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The Role of Capital Structure in Austrian Business Cycle Theory

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Abstract
We argue that the application of financial analysis, especially that of *duration*, clarifies and supports the application of the average period of production in Austrian business cycle theory. We also suggest that the focus in the recent ABCT literature should be more on the average period of production and less on the stages of production as depicted in Hayek's triangle in Roger Garrison's model.

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I. Introduction

Recent years have seen an interesting turn in the Austrian business cycle theory (ABCT) literature. On the one hand, there has been an increased interest in and endorsement of the ABCT from non-Austrians as a valid theory to explain crises such as the one that occurred in 2007–08 (Cachanosky and Salter 2016). On the other hand, Austrians have raised questions about the soundness and even necessity of using the *structure of production* construct in the ABCT. For instance, Salter and Luther (2016, p. 52) suggest that whether "these malinvestments [induced by a credit expansion] conform to the *specific* distortions of the *time structure of production* discussed in the traditional ABCT is *irrelevant* in our view. *Any* investment in inappropriate projects will do" (emphasis added).

In our view, the ABCT not only sheds light on the events building up to the 2007–08 financial crisis, but the structure of production can also be reframed in a way that (1) solves theoretical problems and (2) provides the change in relative prices that produces the *specific* distortions of the *time structure of production* discussed in the

traditional ABCT. We develop these issues in more detail in our previous work.[1] For the purposes of this symposium, we emphasize points related to the role of capital structure in the ABCT.

In the next section, we discuss the distinctive characteristic of the ABCT. In section 3, we review the challenges surrounding the average period of production and its role in the ABCT. In section 4, we explain how the structure of production can be saved and the implications of our approach. Section 5 concludes.

II. What Distinguishes the ABCT?

The ABCT is not just a theory about any distortion produced by credit expansion. It is a theory positing that a specific distortion pattern takes place when easy monetary policy pushes interest rates below their equilibrium (sustainable) levels. These specific distortions occur in the so-called structure of production, the time structure of production, roundaboutness, or average period of production (APP). To question the *specific* distortions that would take place in the structure of production is to question the theory itself. To renounce the role of the structure of production in the ABCT is to renounce the theory's identity.[2]

The structure of production is not only *the* distinctive characteristic of the ABCT, it is also the most obscure and objectionable component of the theory. This is because of the complexities of capital theory, of which the structure of production is a key element. Capital-theory difficulties survived the three well-known capital-theory controversies during the twentieth century.[3]

Note that in the first paragraph of this section we use four different terms to refer to the same component of the ABCT: how production is structured in time. The existence of these different terms, some more obscure than others, to refer to the same phenomenon indicates how intricate capital theory can be. One reason for this is that the structure of production implies multiple dimensions or variables that are confounded in a single term. First, taken to refer to a *given* structural method of production or

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[1] See Braun, Lewin, and Cachanosky (2016); Cachanosky (2015, 2017); Cachanosky and Lewin (2014, 2016a, 2016b); and Lewin and Cachanosky (forthcoming, 2016). In Lewin and Cachanosky (2017), we offer a broader discussion and draw out the implications of our work.

[2] See also the discussion in Sechrest (1997) and Shah (1997).

[3] See Cohen (2008, 2010), Cohen and Harcourt (2003), Felipe and Fisher (2003), Knight (1935), Machlup (1935), Osborne and Davidson (2016), and Yeager (1976).

technology, a different amount of time can be allocated. For instance, in this sense, the same capital structure can produce a twelve-year-old or a twenty-one-year-old whisky; it is the *time* invested that differentiates one product from the other. Second, for a *given* period, different capital goods and labor skills with a similar capital intensity can be used to produce the same good. Finally, the same good can be produced with different technologies that imply different capital intensity. The problem is that all these different dimensions or scenarios need to be analytically separated, but they are blended in terms not very self-descriptive such as *roundaboutness* or *average period of production*.

But besides these difficulties, the core argument of the ABCT is that if the interest rate is the price of time, then a relative fall in the price of time would increase the consumption of time in the production of goods and services. This is why, for consistency, the ABCT cannot be stripped from the structure of production and interest-rate movements. However, different from other "resources," time cannot be stored; time works with other factors of production. It is more accurately a separate *dimension* of production. In the next two sections, we discuss three issues with capital theory that are central to our argument.

III. The ABCT and the Structure of Production: The Challenge

A crucial issue with Menger and Böhm-Bawerk's capital theory is the concept of the *average period of production*. The intuition behind a *period* of production (average, total, or otherwise) is straightforward. As long as it recognized that production takes time, then it would appear that there has to be a total, and therefore also an average, period of production. But, *how* to measure this period of production is a separate issue. And misspecifying *how* to measure the period of production is a different issue than saying the there is no such thing as a period of production.

