe impacts on households and the food system, while growth drives changes that lead to the next chapter on long-term economic development in agriculture, food systems, nutrition and health.

9.2 RECESSIONS AND UNEMPLOYMENT, WITH LINKS TO FOOD JOBS AND THE SOCIAL SAFETY NET

9.2.1 *Motivation and Guiding Questions*

So far, we have seen how understanding macroeconomic growth and development requires a different kind of analysis than our analytical diagrams for individual markets. In this section we focus on fluctuations, and the following chapter focuses on long-term growth and differences across countries. Fluctuations are marked especially by the onset of recessions with simultaneous job loss across multiple sectors and regions of the country. How do those waves of unemployment hit different groups in society, and relate to demographic trends in employment outside the home?

Food system jobs and livelihoods play a distinctive role in the economy and are affected differently by fluctuations and growth in market activity. Farm production is done mostly by self-employed family members whose earnings fluctuate, while employees in businesses lose their jobs when demand for their product declines. Also, historically and today at low-income levels most food preparation is done by family members within the home, but economic growth involves a larger fraction of time spent in paid employment including food transformation and marketing after harvest, and food service for meals away from home. This section includes coverage of how the composition of employment varies over time, in society as a whole and in the food system, and how social assistance and safety nets, including food assistance, can respond to limit the impacts of income loss.

By the end of this section, you will be able to:

1. Describe how and why periods of economic growth are interrupted by recessions, with downturns in spending and periods of high unemployment;

2. Explain how the circular flow of transactions within a country transmits a downturn in demand from one sector or region to other parts of the country;
3. Describe the available data on how growth and recessions relate to nutrition assistance programs, farm employment and food system jobs; and
4. Describe the available data on changes over time in labor force participation and disparities among groups in employment and earnings.

9.2.2 Analytical Tools

This chapter concerns the macroeconomics of employment, in terms of supply and demand for labor of all kinds. The tools needed begin with measurement, but also return to analytical diagrams for the supply and demand of worker for each sector as shown in Fig. 9.7.

The analytical diagrams in Fig. 9.7 help explain the wages or salaries paid for a specific type of worker in a particular location, drawn with a relatively steep and inelastic supply of labor from people who need to find a job, and a somewhat flatter more elastic demand from employers. The left panel illustrates one way that people might mistakenly believe labor markets work, which would be a perfectly competitive market in which all workers and all jobs are identical, so employers adjust wages until supply just equals demand. In a perfectly competitive equilibrium, there would be no unemployment, with just one applicant for each opening and just one job offer for each candidate, so candidates would be indifferent between jobs. That is unrealistic for many reasons, including that each worker and each job is unique in some ways, so employers typically want multiple applicants from whom to select, and want to offer a sufficiently high wage that successful candidates will be motivated to stay in the job.

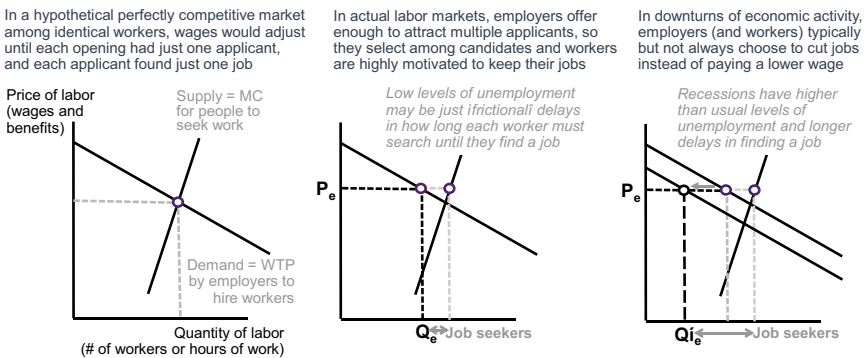


Fig. 9.7 Labor supply, labor demand and unemployment in good times and bad

Structural features of the labor market make the observed market equilibrium somewhat like the middle diagram, where competing employers all offer a wage sufficient to make their jobs attractive to multiple candidates, resulting in some degree of unemployment while workers and employers search for the best fit. When unemployment is low there are relatively few candidates for each position, and job searches as well as job vacancies are brief, but there is still ‘frictional’ unemployment as some workers spend several weeks or even months looking for their preferred position. In settings where workers are desperate for a job as soon as possible, and employers are willing to take the first candidate they find, frictional unemployment might fall to near zero. Other factors could increase frictions, such as a geographic distance between existing workers and newly available jobs, credential requirements that make it difficult for candidates to apply, or monopsony power when only one employer seeks a specific kind of worker in a particular place. Those kinds of market failures would lead to higher levels of unemployment at all times, but a kind of unemployment that can be of even greater concern is what happens when demand for all kinds of goods and services stops growing or begins to decline.

The right panel in Fig. 9.7 shows what typically happens during downturns. When a business experiences a cut in demand, for example 10% fewer customers, managers typically choose to reduce the number of workers instead of paying each worker lower wages for the same work or asking each worker to do fewer hours at the same wage. Exceptions to this are typically casual or gig labor and self-employment. In many jobs the employer prefers a fixed schedule so would not want to reduce number of hours for all workers proportionally, and managers also want workers who remain on the job to remain highly motivated. Both factors imply that instead of cutting the income of those who remain employed, there is widespread job loss and a higher unemployment rate during the downturn, and then workers are hired back as the economy recovers.

