Chapter 9
Shocks

The demand and supply relationships in the frameworks we have studied have been developed from microeconomic foundations, which, in general, are optimizations of some objective function subject to some constraint function(s). The demand and supply relationships can shift (in price-quantity space) if either or both the objective function and constraint function(s) experience some "change." Much of economic analysis concerns the consequences of sudden "changes" in constraints – for example, prices or taxes in consumer analysis.

But we can also easily imagine that the objective function of whichever framework we are studying may experience sudden "changes." This latter idea is the focus of this chapter – in particular, we study here sudden changes in an appropriate utility function if consumer analysis is the focus, and an appropriate profit function if firm analysis is the focus.

The reason why an objective function might "change" (apart from examples provided below) will be studied more deeply soon. From an analytical perspective, though, these "changes" in foundations lead to precise shifts (that is, a resulting set of "changes") in the accompanying demand and/or supply curves.

To introduce formal terminology, the changes that we study here are termed **"shocks."** Heuristically, a "shock" is an unexplained or unexplainable alteration in some basic element of an economic framework, which in turn causes optimal choices to be affected. If taking a supply-and-demand perspective, these alterations manifest themselves in **shifts** of supply and/or demand in appropriate markets.

On the side of consumer analysis, we can study shocks to the consumption-leisure framework, or shocks to the consumption-savings framework, or shocks to both the consumption-leisure and consumption-savings framework (in which case we are considering the intertemporal consumption-leisure framework). For some parsimony, we consider only the consumption-leisure framework below.

Specifically, by varying either the wage or the price of consumption (and holding the other constant), we traced out a single labor supply and consumption demand function. However, much of macroeconomic fluctuations are attributed to shifts, not movements along, the aggregate demand function, which in turn can be attributed to shifts of the consumption demand function. We need to consider now why this function might shift.

The most natural explanation of such shifts is that consumer tastes change over time, perhaps due to evolving cultural norms or society-wide unexpected events.[61]

Given our study of consumer theory, we have a ready way of modeling such changes in consumer preferences, namely by supposing that an individual's utility function changes occasionally – that is, the utility function is subject to periodic **shocks.** We will briefly consider one way of introducing this feature into our theoretical model and see that it does indeed induce shifts in the consumption demand function (and thus by extension the aggregate demand function).

Production Shocks

Just as we extended our frameworks for consumer analysis by augmenting an individual's utility function with unexpected "shocks," we can extend our model of firms to suppose that the aggregate production function sometimes also suffers unexpected shocks.[62] The introduction of a shock to the production function has the effect that for any given amount of both capital and labor, total output depends on the level of the shock. Such a shock is most commonly interpreted as a "technology shock."

The most usual way of introducing production function shocks is to suppose that it simply multiplies the production function. Letting A denote this shock affecting the production function, we would now write the production function as $A \cdot f(k,n)$, where A is simply some constant over which a firm has no control but may change over time. It should be clear that if we set $A=1$ always, then we recover the model we have just discussed.

If A rises, then the production function depicted in Figure 31 is modified as in Figure 44. This technology shock to the production function will be important to our later study of real business cycle theory.

[61] For example, based on some macroeconomic evidence since the terrorist attacks of September 11, 2001, one could make the case that, broadly speaking, the average American individual's preferences over "consumption" and "leisure" changed at least for a little while, towards valuing "leisure" more highly.
[62] In fact, TFP shocks are a much more common theoretical modeling device than preference shocks. For reasons beyond the scope of this text, however, this approach has failed to capture at a theoretical level some important features of macroeconomic data, especially regarding the behavior of inflation.

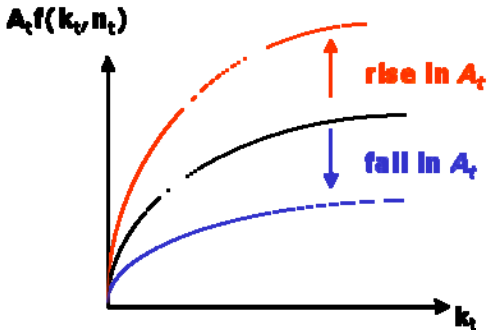

Figure 44. An increase (decreased) in A_t causes output to increase (decrease) for any given quantity of capital and labor.

Preference Shocks

Shocks don't occur only on the technology side of the economy; they can also on the utility side of the economy.