A. An Old Problem: What Does "Average Period of Production" Mean?

The old problem surrounding the conceptual consistency of the APP starts with a misspecification in Böhm-Bawerk's formula. Böhm-Bawerk offers, more as an illustration than as a definite measurement, a formula based on units of *physical* labor inputs, *not* based on the market *value* of those labor inputs. In addition, Böhm-Bawerk's presentation invites a *backward-looking* interpretation of the period of production. Böhm-Bawerk presents us, then, with two problems. The

first concerns difficulties related to the heterogeneity of labor (and other factors of production). The second concerns the period of production as backward looking—there is either no starting point or it becomes an arbitrary decision. This issue had a significant presence in the capital controversy debates.[4]

Interestingly, it was a non-Austrian, John Hicks (1939, p. 186), who offered a solution to the problems in Böhm-Bawerk's representation. Hicks's solution is well known today as the financial *duration* of a cash flow. Also, there are two versions of financial duration. Macaulay duration is a measure of the average life of a cash flow. Modified duration is a sensitivity measure of how much the present value of a cash flow changes with movement in the discount rate. In continuous time, the two measures are equal. Financial duration is not only a forward-looking approach of a cash flow (market value), it also embodies in a well-defined and well-known formula two key concepts from Austrian capital theory: average period of production and interest-rate sensitivity. Also interestingly, Austrians did not pick up on Hicks's contribution but rather followed a more complex and lengthier (roundabout) path leading to a similar but less clean and general outcome than Hicks's. The Austrian path leads to *new* problems in capital theory and, therefore, also to new problems in the ABCT.

B. A New Problem: Stages of Production

Hayek (1931) provided a significant variation on Böhm-Bawerk's approach by introducing what is now known as a Hayekian triangle (also interesting, Hayek takes inspiration for his triangle from Jevons.) Hayek's two improvements over Böhm-Bawerk consist in adding *value* as production moves along different stages of production and in tracking time in value terms (i.e., a six-period investment of $1 equals a two-period investment of $3) rather than in pure time (minutes, hours, days, weeks, etc.) in terms of physical labor time, or man hours. In fact, by doing this, Hayek's triangle becomes a particular case of financial *duration* when there is no interest-rate compounding. Because of this, in Hayek's triangle, the APP is located in the middle of the horizontal (value-time) axis. Hayek's triangle becomes a key component in Garrison's (2001) model, which influenced the contemporary ABCT literature.

[4] For a discussion on capital theory see Lewin (1999) and Powell (2010).

The Hayek-Garrison treatment is missing the Hicksian component. It seems that neither Hayek nor Garrison made the same connection as Hicks did. The Hayek-Garrison framework shifts the emphasis away from the APP toward relative changes in stages of production. However, even though stages of production (the particular order in which production needs to take place—i.e., mining first, retailing last) are a clear conceptual device, they do not have an objective counterpart in reality. Because of this, empirical studies that try to test the ABCT following Garrison's model face significant difficulties. However, the fact that the results do not perfectly match Garrison's model does not mean that the ABCT is flawed any more than it means that the model is ill-fitted to reality.[5] It should be added, however, that according to Garrison (2001, p. xiii), the model is more intended to be a pedagogical tool to persuade students than a guide for theoretical and empirical research. The problems found in the contemporary ABCT literature seem to originate more in a misapplication of the model than in shortcomings of the model itself. It is this kind of issue that eventually contributed to questioning the role of the structure of production in the ABCT.

IV. Saving the Structure of Production

To save the structure of production, we need to shift the focus away from stages of production and put it back into the APP.[6] To do this, we need to follow Hicks's lead, with the advantage of modern financial analytical tools and mathematics.

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[5] An example of these issues is the problem of *looping*, when two stages of production are suppliers of each other. The energy sector, for instance, supplies services to the financial markets and the latter supplies services to the former. This setup makes it difficult to separate the ABCT effects according to their position across the stages of production in any observation since each producer is in different stages of production at the same time. Also, an industry like the financial sector can provide its services from all across Hayek's triangle, from late to early stages of production. More importantly, as explained below, it is the interest sensitivity of particular investments that distorts the capital structure, and stage of production does not correlate coherently with interest sensitivity of investments in that stage for reasons just explained.

[6] While related to each other, APP and stages of production are conceptually different. We can imagine a production process with fewer stages of production but a higher APP and another production process with more stages of production but a shorter APP. This is possible because stages of production have to be arbitrarily delimited. The number of stages of production may or may not shed light on how long a production process is.