Unemployment and Real Wages

There is no single unified labor market for the entire country. Different workers and different jobs pay different wages, but macroeconomic fluctuations cause synchronized swings in demand for many types of labor, leading to economywide fluctuations in employment and earnings. The synchronized booms and busts in U.S. labor markets, and the much larger fluctuations in unemployment than in wages, are shown in Fig. 9.8.

The central fluctuating line in Fig. 9.8 is the official unemployment rate in the U.S., defined as the number of people actively looking for work over the past month who do not yet have a job, divided by that population plus those in either full-time or part-time employment. Other ways of defining unemployment generally move in parallel to this headline measure, which is easily described as the share of the country’s workers who are actively looking for a job. Over each business cycle since 1947, this rate attains its lowest levels in the

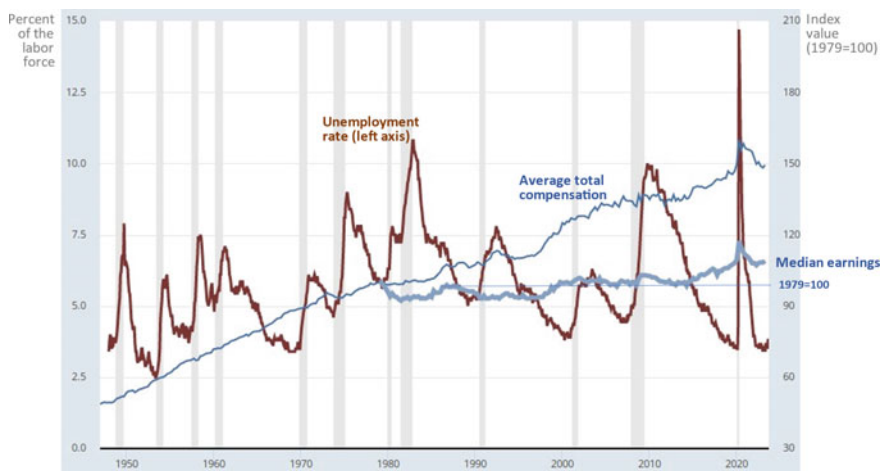


Fig. 9.8 Unemployment and real wages in the U.S., January 1947–September 2023
Source: Reproduced from Federal Reserve Economic Data (FRED) using the seasonally adjusted monthly data from the Bureau of Labor Statistics for unemployment on the left axis as a percentage of people actively looking for work, and two measures of workers' earnings relative to January 1979 = 100: the average total compensation all workers in the light line since 1947, and the median usual earnings of full-time workers in the thicker line that begins in January 1979. Updated versions of this chart are at <https://fred.stlouisfed.org/graph/?g=19QMp>

months just before a recession, when the lowest possible frictional unemployment rate falls to somewhere between 2.5% and 5%. The unemployment rate then spikes abruptly during the recession as businesses conduct simultaneous job cuts due to reduced output, and workers are later hired back. The unemployment spike during the COVID recession of 2020 was exceptionally high but also exceptionally short-lived. By December 2021 the unemployment rate had dropped back to its pre-recession lows below 4%, a level not seen since the late 1960s.

The lighter lines show workers' earnings in real terms, after adjusting for inflation. The wage rigidity illustrated in Fig. 9.7 applies most directly to nominal wages, but the wellbeing of workers depends on the real value of those wages which are shown here in index number terms, relative to a value of 100 in January 1979. The longest available time series is the thin line since 1947 showing average total compensation to full time workers. That compensation includes health insurance and other benefits and is shown to have risen steadily through the 1950s and 1960s, faltered in the 1970s and then been almost unchanged from 1980 to 1985 before rising in the 1990s, 2000s and especially after 2014.

The thicker line starting in January 1979 shows median usual wages paid to full-time workers. That differs from average total compensation per hour in three main ways: it shows the median which means less influence of high

earners who raise the average, it refers only to wages and so excludes health insurance and other benefits, and it counts only full-time workers in contrast to the part-time workers included in total compensation per hour. The first two differences help explain the much smaller rise in median wages than average earnings between 1979 and 2010. Since January 2011, median wages and mean hourly compensation have moved in near lock step, staying flat to 2014 and then rising significantly over the five years just before the pandemic.

Wage changes during the pandemic are a valuable illustration of selection and composition effects, as the apparent spike in median wages and average compensation in 2020 occurred only because lower-wage workers were more likely to lose their jobs. Median and average earnings dropped as lower-wage workers were rehired and as post-pandemic inflation eroded their buying power, but as of early 2023, mean compensation was about 50% above its level at the start of these data in 1979, and median wages were about 8% above the level at which they had been in 1979 and again in the 2000s to 2014. That change implies growth in median real wages of about 1% per year during the 2014–2022 period. The absolute level of median wages in 2022 is not shown on the chart but amounts to about \$27 per hour in 2022.

Recessions and the Safety Net: Unemployment Rates and SNAP Benefits in the U.S.

