Chapter 4

Capital and the Structure of Production

> Heterogeneity of Capital means heterogeneity in use; Heterogeneity in use implies Multiple Specificity; Multiple Specificity implies Complementarity; Complementarity implies Capital Combinations; Capital Combinations form the elements of *the Capital Structure*. We are living in a world of unexpected change; hence capital combinations, and with them the capital structure, will be ever changing, will be dissolved and re-formed. In this activity we find the real function of the entrepreneur.
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> —Ludwig Lachmann (1956), *Capital and Its Structure*: 12–13.

Producing the toaster discussed at the beginning of the previous chapter involved the combination of over 400 inputs. As the Toaster Project illustrated, this involves significant coordination across both time and geographic space. In the previous chapter, we discussed the role that economic calculation plays in coordinating people's economic activity. This chapter builds on that foundation by exploring the unique nature of inputs, or capital goods, necessary to produce final consumer goods. Beginning with Carl Menger's work in 1871, Austrian economists have emphasized the unique characteristics of capital, which refers to goods that are valued because of their contribution to producing subsequent consumer goods.

In his *Principles of Economics*, Menger presented production as a sequential process that involved capital goods (what he called "goods of a higher order"), which are combined to produce final consumer goods (what he called "goods of the first order"). Different capital goods fit into the structure of production depending where they fall in the sequential process of producing final goods.

The lowest-order capital goods (those directly prior to the production of the final consumer good) would be second-order goods. Those immediately prior to that would be third-order goods, and so forth through every step of production.

Continuing with our toaster example, the initial mining of the copper, iron, and nickel would be the capital good of the highest order. The transformation of these goods into the various elements used in the internal workings of the toaster would be lower-order goods. The process of fitting the toaster body over these internal elements, which is the final stage of production, would constitute the second-order capital good. The final toaster would be the first-order or consumer good.

Menger's taxonomy of capital goods captured the essential role of time in production. The process of producing consumer goods occurs through time as various capital goods are coordinated to yield a final output. This time-consuming process of production is necessary for economic progress. Using their creativity, people realize that they can forgo direct consumption of higher-order goods today and instead use them as inputs into a good that will not be produced until some point in the future.

Consider a basic example to illustrate this point. It is possible for people to fish using their hands or a stick as a spear. These methods will certainly yield some fish that can be consumed. Alternatively, they can forgo fishing today and invest their time and resources in constructing a net that will yield even more fish in the future. This process of production takes time and requires people to forgo the consumption of resources in the present (fishing today by hand or with a spear) for a payoff in the future. This same logic applies to the production of almost all goods and services in an advanced economy that require forgone resources and time to produce.

In addition to the central role of time, Menger's deep appreciation of subjective value is also evident in his treatment of capital. In his view, the value of capital goods is derived from the expected value of the lower-order goods they aid in producing. That is, the value of capital goods is not inherent in the goods themselves, but instead is derived from the lower-order goods in the structure of production. Raw materials do not have inherent objective value, but instead derive their value from what they contribute to the production of other, value-added capital goods in the structure of production. These lower-order goods likewise derive their value from their contribution to the production of the final

consumer good. What ultimately drives this process is the expected value of the final consumer goods (the first-order goods) as determined by consumers. On the market, these subjective valuations are captured in the market prices of capital goods as discussed in the prior chapter on economic calculation.

Taking Menger's framework as a foundation, Ludwig Lachmann further developed the Austrian understanding of capital. He emphasized that capital was characterized by heterogeneity, multiple specificity, and complementarity. Heterogeneity implies that capital goods are different. This might seem obvious, but standard economic theory treats capital as a homogeneous blob that can be used interchangeably and does not require any kind of careful planning or coordination through time. If capital goods were indeed homogeneous, they could be used interchangeably to produce whatever final products consumers desire. From this perspective, capital is analogous to a ball of Play-Doh®. The same capital can be shaped into whatever output is desired by the designer. And if mistakes are made, capital resources can be reallocated quickly and with minimal cost by quickly reshaping the ball of Play-Doh®.

Scholars working in the Austrian tradition, in contrast, emphasize that capital is not homogeneous. All capital is not the same and cannot be used interchangeably. A pair of pliers is not the same thing as a pickup truck. Each capital good can be used to achieve different purposes. A pair of pliers could not tow a trailer and a pickup truck cannot be used to twist a piece of wire. Based on their unique physical characteristics, it is more accurate to think of capital as LEGO®s rather than a ball of homogeneous Play-Doh®. In order to achieve the desired production plan of building a set of LEGO®s, specific unique pieces must be combined in a certain temporal order. If a mistake is made along the way, it is costly because individual LEGO® pieces need to be carefully removed and specific pieces need to be inserted to correct for the error to achieve the desired production plan. This is the situation that characterizes a complex, advanced economy.

