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Austrian Economics, Market Process, and the EVA® Framework

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Abstract:
In this paper I present a financial framework, known as Economic Value Added or EVA®, used to value firms and apply it to topics highlighted in the Austrian literature. In particular I contrast the market process emphasis in the Austrian literature with the neoclassical firm profit maximization and the role of Kirzner's *entrepreneurial alertness*. Then I show how these *micro* topics can be aggregated into *macro* issues such as the Cantillon Effect, an aggregate average period of production, and the impact of country risk into value creation.

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1 Introduction

A traditional topic in the Austrian economics literature is the emphasis on market *process* (towards equilibrium) versus the analysis of the conditions *in* equilibrium. This emphasis on the market process is also coupled with a focus on the realism of the assumptions used in economic theory. The concept of economic calculation, that is, the estimation of profit and losses, plays a central role as driving force in the analysis of the market process. It is different, however, to say that economic calculation plays a central role than to offer a specific method to calculate profit and losses. It is also different to identify the components required to calculate profits and losses than to actually explain how they interact with each other.

How to do economic calculation, however, is not a mystery. If we look at how investors perform their calculation we see they resort to financial tools and financial mathematics. Yet, the connection between financial calculation and market process has been mostly, when done at all, superficial. In this paper I offer an application of financial calculation to the market process analysis that centers on Austrian themes. In particular, the Economic Value Added, or EVA®, framework is of particular interest. If Austrian claims are correct, then when we analyze the economic agents based on *how* they actually make investment decisions rather than *assuming* a model with questionable assumptions we should find results consistent with Austrian theories.

In other works Peter Lewin and I have shown how a financial application like the one I present in this paper can shed light on capital theory complexities and how the Austrian Business Cycle Theory (ABCT) can consistently be financially framed (Cachanosky and Lewin 2014; 2016a; 2016b; Braun, Lewin, and Cachanosky 2016). In this paper the focus is less in *macro* issues and more on the *micro* arena. Nevertheless, this does not mean I will have nothing to say about *macro*. To the extent that *micro* and *macro* are connected, the *micro* effects should be seen at the *macro* level. It is this connection, rather than a detailed discussion, that I present regarding macro issues in this paper.

The paper unfolds as follows. The next section presents the EVA® framework, its economic interpretation, and contrasts it with the conventional theory of the firm. Section 3 explains how Kirznerian alertness can be interpreted in the financial calculation used in this paper. Section 4 connects the previous discussion into *macro* topics such as the Cantillon Effect, the aggregate *roundaboutness* of the economy, and the effect of institutional quality (i. e. country-risk) into value creation. Section 5 concludes.

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2 The EVA® Framework and the Theory of the Firm

2.1 The EVA® Framework

It is well established in finance that the price or market value of an asset or a firm is the discounted present value (PV) of its expected free-cash-flow (FCF). If c represents the cost of opportunity, then for a time period (t) that goes from 0 to infinity or its final period (T):

$$PV_0 = \sum_{t=0}^{\infty} \frac{FCF_t}{(1+c)^t} \tag{1}$$

It is customary in textbooks to assume, for simplicity, that the discount rate is the same for all periods. This does not need to be the case. In financial markets, for instance, bonds are discounted with discount rates obtained from a non-flat yield curve. In corporate finance, c is represented by the *weighted average cost of opportunity* $(WACC)$ which, as its name suggests, is a composite of the opportunity cost of the capital invested by all investors.