Government spending can help stabilize the economy to some degree, by spending public funds to fill the dip in household incomes caused by recessions. The government then recovers those funds later through taxation, in the same way that it pays for public investment in infrastructure or other activity. Making countercyclical payments effectively is administratively difficult because their effectiveness depends on being disbursed immediately throughout the affected population. Countercyclical expenditure can also be politically difficult because it requires the government to spend more at a time when the population is spending less, leading voters and taxpayers to feel as though the government is out of step and not experiencing their hardship.

Government programs that respond quickly to downturns are known as automatic stabilizers. These instruments of policy play some role in the economy even during periods of growth and are designed so that public spending can respond quickly as soon as jobs are lost. Unemployment insurance is an important kind of stabilizer, as are taxes that rise with income during periods of growth and then decline automatically in recessions. Those stabilizers are primarily sensitive to income variation for high earners, which limits their effectiveness in offsetting the effects of a recession among low-income people.

In the U.S., an increasingly important stabilizer is the use of SNAP benefits, which can respond quickly because eligibility is well defined, and many eligible people are able to access initial or expanded benefits soon after they experience income loss. The program is already in place and being used by those in need. People cannot know whether an individual case of hardship is

due to an economywide recession or own local circumstances, and the program responds to them equally. No policy decisions are required because funding for the program is authorized as an entitlement, meaning that the Federal government will reimburse states for any level of spending that adheres to program rules. The entitlement is authorized every five years or so as part of a food and agriculture package known as the Farm Bill, assembling the interests of all food system participants including the anti-poverty community that supports SNAP.

As its name suggests, SNAP is authorized under the ‘nutrition’ title of its authorizing legislation, and its benefits can be redeemed only for food. SNAP benefits are designed to supplement the recipient’s own spending, and the benefit formula generally ensures that recipients do indeed spend some of their own money on food in addition to the assistance received. The analytical diagrams in Section 8.2 show how this makes the program like a cash benefit, as recipients use their benefits card for groceries until its monthly balance runs out and then switch to their own money. That feature ensures that recipients use the card as intended and have no interest in converting SNAP benefits to any use other than buying food.

The advantages of giving low-income people a debit card with which to pay for groceries have made SNAP a popular program with program beneficiaries, government policy makers and businesses in the food sector. Since its introduction in the 1960s, the program grew to account for about 4% of all U.S. spending on food at home during the period from 1981 to 2007. The 2008–2009 recession led to a sharp increase in SNAP use to 9% of U.S. food spending in 2011 and 2012, falling back to 5% in 2019. The program was particularly attractive an instrument to help eligible people during and after the COVID recession, with total payments rising to 8% in 2020 and then 12% in 2021, partly due to emergency provisions for eligibility as well as an increase in the benefit level for 2021.

The increase in SNAP use and the program’s responsiveness to need around recessions is shown in Fig. 9.9.

Figure 9.8 shows the same unemployment line as the previous chart but starts in 1965 to show the gradual expansion of SNAP since its beginnings in 1967. The program was introduced at a time of rising incomes and falling unemployment, when many Americans were becoming increasingly prosperous, but voters and government officials understood that not everyone could acquire a similarly high-quality diet. Pilot programs were launched in the form of ‘food stamps’ that recipients bought with their own cash, as a way of ensuring that the benefit supplemented their own spending, and the USDA used a set of low-cost food plans to show how the benefit level could ensure access to sufficient food to meet nutritional needs.

As shown in Fig. 9.8, the SNAP program grew quickly and became strongly countercyclical in the 1990s, shrinking when unemployment fell and rising soon after spikes in unemployment caused widespread loss of income and wealth. Program spending is shown on the right axis, in real purchasing power

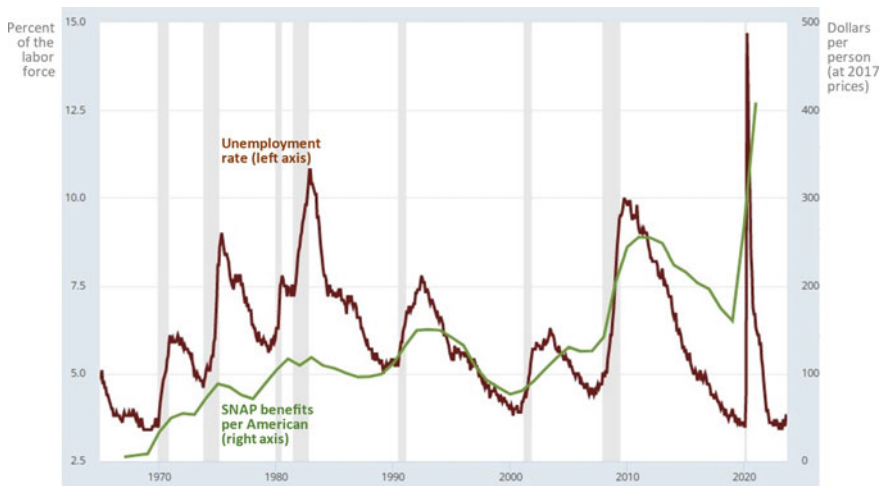


Fig. 9.9 Unemployment and SNAP benefits in the U.S., 1967–2021 *Note* Reproduced from FRED using the same unemployment data shown in Fig. 9.8, with the addition of benefits paid through the U.S. Supplemental Nutrition Assistance Program [SNAP]. Benefits are shown per person [not per beneficiary], counting the entire resident population plus armed forces overseas. The value of benefits is in real terms deflated by the consumer price index for food at home, in U.S. dollars at 2017 prices. Updated versions of this chart are at <https://fred.stlouisfed.org/graph/?g=19VyB>