Appreciating the heterogeneity of capital is also important because production plans vary from one individual to the next. What is considered a capital good and where it fits into the production plan varies from person to person. One person might consume an egg, which would make it a first-order consumption good. Another person might use the egg as an input into baking a cake, making the egg a capital good. A smart phone might be used by one person to play games—a consumption good—and by another person to conduct

business—a capital good. The idea that the same good can be used by different people for different purposes refers to heterogeneity in use, which reinforces the idea that whether something is a capital good depends on how people view the good as fitting into their broader plans and goals. This suggests that there is no fixed and pre-defined stock of capital since whether something is capital depends on how individuals subjectively perceive its use.

In addition to being heterogeneous, each individual capital good can itself be employed in multiple potential uses. A pickup truck can be used not only to tow a trailer, but also to carry cargo or to plow a snow-covered street. Likewise, a pair of pliers can be used not only for electrical work, but also for carpentry or jewelry making. This illustrates the multi-specific nature of capital, which means that heterogeneous capital has many, albeit limited, uses. Economic actors must determine the best use of these scarce resources from an array of competing alternatives.

The heterogeneity and multi-specificity of capital goods imply that capital goods are complementary to one another and must be used in capital combinations to achieve a production plan. Entrepreneurs need to discover these combinations and determine how they fit in the broader process of production in order to yield the desired consumer goods. If the plastic case was placed on the toaster base prior to the construction and installation of the heating elements, then the final product would not be a functioning toaster. The production of the final consumer good (a toaster that functions by heating bread) requires that capital goods be combined in a specific, complementary, and sequential manner to produce the final product. These capital combinations make up what is referred to as the capital structure within an economy. This structure is characterized by a complex set of relationships with a coherent pattern of order. The capital structure is not fixed. Instead it is in a constant state of change as a result of three factors.

The first is human error, whereby decisions made about the use of capital goods are revealed to be mistaken. An entrepreneur, for example, may decide to allocate capital goods to producing desktop computers when consumers in fact desire laptops. Some elements of the capital structure used in the production of desktop computers may be the same as those used in the production of laptop computers, but others will differ, and capital substitutions will need to be made to meet the true desires of consumers.

Second, innovations in production technologies—machinery, techniques, and organizational forms—may make portions of the prior capital structure inefficient. Advances make old ways of producing goods and services less efficient compared to new alternatives. When this occurs, entrepreneurs will need to adjust how capital is allocated within the broader structure of production.

Finally, consumer desires might change so that what was previously produced is no longer valued compared to alternatives. Before, consumers may have wanted desktop computers, but now they want tablets. In this case producers will need to revise their production plans, and the associated capital, to satisfy the new consumer wants.

There is nothing troubling about a continually changing capital structure. In fact, improvements in economic well-being require changes to the capital structure in response to changes in economic conditions, more accurate knowledge of those conditions, and improvements in technology and organizational forms. The result is the need for ongoing capital substitution and re-grouping in the face of changing circumstances. The problem with traditional neoclassical methods of studying the capitalist production process lies in either treating capital as a homogeneous blob, or relying on a momentary snapshot of the capital structure at some period of time. In contrast to either the blob method or period analysis, Austrian economists emphasize that we need to focus on the process by which combinations of heterogeneous and specific capital are shuffled and reshuffled in the broader context of the capital structure.

The concept of the capital structure stands in contrast to the idea of a "capital stock," which refers to an aggregate measure of all capital at a point in time. Obtaining a single measure of the capital stock requires that capital be added together using a common denominator such as money. Ludwig Lachmann, however, argued that this approach does not make sense because it assumes that prices are in equilibrium. Given subjective expectations and valuations, whether someone values a good as a capital good is not objectively observable. Moreover, human expectations will often be incorrect because of the three factors discussed above. The notion of a capital stock only makes sense in a world where equilibrium has been achieved, meaning that all plans and expectations align perfectly. But, in a disequilibrium world characterized by constant error and change, the idea of a capital stock is not useful. It is for this

reason that Lachmann, and other Austrian economists, focus instead on the capital structure. In disequilibrium, what matters is how heterogeneous and multi-specific capital goods fit together in production plans and how capital substitution occurs in the face of error and changing conditions.

How does the capital structure emerge and evolve given the numerous consumer goods that can be produced, the numerous capital combinations that can be paired, and the reality that people have different, and often conflicting, plans and expectations? The theory of the market process offers an answer to this question.