To illustrate this, recall our usual one-period consumption-leisure model. We now slightly augment the utility function in that framework to be

$$u(Bc, l), \tag{1.1}$$

in which B is some given constant over which the individual has no control. The constant B simply multiplies whatever consumption level the individual chooses in the final determination of utility. For example, the utility function may be $u(Bc,l) = \sqrt{Bc} + \sqrt{l}$. With this formulation, it is clear that our baseline consumption-leisure model simply had $B = 1$ all the time. For any given value of B then (not only $B = 1$), the indifference map over consumption and leisure is just as before, as illustrated by the solid indifference curves in Figure 45.

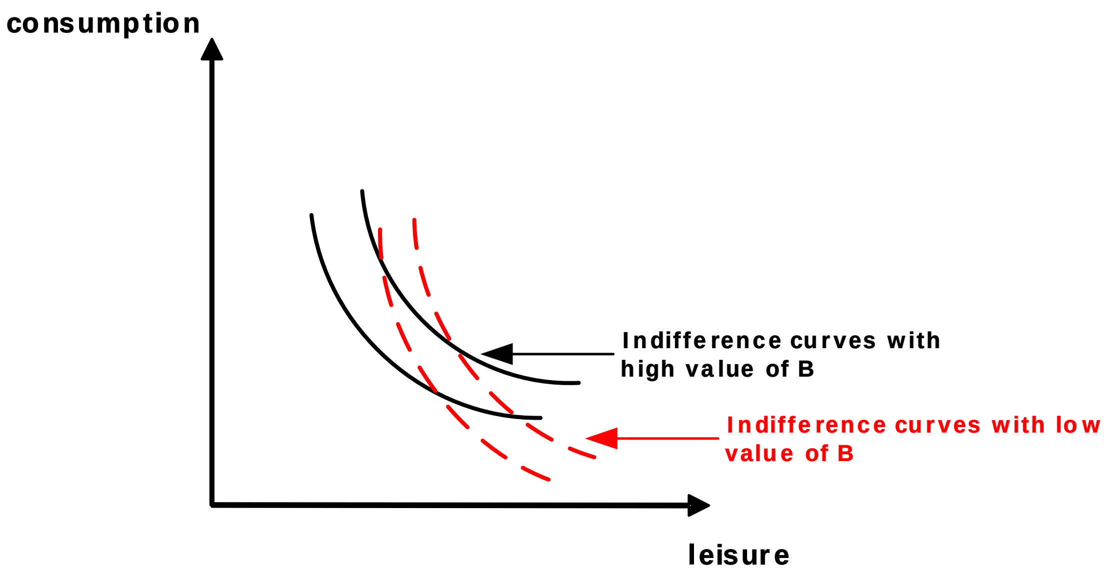

Figure 45. As B falls, the individual's indifference map steepens because the individual is willing to trade more consumption for leisure.

Now suppose all of a sudden B falls due to some unexplained event. The fact that B multiplies consumption in the utility function means that a lower value of B makes the "consumption utility" component of the utility function stronger for an unchanged level of consumption. For example, if initially $B=1$ and the consumer were optimally choosing $c^*=10$, the consumption utility component of the above utility function would be $\sqrt{1\cdot 10}=\sqrt{10}\approx 3.16$. If all of a sudden B falls, to $B=0.5$ say, and the consumer did not change his level of consumption, then his consumption component of utility would be $\sqrt{0.5\cdot 10}=\sqrt{5}\approx 2.23$. This means that each unit of consumption is now less valuable in utility terms.[63]

Because the individual decides both how much consumption and how much leisure he takes, the fact that consumption is now less valuable in utility terms means that he is willing to give up more units of consumption for a given increase in leisure. Thus the indifference curves of the individual steepen in Figure 45 due to the fall in B.

Now let's think about how the individual's optimal consumption choice changes as a result of the fall in B. The situation is presented in Figure 46. With the wage rate W, the price P, and the labor tax rate t all held constant, the new optimal choice features less consumption and more leisure – the latter implying that the individual now works fewer hours.

[63] More properly speaking, in terms familiar from microeconomics, the fall in B means that the marginal utility of consumption has decreased, and at an unchanged price of consumption the individual will optimally choose less consumption.