The FCF, however, has two components. The first one is the *net operating profits after taxes* $(NOPAT)$, and the second one is the investment (I). FCF, then, mixes operating profits and losses with investment decisions into one number. The interpretation of how well a firm is doing becomes more difficult because a negative FCF does not show whether this is because investment is larger than profits, or because the firm is having loses. It can be shown that eq. 1 is mathematically equivalent to its EVA® representation (Cachanosky and Lewin 2014, 663; Koller, Goedhart, and Wessels 1990, 697–9):

$$PV_0 = K_0 + \sum_{t=0}^{\infty} \frac{(ROIC_t - c_t)\, K_{t-1}}{(1+c)^t} = K_0 + \sum_{t=0}^{\infty} \frac{EVA_t}{(1+c)^t} \tag{2}$$

Where $ROIC$ stands for *return over invested capital* and is equal to the profits over the invested capital $\left(\frac{NOPAT_t}{K_{1-t}}\right)$. Intuitively, what this algebraic transformation does is (1) take out the investment component from the FCF and show it as different values of K in each period and (2) use rates for profits and cost of opportunity instead of absolute values. EVA is the economic profit (loss) of the firm, which is captured by the spread between the rate of return and the opportunity cost times how much capital, in financial terms, is invested. This expression, then, allows to observe economic profits directly instead of being mixed with investment decisions. In period 0, then, the value of the firm equals the value in that period of the firm's capital(K_0) plus the present value of all expected future economic profits. Each period shows how much value is *added* to the actual value of the firm. The sum of all expected future EVAs is the *market value added* (MVA) to the actual value of K: $PV_0 = K_0 + MVA$, or$MVA = PV_0 - K_0$.[1]

Let me clarify the reading of this formula. The price of a firm (PV) has two components, the money needed in period 0 to start the business *plus* how much value the investors think they can *add* to the market value of the factors of production needed to start running the business. This distinction is absent in a simple known cash-flow like the case of a fixed coupon bullet bond. This distinction is also absent in a standard mainstream model where there is perfect knowledge and therefore there is no room for competing entrepreneurial views (i. e. there is no competition properly understood). But in the realm of firms, the future cash-flow is expected and uncertain rather than certain and depends on different business strategies. It should be clear later on this paper that the MVA is what the kirznerian *alertness* is trying to maximize.

This financial representation can be connected to three topics in the Austrian literature. The first one is the interest rate being the price of time, rather than being either the price of money or capital. The variable c captures the cost of *waiting* or the profits foregone in the second best business alternative, not the cost of renting capital. It is the minimum return that investors expect *per* dollar for a given period of time to make this venture worthwhile.

The second connection is with the financial interpretation of capital. The Austrian literature has emphasized the *heterogeneity* of capital goods (i. e. tools) and the problem of resource allocation (Powell 2010). But this emphasis comes coupled, especially by Mises (1949, Chapter XV.2), with the distinction between *capital goods* and *capital*. While the former refers to tools used in the production process, the latter is the market value of such tools. As such capital is a key element in the economic calculation done by economic agents in a well-developed economy. It is this financial dimension that is captured by K.[2] A more detailed discussion of this issue is offered by Peter Lewin's paper included in this issue. A glance at eq. 2 also shows that profit and loss calculation is not possible without a value of capital.

The third connection is with the elusive and intricate concept of *roundaboutness* or average period of production (APP). As long as it is accepted that production takes time, then there is also an average period of production. This simple intuition, however, clashes with significant difficulties of measuring the period of production. This issue played a significant role in a series of capital controversies, the Cambridge-Cambridge debate being the last one.[3] One of the reasons for the problems with a measurement of the average period of production has to do with Böhm-Bawerk's attempt to use a physical, rather than a market value, formula to specify a measurement of the *APP*. This issue still remained unsolved with (Hayek 1931) use of Jevon's triangle, still used today and referred as the Hayekian triangle in (Garrison 2001).[4] The conflation of two different dimensions, capital value (rather than capital goods) and time, into the idea of *roundaboutness* contributes to the challenge of arriving at an unambiguous measurement of *APP*. The EVA® financial representation, however, explicitly shows the two variables that are the essence of *roundaboutness* or *APP*, namely capital and time. This issue was solved by (Hicks 1939, 186) but, unfortunately, remained largely ignored in both the Austrian and non-Austrian literature.