for food in 2017 U.S. dollars, per person in the U.S. The initial rollout in the 1960s and 1970s occurred gradually, reaching an expenditure level of about \$100 per person by 1980. The program was not initially designed to expand quickly in recessions; benefit levels did not rise in response to the 1983–1984 recession. SNAP spending then fell as unemployment declined, and a variety of program changes made it such that spending rose in response to the recessions of 1990 and then fell back to earlier levels in 2000, before rising in the recession of 2001. Most importantly for the current period, changes at that time positioned the program to expand quickly during the 2008–2009 recession, and again even faster in response to the pandemic in 2020 and 2021.

SNAP data in Fig. 9.8 are for the entire year which hides the speed of response but does reveal how hardship typically persists for some time after each spike in unemployment. Households continue to receive benefits only as long as they remain eligible. Many remain beneficiaries for less than a year while others stay on but at varying levels of benefit. Total SNAP spending is not an ideal measure of hardship, but it is extremely useful, capturing some aspects of the extent and depth of the deprivation people would face if they had only their market income. Eligibility is determined based on a fixed formula that takes account of earnings and assets, and payments depend on how far the household's income is below the cost of foods itemized in the USDA's Thrifty Food Plan. Program rules change over time, with for example a revision of the

Thrifty Food Plan in 2021 that led to higher payments per beneficiary, and use of the program to deliver cash-like benefits in place of school meals during the pandemic as shown in Fig. 7.3 in the section on poverty measurement. The program's core features include that kind of flexibility, making its basic design helpful for policy makers, attractive for beneficiaries, and highly informative about the way that governments can respond to both chronic and temporary hardship in the economy.

Employment, Minimum Wages and Low-Wage Jobs in the Food Sector

One frequently discussed aspect of wages and unemployment is the role of government-mandated minimum wages for certain kinds of workers. In the U.S., the federally mandated floor on wages that can be paid to most workers has been unchanged at \$7.25 per hour since 2009. As of 2023 that rate still applies in 20 states, while 30 states and several cities have mandated higher minimum wages, reaching up to \$17 for the city of Washington DC.

Minimum wages could be especially relevant for the food sector, which includes a large fraction of all work that can be done with limited on-the-job training and few formal qualifications. These jobs are open to the widest range of potential candidates, so employers can offer some of the economy's lowest wages and still attract applicants. A complicating factor is that U.S. food service and restaurant workers receive some of their compensation as tips. Tipped jobs are subject to a lower Federal minimum for their base wages, but there are little data about actual tips received.

Setting and enforcing a minimum wage could affect the unemployment rate if its level were set above the equilibrium wage shown in the middle panel of Fig. 9.7. To show its effect we would draw a horizontal minimum above the equilibrium level and observe that offering that higher wage elicits a few more job applicants along workers' labor supply curve but leads employers for that kind of job to cut back on offers along their labor demand curve, potentially increasing unemployment above its frictional rate. The number of additional lower-wage jobs employers might have offered, if any, is extremely difficult to estimate. Each type of job has its unique supply and demand curves, and variation in the degree to which employers want to pay a wage sufficient to attract multiple applicants and keep employees highly motivated, which is why equilibrium wages are typically above the intersection of supply and demand in Fig. 9.7.

Whether and how minimum wages influence the number of jobs in an entire economy extends beyond impacts shown in supply-demand diagrams for a single type of job. Those diagrams hold all else constant, and if the minimum is set above the equilibrium, it would affect the local economy, shifting each supply and demand curve and potentially even raising the number of jobs. In 2021 the Nobel Prize for economics was awarded to David Card for research with Alan Krueger and others on this topic, showing that different effects offset each other leading to no significant change in the number of jobs.

The topic's importance is such that surveys of academic economists include questions on whether U.S. minimum wages raise the unemployment rate. Prior to Card and Krueger's research, most economists consistently said that minimum wages do raise the unemployment rate, but Card and Krueger's findings were so convincing that most economists switched to say that the U.S. the minimum wage is too low to have a significant effect on the number of jobs.

Minimum wages could have a significant impact on workers regardless of whether they affect the number of jobs. One clue as to whether a worker's job is affected would be whether they are paid exactly the minimum. That could be a coincidence, but jobs paying exactly the minimum wage provide a rough indication of the extent to which the law alters employment conditions. There are no data directly counting the number of such jobs, but the U.S. Bureau of Labor Statistics uses the same survey as the median earnings reported in Fig. 9.8 to produce an annual report on the number and characteristics of minimum wage workers. That survey asks workers to self-report their usual wages along with other data about themselves, leading to the results shown in Fig. 9.10.