A. Financial Foundations of ABCT

The core of the ABCT is that a reduction of the discount rate below its equilibrium level results in an increase in the roundaboutness (duration or APP) of the economy beyond what is sustainable. But roundaboutness is in turn associated with capital intensity and the length or APP of the production process.

These two variables can be captured in financial terms. This is why in our research we use the economic value added (EVA®) framework rather than the more standard free cash flow (FCF) approach.[7] A particular advantage of the EVA® over the FCF representation is that the former has an explicit variable for financial capital (*K*). This allows us to shows two important results for the ABCT.

The first is that it can be shown that two cash flows with the same *K* but different lengths have a different duration, the lengthier cash flow being the one with the longer duration (a larger APP and present-value sensitivity to movements in the discount rate). Conversely, two cash flows with similar lengths but different *K* also have different durations, where the larger firm (in terms of *K*) also has a larger duration. Finance, and in particular the EVA® framework, allows us to isolate these two effects embedded together in the term *roundaboutness* in a way that confirms the Austrian intuition.

The second is related to how capital intensity should be understood. According to the ABCT, a lowered interest rate incentivizes investment in capital-intensive activities. This is, however, inaccurate if by "capital intensity" we mean the ratio of capital goods to labor. Capital does not come only in the form of goods; there is also human capital, social capital, environmental capital, and more. If, instead, we follow Mises's treatment of capital as the market value of all production tools regardless of their form and shape (goods, human, social, etc.), then we have the financial capital *K* that appears in the EVA® representation. It is the present value of investment projects with a lager *K* that is more sensitive to movements in the discount rate. There is no ratio, and therefore no capital intensity (at least in the traditional meaning of the term). Two investment projects may require the same amount of financial capital with different composition; the first project requires more tools and

[7] EVA® is mathematically equivalent to the FCF approach. It is just a different algebraic expression of the same calculation.

unskilled labor, the second fewer tools but more skilled labor (human capital). Why should the first be considered more capital intensive than the second if the total required investment is the same for both projects?

Once we think about the ABCT in financial terms, then the distinctive effect of this theory becomes straightforward. A reduction of the interest rate below its equilibrium level increases the present value of projects with a larger duration (either because of a lengthier time horizon or a larger *K*) more than the present value of projects with a smaller duration. This is a change in the relative price of these two investment projects. The financial framework of the ABCT does not only deal with complicated issues of capital theory, it also nails down the required change in relative prices in the ABCT.

B. Other Issues: Rationality and Cantillon Effects

The financial framework we use in our work also sheds light on other issues and challenges to the ABCT. For the sake of brevity, in this section we refer to two of them. The first is about rationality, and the second is about the role of Cantillon effects in the ABCT.

It has been suggested that the ABCT is not consistent with rational behavior by economic agents.[8] It is argued that if economic agents are rational, then they will not systematically make the same mistake of investing in projects that are too roundabout. Yet, there are some reasons why an ACBT-type crisis might repeatedly occur in the presence of rational economic agents.

For instance, the economic context of each cycle might be different, meaning the economic agents are facing the cycle as if for the first time. Or it might be that a new generation of economic agents is now populating the economy and they do not have previous experience; they are living the cycle for the first time. That historical facts are known does not mean they will be correctly or uniquely interpreted. For instance, the ABCT might be discarded by most of the economic profession, and therefore this theory is neither taught to nor known by the economic agents. The complexity of the scientific method in economics and of the economic process itself can lock in the economic agents to seeing an "empirical verification" of a wrong theory. Empirical observation in a simple case such as observing the sun rotate around the Earth can make us believe that the former is rotating around the latter rather than the other way

[8] For a summary of this literature, see the references in Cachanosky (2015).

around. Every day becomes an empirical confirmation of the wrong theory.

However, the ABCT does not require less-than-rational agents. This might be the case *if* we use one representative economic agent who lives forever in an unchanged environment and we ignore the effect on the present value of investment projects when interest rates move downward. Assume a population of rational economic agents rather than one representative entrepreneur. Even though the equilibrium conditions are unknown, the rationality of the economic agents puts the expectation of most of them around the equilibrium interest rate. But some agents think that the correct interest rate should be lower or higher than the actual equilibrium value.

If we think of this situation in financial terms, we see that the errors do not cancel out in a way that, on average, the behavior of the economic agents is that of the representative agent. The effect on the present value of each agent's portfolio of investments is affected with different intensity. Those who think that the low interest rate is the correct value see their beliefs confirmed by the monetary authority. And because the present value of projects with higher duration has increased more than the present value of projects with a lower duration, these investors are both willing and able to outbid entrepreneurs with a more conservative interest-rate expectation in the market for factors of production. A wealth effect benefits the agents who think the interest rate should be lower compared to the entrepreneurs who expect the equilibrium to be at a higher interest rate. The problem is not that the ABCT requires less-than-rational agents; the problem is not framing the decision making correctly—that is, in financial terms. Neither Garrison's model nor macro models of the AD-AS type usually include the financial duration effects that we discuss in this paper and in our work.