Hick's solution, however, is well known today as the financial *duration* of a cash-flow. Even more interestingly, the financial *duration* has two interpretations closely connected with *roundaboutness*. The first one is the *Macaulay duration*(D), which is the average value-weighted amount of time in a cash-flow to maturity. Maybe even more interestingly, on this point Hayek's triangle is not that far away from Hicks. Hayek's triangle shows value-time, rather than pure time (months, years, etc.), on the horizontal axis. This means that two dollars invested for three years is equal to one dollar invested for six years. Hayek's period of production is, in fact, a simple case of Macaulay duration where interest rates are assumed to not compound in time (Cachanosky and Lewin 2016b, 42–43).[5] The concept of *APP* would probably have been more assimilated if Hayek had focused more on the *duration* of the period of production and less on the number of *stages of production*. But Hayek's implicit *duration* has been overlooked by the literature as well.

The other interpretation alluded to above is that of *modified duration* which is an elasticity measure of how sensitive the present value of a cash-flow is to changes in the discount rate. Higher D, then, also means higher present value sensitivity to discount rates.[6]

The EVA® framework allows an unambiguous measure of *APP* with an important characteristic that remains concealed in the *FCF* representation: The present value of cash-flows with larger values of K (and *MVA*) are also more sensitive to changes in the discount rate than cash-flows with lower values of K. Financial duration, then, captures in one formula the two Austrian intuitions regarding the *APP*: (1) that longer projects are more sensitive to changes in discount rates and (2) that more capital intensive activities are also more sensitive to movements in the discount rates. This second intuition, however, requires a clarification. Capital intensity should not be understood as the ratio of capital goods over labor, but as the size of the financial capital invested in the firm, regardless of the type of resources employed (physical, human, social, etc.) Properly speaking, larger firms (in terms of K) are more sensitive to movements in the discount rates regardless how K is deployed. This, in turn, is consistent with Mises's emphasis of capital as a financial concept. The usual expression in the ABCT literature that low interest rates produce a boom in *capital intense* industries is not totally accurate. More precise would be to sustain that what is incentivized by a low interest rate is the investment in firms that require large amounts of financial capital in whatever form they come (physical capital, human capital or labor, high quality resources, etc.)

2.2 Contrast with the Theory of the Firm

A few differences from the neoclassical representation of economic profit (EP) maximization of the firm can be pointed out. In its textbook treatment, the neoclassical profit maximization problem is captured by eq. 3]:

$$EP = PQ - wL - cK \tag{3}$$

Where P is the price at which the output Q is sold, L is labor and w is the wage rate. K is capital and c (the interest rate) represents the cost of capital.[7] Q is produced by a neoclassical production function such as a Cobb-Douglass with L and K as the input variables; an increase in one input increase output at a decreasing marginal return but increases costs at a constant rate.[8]

Note first that in this neoclassical representation c is the price of capital, not of time (because time does not appear in this representation interest rate cannot be its price.)[9] This also implies an asymmetric treatment of L and K. While the former is measured in units of some sort, like hours, the latter is already in money terms. The wage is measured in dollars, but c is a rate. It is usually explained that c represents the cost of renting capital, but this is not less true for labor. Save for slavery, labor cannot be bought and is therefore rented from the worker at the price w. The price of capital goods is the market price needed to buy it as a tool. If it is rented, then the rental rate is the price of its services, just as the wage rate is the price of labor services. The price of physical capital services depicted in eq. 3 is thus the rental rate on capital (whether rented or owned). A different cost is the opportunity cost of the investors' financial capital. The profits, or revenue left after covering the cost of production, needs to be contrasted with the opportunity cost of the investor. The textbook neoclassical representation focus is on profits *before* rather than *after* the investor's opportunity cost.

Second, because time is not part of this representation, the neoclassical firm does not face the problem of optimizing its *APP*. The same value of *K* can be associated with different *APPs*. This dual problem of choosing the optimal values of *K* and *APP*, captured especially in the Austrian Business Cycle Theory (ABCT), is absent by construction in the neoclassical treatment at the firm level.