The Bureau of Labor Statistics cautions that survey respondents may report wages at exactly the minimum even if their actual wage is different, just because that number is easily remembered. Misreporting of that type would shift the levels shown in Fig. 9.10, but the trends reveal a clear pattern over

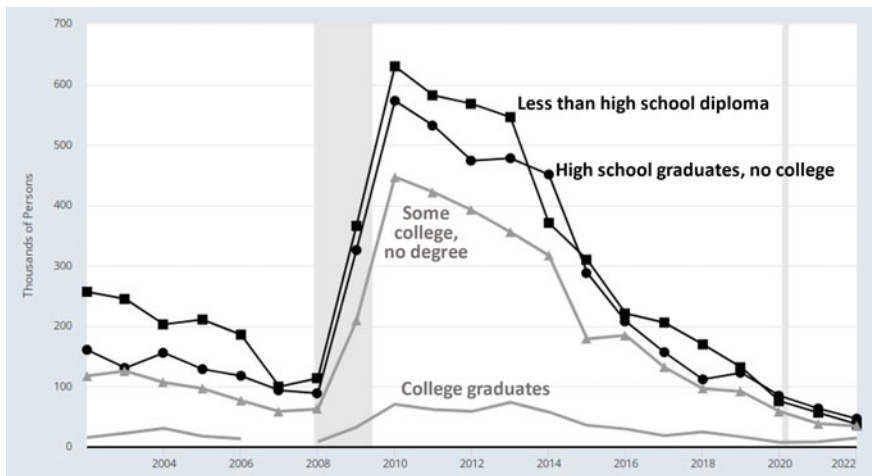


Fig. 9.10 Number of workers paid hourly at the Federal minimum wage in the U.S., 2002–2022 *Source:* Reproduced from Federal Reserve Economic Data [FRED] using Bureau of Labor Statistics, Characteristics of Minimum Wage Workers. Data are national totals estimated from self-reported wages for Current Population Survey respondents over 16 years of age. Updated versions of this chart are at <https://fred.stlouisfed.org/graph/?g=19RsF>

the business cycle. The number of minimum-wage earners was falling during the growth period before the 2008–2009 recession, which drove the number up sharply even among college graduates. For workers with less education, the number in minimum-wage jobs fell sharply from 2011 onwards, converging to similarly low levels in each category by 2022.

Food system jobs are disproportionately at and around the minimum wage, partly because there are fewer barriers to moving in and out of these jobs. The relative importance of each sector can be seen in the Bureau of Labor Statistics' annual report on characteristics of minimum wage workers. In 2022 they estimate that 79 million workers were paid hourly. Of those, about 7 million listed their occupation as food preparation and food services, and 0.7 million were in farming, fishing or forestry. The number of workers who reported being paid exactly the minimum wage was 141,000 or about 0.2% of the national total, and of those paid the minimum wage about 48,000 (34%) reported their occupation as food preparation and food service, and only 4000 (0.3%) were in farming, fishing or forestry. A decade of rapid growth in wages and national income, only 0.7% of the country's food service workers report being paid exactly the Federal minimum wage in 2022. The same report for previous years shows that share had been ten times higher at 7.0% in 2010, up from 2.8% in 2002.

Food system jobs include a large fraction of all tipped workers, many of whom have low total earnings. There is no authoritative measurement of income from tips, but the Bureau of Labor Statistics' annual report on minimum wage workers also reports on those who report being paid less than the Federal minimum. The data for 2022 and 2010, together with those reporting being paid exactly the minimum, are shown in Table 9.3.

In 2022, of the 7 million workers who reported their occupation as food preparation and services, 8% reported being paid less than the Federal minimum, which typically means they also earn tips—although many tipped workers actually earn more than that and might report doing so on the Current Population Survey used for these data. Back in 2010, a much larger fraction of workers reported being paid exactly the minimum and below the minimum, reflecting the large increase in demand for labor in the U.S. over the years from 2011 to 2022.

Food and Farm Employment in the U.S.

Employment opportunities relating to food are closely tied to macroeconomic conditions. Long-term changes and differences among countries in agriculture and food systems are addressed in Chapter 10, including how demographic changes and off-farm opportunities alter the number of owner-operator farm families. Here we focus only the number of hired workers and employees, for which the most reliable data in the U.S. come from surveys of business establishments conducted by the Bureau of Labor Statistics to count nonfarm employees and surveys of farm operators conducted by the National Agricultural Statistics Services to count hired farmworkers, both available since

Table 9.3 Number of U.S. workers at or below the Federal minimum wage in 2022 and 2010

	2022			2010		
	<i>Hourly workers (thousands)</i>	<i>At minimum (percent)</i>	<i>Below minimum (percent)</i>	<i>Hourly workers (thousands)</i>	<i>At minimum (percent)</i>	<i>Below minimum (percent)</i>
Total	78,729	0.2	1.1	72,902	2.5	3.5
<i>By occupation</i>						
Food preparation and serving	6961	0.7	8.0	6604	6.8	18.9
Farming, fishing, and forestry	656	0.0	0.6	621	2.3	3.2
All other occupations	71,112	0.1	0.5	65,677	2.1	1.9
<i>By industry</i>						
Leisure and hospitality	9558	0.7	6.0	8751	7.0	16.0
Agriculture	802	0.0	1.0	726	2.1	2.2
All other industries	68,369	0.1	0.4	63,425	1.9	1.8

Source: Authors' summary of data extracted from U.S. Bureau of Labor Statistics, Characteristics of Minimum Wage Workers for 2022 and 2010. All variables refer to workers paid hourly who are at or over 16 years of age. Updates are at <https://www.bls.gov/opub/reports/minimum-wage>, with additional data at <https://www.bls.gov/cps/tables.htm>

January 1990. Trends and fluctuations in the two kinds of food system employment are shown in Fig. 9.11.