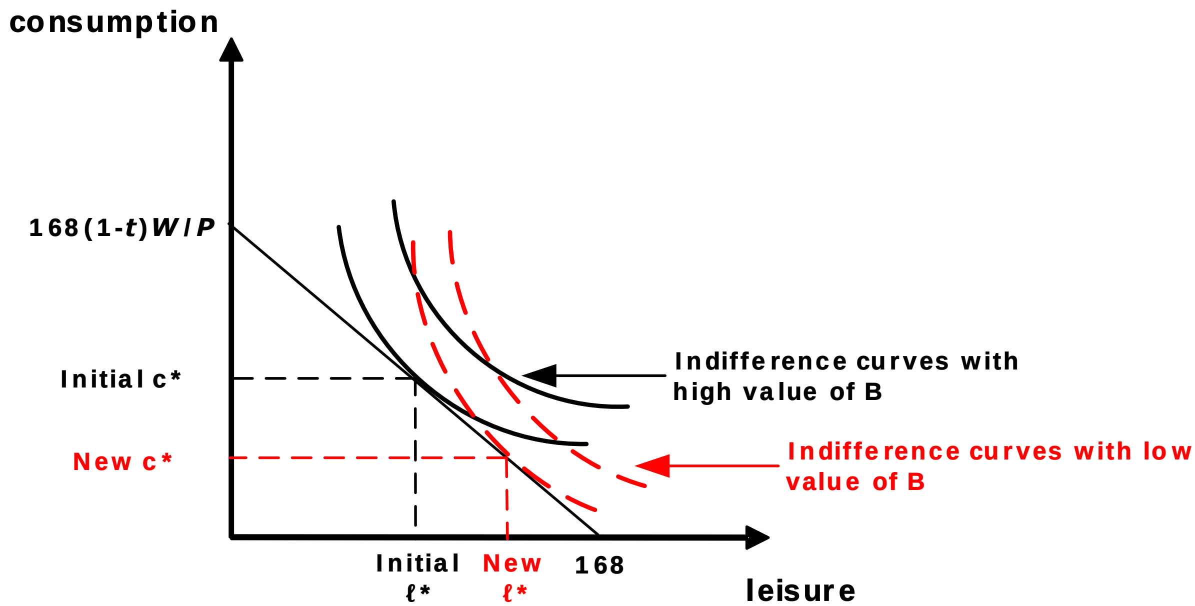

Figure 46. Following a decline in B (with the nominal wage W, the nominal price P, and the tax rate t held constant), the new optimal choice features less consumption and more leisure (and hence fewer hours worked).

The change in the optimal choice in Figure 46 occurs with no change in the price P. It should be clear that such a reduction in consumption would occur for any given price P. Thus, for any given price P, optimal consumption is now lower, which is precisely what it means for the consumption demand function to shift inwards, as shown in Figure 47. For convenience, the shift in Figure 47 is shown to be a parallel shift, but in general the nature of the shift will depend on the exact shapes of the initial and new indifference curves. But the general point is that the consumption demand curve shifts (and hence the aggregate demand curve shifts) due to changes in consumer tastes.

One further observation follows from this analysis: because the individual chooses to work fewer hours following the fall in B, the entire labor supply curve must shift inwards.[64]

Finally, such utility function shocks can also be introduced in the consumption-savings model. An important result of doing so is that such shocks would cause the aggregate

[64] Verify for yourself that this is true.

savings function to shift.[65] The analysis of this effect proceeds completely analogously as the above, except we would examine the indifference curves in $c_1 - c_2$ space rather than in $c - l$ space.

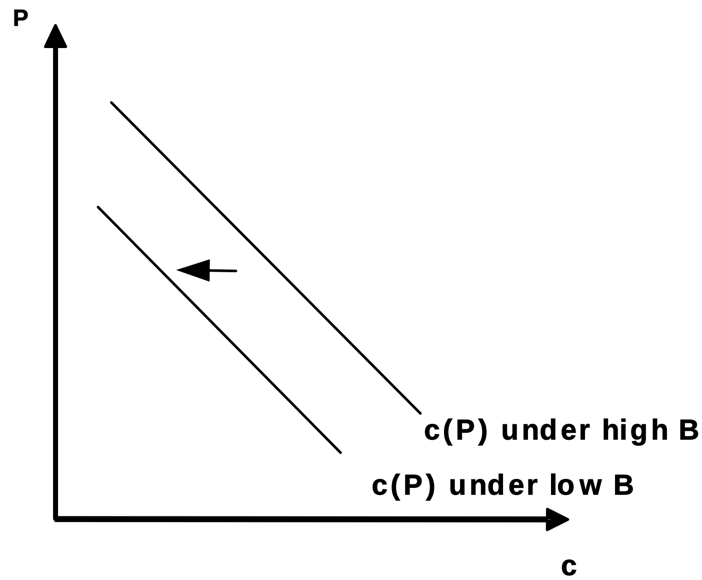

Figure 47. The consumption demand function shifts following the preference shock.

The example we just went through was for the consumption-leisure framework. But this entire preference shock analysis can also be recast in the consumption-savings framework, which is left as an exercise for you to work through.

[65] For example, interpreting the events of September 11, 2001 as causing a preference shock to U.S. consumers, we could explain why consumption demand in the present has decreased while savings for the future has increased.