Formulas [2] and [3] can be combined to show that the neoclassical treatment is part of the entrepreneurs optimizing problem. Note, however, that these two formulas assign a different meaning to the variable *K*. I keep the *K* variable as used in the financial or EVA® framework and I replace labor and capital in the neoclassical representation for the acquisition of all raw material required to produce goods. These raw materials (cost of production) are captured inside the *NOPAT* (and *ROIC*) rather than inside *K* in the EVA® representation. Knowing that $ROIC = \frac{NOPAT}{K}$, eq. 2 can be opened into eq. 4], which explicitly shows the quantities and their prices:

$$PV_0 = K_0 + \sum_{t=0}^{\infty} \frac{\frac{(P_t.Q_t - PR_t \cdot R_t)}{K_{t-1}} - cK_{t-1}}{(1+c)^t} = K_0 + MVA \quad (4)$$

Where *R* represents raw materials and *PR* represents the price of raw materials. Certainly, the neoclassical representation (eq. 3]) is simpler than the financial one (eq. 4]), but the latter is more precise if by precision we understand a closer representation to the optimization problem actually faced by the firm. It is more clear now that the entrepreneur does not maximize profits as defined in eq. 3], but maximizes the PV of the firm. If the entrepreneur has no direct control on K_0 and takes this value as given, then the role of the entrepreneur is to maximize the MVA; eq. 3 is then *part* of the maximizing problem of the entrepreneur.

Equation 3 implies that the firm maximizes one *EP* because there is no time included, but from eq. 4 it follows that the firm problem is to maximize its *value*. This difference is not just semantics. While it is the case that to maximize the firm value yields profit maximization, once we account for different periods of time it does not follow that the firm is necessary maximizing its value by maximizing profits. It is possible that a strategy that maximizes profits in the short-run can lead managers to reduce investment today, where a lower *K* yields a larger *ROIC* and a larger *EVA* spread $(ROIC - c)$ at the expense of smaller *EVAs* in the future that more than compensate lower *EVAs* today. Assume, for instance, a firm with only two periods and two strategies. The first strategy yields a profit of 90 in the first period and zero in the second one. The second strategy yield zero profits in the first period and 100 in the second one. Once we take into account time, then we can choose the profit schedule that maximizes the value of the firm. At a high enough discount rate it is possible that profits of 90 in the first period yield a higher value than a profit of 100 in the second period. To maximize profits and value are equivalent problems when the variable time is left out of the equation and it therefore it is not part of the optimization problem.

Finally, the financial treatment separates the cost of production (inside the *NOPAT* or *ROIC*) from the opportunity cost of capital(c). The neoclassical profit maximization treatment interprets the cost of labor and capital as the cost of production, but there is no explicit distinction between production costs and opportunity cost. For the firm to receive economic profits, total revenues need to beat both, production costs and the opportunity cost. The leftover revenue after paying for the cost of production needs to be larger than the opportunity cost.

3 Kirznerian *Alertness*

Kirzner's (1973, Chapter 2) *entrepreneurial alertness* is another distinctive concept in the Austrian literature. Because in equilibrium all optimal economic decisions have already been taken there is no need of an entrepreneur as the economic agent that discovers market opportunities; *entrepreneurial alertness* is the defining characteristic of the "entrepreneur." In terms of this paper's framing, *entrepreneurial alertness* is the activity of discovering market disequilibria. In a world with incomplete and dispersed information, market disequilibria are not given, they need to be discovered. While in the Austrian literature the entrepreneur is a necessary economic agent, in the neoclassical analysis his presence is unnecessary. Schumpeter's treatment of this subject offers a clear contrast. While in Kirzner the *entrepreneur* is the agent that moves the economy towards equilibrium, in Schumpeter the *entrepreneur* moves the economy outside its equilibrium. Discovering market disequilibria (Kirzner) is different from producing a new equilibrium (Schumpeter).[10] Schumpeter's approach is more suggestive of real-world innovation, rather than discovery, but both approaches stand in contrast to the standard neo-classical neglect of the entrepreneur.