The data shown in Fig. 9.11 omit self-employed farm family members which the USDA counts separately. By the USDA's definition there are roughly two million farm operations in the U.S., with roughly three million self-employed family members. What Fig. 9.11 shows is that the number of postharvest food system workers, those employed off the farm to transform agricultural output into retail products, has risen very rapidly since 1990 for food away from home from 6.4 to 12.4 million food service workers, and risen slightly for the grocery and packaged food sector from about 2.8 to 3.2 million food and beverage retail workers, and 1.5 to 1.7 million food manufacturing workers. The number of hired farm workers fluctuates seasonally, like food service workers, but has trended downward from over one million to about 0.8 million hired farm workers and employees.

Macroeconomic fluctuations that affect overall employment have a minor impact on farm, food manufacturing and grocery store jobs, which are affected primarily by other factors such as mechanization of farm work, and trends such as the reduction in retail grocery jobs in the 2000s and then its recovery after

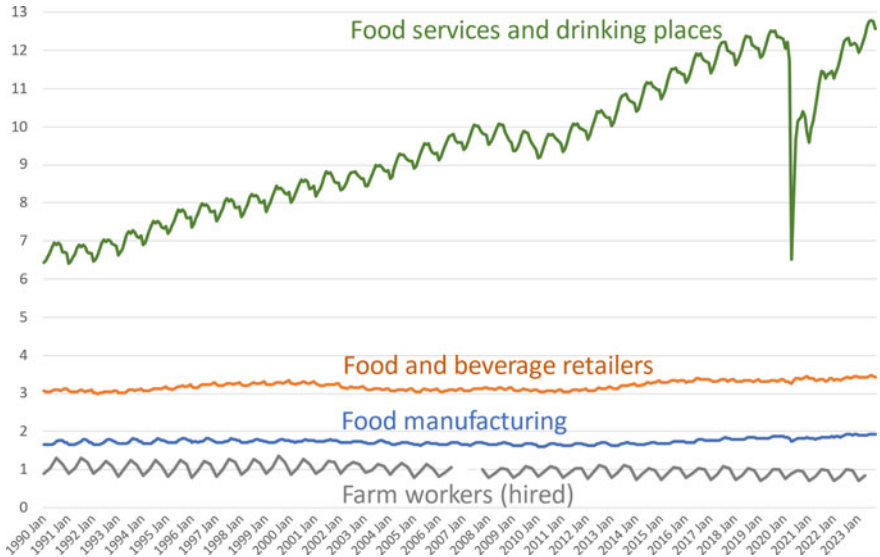


Fig. 9.11 Farm and food system employment in the U.S., January 1990–September 2023 *Source:* Authors’ chart of USDA and BLS data, shown as millions of workers by month for food sector employment and seasonally in January, April, July and October for hired farm workers. Food employment is from U.S. Bureau of Labor Statistics, Current Employment Statistics survey, not seasonally adjusted. Updated data are at <https://www.bls.gov/ces/data/employment-situation-table-download.htm>. Farm data are from USDA National Agricultural Statistics Service, Farm Labor Survey and includes only hired workers [not self-employed or unpaid]. Data for July 2007 are missing. Updated values are at https://www.nass.usda.gov/Surveys/Guide_to_NASS_Surveys/Farm_Labor

2012. Most importantly we see almost continuous increase from year to year for the number of jobs in bars and restaurants as well as other food service establishments, except for decline during the 2008–2009 slowdown, and the sudden collapse followed by quick recovery during the COVID pandemic.

Seasonality in both farm and restaurant work has an important influence on the kind of jobs that are offered. So does the fact that farm work is dispersed across rural areas, and that many restaurant and food service jobs can be done by people with few other options. Both categories offer relatively low-wage work, with no growth in hired farm opportunities and rapid growth in food service employment. Food manufacturing and retailing have more higher wage opportunities but grow slowly.

Labor Force Participation and Disparities in Employment

Trends in food system jobs and evolution of the macroeconomy have a major impact on labor force participation, meaning the shift from unpaid work within the household to working for others outside the home. Other factors

also influence that shift, including the demographic composition of households, duration of schooling and the physical and mental health of household members. To adjust for changes in population age and years in school, it is helpful to focus on labor force participation during the years of peak employment in the 25–54 age range. Those data are compared between men and women and to the whole population in Fig. 9.12.

As shown in Fig. 9.12, the fraction of all people who have a job rises during periods of economic growth and drops during recessions, with major differences by age group and between men and women. For the overall U.S. population, there was little or no trend in the 1950s and 1960s while employment rates rose for those aged 25–54, because of the baby boom in children born after World War II and increased schooling that raised the share of people under 25 who were not working. Similarly, the overall U.S. employment to population ratio has declined since the late 1990s while employment rates have fluctuated without a trend for those aged 25–54, now due to the rising fraction of people who are older and no longer working.