The second issue we want to discuss is the role of Cantillon effects in the ABCT. The Austrian literature emphasizes the problem of relative prices changing when there is a monetary shock (monetary illusion). This effect is referred to as the Cantillon effect. If by Cantillon effect we interpret changes in the structure of intermediate and final goods and services (inside *P*), then the ABCT does not rely on a Cantillon effect.[9] What the ABCT requires is a change in the

[9] We offer a narrow interpretation of Cantillon effect to emphasize our point. A more accurate understanding of the Cantillon effect is that *any* change in money will affect relative prices one way or the other. Under the gold standard, an

relative present values of different projects, not a change in the relative prices that are expected to hold at different points in time.

To be clear, we are not saying that Cantillon effects (as defined here) do not occur or are unimportant. All we are saying is that the Cantillon effect *is not* a part of the ABCT (and should not be). To show, as we do in our work, that the ABCT holds *absent* Cantillon effects (on intermediate and final prices) is to show that the theory is well grounded and does not require this additional assumption to hold. That any type of distortion may simultaneously occur while the ABCT effect is taking place means neither that the APP is a meaningless concept nor that it should be abandoned.

C. Parallels between Garrison's Model and Our Financial Framework of ABCT

We take this opportunity to briefly mention two parallels between Garrison's model and our work. We are far from saying that there are no merits in Garrison's model even if we are more inclined to look at duration than stages of production.

The first similarity is in the presence of value time rather than pure time. Macaulay duration is the average time of a cash flow weighted by the value (cash flow) of each period. In Garrison's interpretation, the horizontal axis of Hayek's triangle is also value time rather than pure time. This plus simple interest-rate accumulation yields the APP of Hayek's triangle—a particular and simple case of duration. The core of our work is already implicitly embedded in Garrison's model.

The second similarity is an issue we have not mentioned so far in our work: the break or dual push on the Hayekian triangle that takes place when interest rates are pushed downward. An interest-rate reduction incentivizes investment in projects with a longer duration. This is shown by the left side of the Hayekian triangle being pushed outward (to the left.) But the fall in the interest rate also incentivizes consumption in the present. This is captured by the upper-right corner of the triangle being pushed upward. This is what causes the hypotenuse of the triangle to break somewhere in the middle.

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unexpected discovery of gold would trigger a Cantillon effect just as an increase in fiat money by a central bank would.

Also, an increase in credit by the central bank decreases the price of time (the interest rate) *before* prices of intermediate and final goods are affected. This is also a Cantillon effect. In fact, this is the specific Cantillon effect upon which the ABCT is built.

Our work mostly focuses on the problem of defining APP rather than on tracking down Garrison's model. This is why we emphasize the increase in duration or APP when the discount rate goes down. Still, the consumption effect can also be captured in the financial interpretation of the ABCT. The increase in consumption means that the price of final goods increases, and this causes the value of their cash flows to increase. This increase in the cash flow has a larger impact on sooner rather than later periods. The effect on the present value of the project is the opposite to that of a fall in the interest rate. Very short projects may see their present value increase more than not-so-long cash flows due to the impact of a higher cash flow that is taking place sooner rather than later. However, it should be considered that in the ABCT, the fall in the discount rate occurs *before* prices increase; this why the net effect of the ABCT is an increase in APP or duration.

V. Conclusions

ABCT consistency has been challenged, and to some extent rightly so. The theory's distinctive component has been surrounded with challenging issues concerning multiple dimensions melded into a single term. Conventional macroeconomics is not well equipped to deal with the capital-theory nuances required by the ABCT. The commendable effort of Austrians to speak to non-Austrians using conventional macroeconomic theories and tools, however, has pushed the ABCT into a difficult position. Either the average period of production is clarified, or it is replaced by something else (any investment in inappropriate projects will do.)

In this brief paper, we have discussed how our work clarifies and provides a well-defined metric of APP. Besides the implications of the financial application to capital theory (capital valuation, reswitching, etc.), this approach saves the structure of production and by doing so maintains the identity of the ABCT. The financial approach also serves as a test of whether or not the ABCT is consistent with how economic agents actually make investment decisions. To show in financial terms how an Austrian business cycle can take place supports the ABCT as a theory consistent with the reality it intends to explain. Of course, this is not to be interpreted as the ABCT being the only valid type of business cycle.

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