In equilibrium *ROIC* equals *c* and there are no more *EVAs* (economic profits) opportunities to seize, and therefore firms cannot increase their *MVAs*. *Entrepreneurial alertness* is the capacity to discover previously unknown *EVA* opportunities. To be sure, what *ex ante* seems to be a promising profit opportunity, can *ex post* often be shown to be wrong. Successful entrepreneurs are the ones with less *ex post* mistakes. Since business valuation is forward looking, the *MVA* estimation requires a forecast of market conditions that influence the expected cash-flow of the firm. Discovering market opportunities implies discovering an *MVA* ignored by the market. This is why this *MVA* value *it is not* captured in the K_0 variable.

4 From *Micro* to *Macro*: Financial Microfoundations

In this last section I offer three examples of how this financial framework, so far applied to microeconomic issues, can be extended to macroeconomic topics. In particular, how changes in relative prices can affect the allocation of resources across different firms but also inside firms. How an aggregate *roundaboutness* or APP can be estimated and what effects should be expected from changes in the discount rates. Finally, I show how to capture the impact of institutional reforms and risk on value creation.

4.1 Cantillon Effect and the Value Drivers

The Cantillon Effect refers to the non-neutral effects of an excess of money supply on relative prices. Namely, the prices of final goods change at different points in time rather than doing so at the same time in the same proportion. Assume the central bank decides to expand money supply and uses the newly printed money to buy Treasury bonds directly from the Treasury. The Treasury receives newly printed money that has not been used yet and, therefore, the purchasing power of money has not yet changed. The government, then, can use the new money *before* prices rise. As the new money enters the market through particular economic agents, different prices will rise at different points in times. On the opposite side, the last person in getting his share of the newly printed money does so *after* prices have risen. This issue is referred as the signal extraction problem, the fact that we know how much money has the central bank issued does not mean we know *which* particular prices will rise or *when* will they be affected.

The effect of Cantillon Effects on business valuation can be captured by opening the *ROIC* into *value drivers*. In corporate finance *value drivers* are used to distinguish which different business areas contribute more to value creation. For simplicity assume only one period so that we can ignore the *t* subscripts. Assume a firm has $j = \{1, \ldots J\}$ business areas (or, for instance, geographic areas where the firm is present), then the value drivers can be obtained by opening the NOPAT into its J components and multiplying and dividing by total *NOPAT* (eq. 5]), which can also be open into its price components (eq. [5]):

$$ROIC = \frac{NOPAT}{K} = \frac{\sum_{j=1}^{J} \frac{NOPAT_J}{NOPAT}}{\frac{K}{NOPAT}} = \frac{NOPAT}{K}\left(\frac{NOPAT_1}{NOPAT} + \ldots + \frac{NOPAT_J}{NOPAT}\right) \tag{5}$$

$$ROIC = \frac{\sum_{j=1}^{J} \frac{P_j \cdot Q_j - PR_j \cdot R_j}{P \cdot Q - PR \cdot R}}{\frac{K}{P \cdot Q - PR \cdot R}} = \frac{P \cdot Q - PR \cdot R}{K} \cdot \sum_{j=1}^{J}\left(\frac{P_j . Q_j - PR_j \cdot R_j}{P \cdot Q - PR \cdot R}\right) \tag{6}$$

From the entrepreneur's point of view, as relative prices change, so do the *value drivers* of each $NOPAT_j$. If this exposition seems complicated, it is much more so for the entrepreneur in the real world. Equations 5 and [5] are only one component of the value of the firm (eq. 2]). This becomes even more complex when the firm can sell the same product at different prices or different inputs can be acquired. The more noise through excess of money supply is added to price movements the more likely errors will be committed by entrepreneurs and investors.