The data for female labor force participation in the 25–54 age range begin only in the late 1970s, showing a sharp rise to the late 1990s, followed by decline and recovery after 2011, while male participation has trended downwards since the late 1960s. That downward trend in male participation

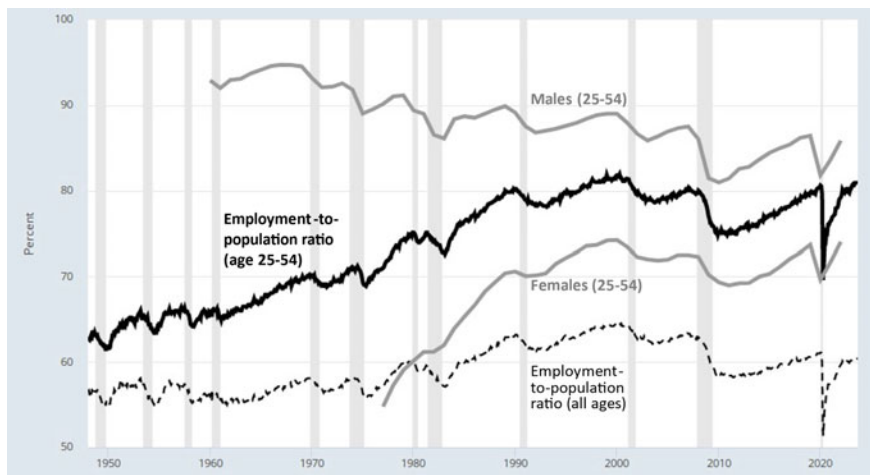


Fig. 9.12 Percent of the U.S. population in paid employment by group, January 1947–September 2023 *Source:* Reproduced from Federal Reserve Economic Data [FRED] showing the entire U.S. population’s employment-population ratio [dashed at bottom], the corresponding ratio for those aged 25–54 [in solid black], and the ratios for males [upper gray line] and females [lower gray line] also aged 25–54. Data are from U.S. Bureau of Labor Statistics and the OECD, using household responses from the Current Population Survey. Updated versions are at <https://fred.stlouisfed.org/graph/?g=19Ts1>

involves both larger drops during recessions and less increase during periods of growth. These trends are among the most fundamental and hotly debated aspects of economic development in the U.S., particularly regarding the causes of declining male participation, and why female participation stopped increasing in the late 1990s.

The overall rise in employment rates through the 1990s for adults aged 25–54 had profound effects on the food system, contributing to higher incomes and greater interest in reducing household on many tasks including meal preparation. Analysis of those trends is the focus of Section 10.2 in the following chapter.

Beyond the male–female disparities in whether people are employed for pay, there are large disparities in earnings from those jobs. The black line below is median weekly earnings first introduced in Fig. 9.8, now accompanied by levels by demographic group in Fig. 9.13.

The gaps in median earnings shown in Fig. 9.13 are driven by structural factors in U.S. society, especially the legacy of slavery, dispossession and violence against Black Americans, and challenges facing recent immigrants and others of Hispanic or Latino descent in addition to the many factors limiting women’s earnings. The trajectories of each group move roughly in parallel as macroeconomic shocks spread throughout the economy. During recessions, median earnings of those who remain employed tend to rise as lower-wage

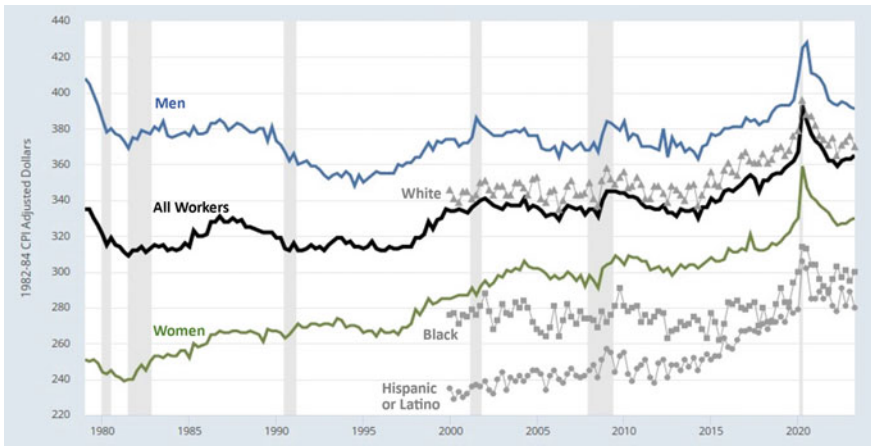


Fig. 9.13 Median weekly earnings by sex and racial category, January 1979–June 2023 *Source:* Reproduced from Federal Reserve Economic Data [FRED] showing real median weekly earnings for full time workers aged 16 and over, in U.S. dollars at 1982–1984 prices, from U.S. Bureau of Labor Statistics. The price level in 2023 happens to be about 300% of the price level in 1982–1984, so the average weekly earnings shown of around \$360 in 2023 have a value in current dollars around \$1080 per week or roughly \$27 per hour. Updated versions are at <https://fred.stlouisfed.org/graph/?g=19TsL>

workers lose their jobs, and then median real earnings often fall in the recovery period after recessions partly because those lower-wage jobs return and reduce the median, but also because inflation erodes the real purchasing power of those wages. Many factors led to stagnation of median real wages, especially for men, until the 2010s, and contributed to the rapid rise in median real wages over the past decade through the pandemic and afterward.

Relative earnings, expressed as female-to-male ratio and similar gaps by racial category, can be calculated from the data in Fig. 9.13 and reveal when there have been periods of convergence between groups, divergence or parallel movements with no change in disparities. Median earnings for women were 62% of male earnings at the start these data in 1979, and that ratio rose almost continuously to 78% in 1994. There was no further convergence during the 1990s, then a small rise to 82% in 2005 and a further very small increase to 84% of median male earnings by mid-2023. That trajectory contrasts with the Black-white ratio that has stayed close to 80% throughout this period, dropping briefly to fluctuate between 75% and 80% in the period from late 2014 to 2018, before rising to 83% in mid-2022. The Hispanic-white ratio was around 68% in the early 2000s, and rose steadily to around 75% since 2020.

Each worker's pay is often a function of their seniority and experience in their line of work, contributing to the persistence of any initial disparities in employment opportunities. To complete this section on how macroeconomics affects job opportunities we return to the unemployment rate first introduced in Fig. 9.8 and show disparities around that in Fig. 9.14.

The disparities in unemployment rates shown in Fig. 9.14 differ from earnings disparities shown in Fig. 9.12 and have much greater variation over time. This variation drives change in the food system in part because job loss causes food insecurity as discussed in Section 7.2, especially when combined with low family wealth leading households to exhaust their savings and run out of money to buy food. The spike in unemployment around each recession is particularly steep for Black workers (top line) and Hispanic or Latino workers (second from top), reflecting the financial precarity that underlies the food insecurity rates shown in Fig. 7.16.

During the recent period of economic growth since 2011, unemployment rates have converged to historically low levels for all groups. The recession of 1982–1983 had raised Black unemployment from under 12% to over 20% while white unemployment rose from under 5% to 9%. The Black-white difference reached over 10% in 1984 and then fell to around 5% in the 2000s, before the 2008–2009 recession raised it again to just above 7.5% in 2011. Since then, the gap has narrowed sharply to around 2% in 2019 before the COVID recession, then back down again to 2% in late 2022 and 2023.

9.2.3 Conclusion

This section traces the short-term fluctuations around longer-term economic growth that drive change in employment, earnings and the living standards of

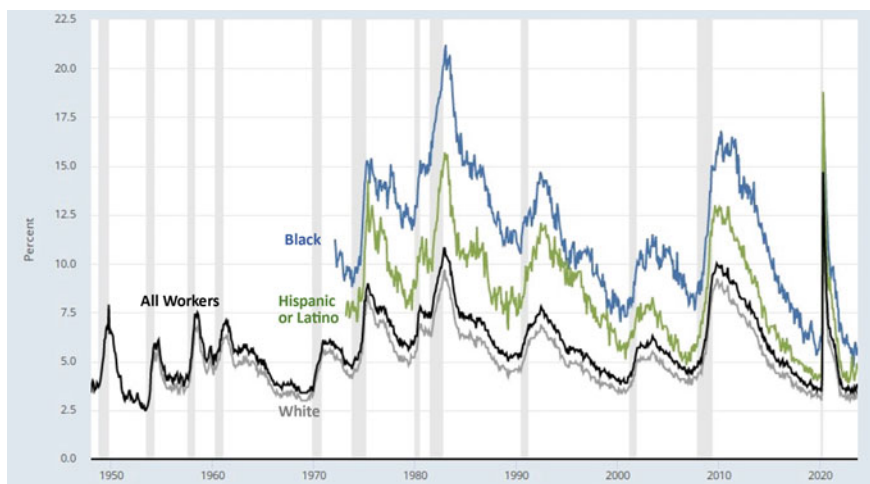


Fig. 9.14 Unemployment rates by racial category, January 1949–September 2023
Source: Reproduced from Federal Reserve Economic Data [FRED] showing the fraction of workers 16 and over without a job who were actively looking for employment, as a fraction of that group plus those employed, from the Bureau of Labor Statistics. Updated versions of this chart are at <https://fred.stlouisfed.org/graph/?g=19T11>

each group in society. The circular flow of activity in each country leads to new job openings and higher wages when innovation and investment opens new opportunities, triggering a period of development and growth. When growth falters, a wave of cutbacks in spending causes simultaneous job loss across sectors and regions of the country.

Recessions and unemployment are particularly harmful for households with low wealth who may run out of money for groceries and therefore experience food insecurity unless governments intervene with monetary and fiscal policy to stabilize incomes. Periods of growth also favor some activities more than others, sometimes widening and sometimes narrowing the disparities between groups. In the U.S., after the very deep and long recession of 2008–2009 and its aftermath of high unemployment, workers experienced more than a decade of rapid increases in real income and reduction in some but not all the country's longstanding extreme disparities.

The ability of government to manage macroeconomic crises was severely tested by the COVID pandemic, whose direct impact on those affected was worsened by sudden loss of employment and income in 2020–2021. A variety of policy responses helped speed economic recovery in the U.S. and elsewhere, such as increased use of food assistance through SNAP and similar programs in other countries. Private enterprises in the food system can also be important sources of macroeconomic resilience, including the role of food retailing and food service businesses in job creation for people who might not otherwise find employment.

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