Consider now a different reading of eqs [5] and [5]. Assume now that $j = \{1, \ldots, J\}$ instead of representing business areas of a given firm represent different economic activities (i. e. agriculture, manufacturing, banking, services, etc.) such that the summation of all *NOPATs* is the aggregate value for the whole country's economy. This now means that in the presence of significant Cantillon Effects some economic activities look more profitable than others. In the previous interpretation we had a firm reallocating resources internally, but this interpretation captures the incentive to reallocate resources across economic activities. It is plausible to assume that it is more likely in this second case that resources will be more irreversible than when reallocation takes place inside a firm. Consider for instance the case of a country that regularly devalues its currency in the foreign exchange market to promote exports over imports. That means that the relative *ROIC* of the export sector with respect to the *ROIC* of the imports sector rises, increasing the allocation of resources in the tradable goods industry at the expense of the non-tradable goods industry.

4.2 Aggregate Roundaboutness

In Section 2.1 I argued that a measure of *roundaboutness* or *APP* is already embedded in the financial calculation of a firm or project market value. If there are *N* firms, and each firm has its own *D (APP)*. This *D* depends on the subjective expectation of each entrepreneur and investor. At the macro level, then, there is an array of *Ds* for each project taking place in the economy. The subjective characteristic of each *D* implies that, strictly speaking, an aggregation of all *Ds* might not be possible. However, if we wish to gloss over this issue and reach an aggregate *D*, this can be represented by the weighted sum of all *N* firms' *D's* (eq. 7]).

$$D = \sum_{n=1}^{N} D_n \cdot \omega_n \tag{7}$$

Where $\omega_n = \frac{MVA_n}{MVA}$ and *MVA* is the sum of all *n MVAs*. A change in *D* is directly influenced by a change in the price of time, interest rates. Assume there are two representative firms, one for low duration (LD) and another one for high duration (HD). Assume a central bank successfully reduces the discount rate used in the market and money is neutral in the sense that there are no Cantillon Effects. Since the value of *HD* firms is more sensitive to changes in the discount rate of *LD* firms, the ratio $\frac{MVA_{HR}}{MVA_{LR}}$ increases incentivizing a reallocation of resources from *LD* firms towards *HD* firms. Then, since MVA_{HR} increases faster thanMVA_{LR}, ω_{HR} increases and ω_{LR} decreases. Aggregate *D* increases for three reasons. First, through a value effect by MVA_{HR} increasing faster than MVA_{LR}. This value effect is to be expected since *roundaboutness* or *APP* is both, a time *and* value concept. Second, through a reallocation of *already* existing resources from the *LD* sector towards the *HD* sector. Third, through new investment taking place in the *HD* sector before than the *LD* sector.

The opposite effect occurs when the discount rate increases towards its equilibrium or natural level. Now relative prices signal for resources to be reallocated from *HD* towards *LD* sectors. It can also be the case that at the equilibrium discount rate some *MVA* in the *HD* sectors are negative calling for the liquidation of these activities. This is the core of the ABCT as it would show in financial calculation as performed in the market.

Note that for the ABCT to take place Cantillon Effects are not required. The ABCT is about resource misallocation across time (duration) because of changes in *c*. This is not to say, of course, that Cantillon Effects are not real or that they are always insignificant. What this exposition does is highlight the core argument of the ABCT by showing changes of relative prices *inside P* are not the focus of this business cycle theory.[11] A financial application to the market process emphasized in the Austrian literature does not only shed light on capital theory issues such as unambiguously defining *roundaboutness*, but makes it more clear what the specific driver of the ABCT is and what distortionary effects are not needed.

4.3 Risk, Institutions, and Value Creation

Finally, I want to show how to capture the effects of risk. There are two risks to capture. The first one is the pure cash-flow risk. If eq. 2 is constructed with the expected *NOPATs*, then a confidence interval can be added by using an estimation of the *NOPAT* standard deviation. This is a straightforward construction that can show minimum and maximum firm values according to beliefs about how dispersed *EVA* can be in the future. Equation 8 shows a representation with a confidence interval that allows defining a confidence level below which the projects ceases to yield positive *EVAs*.

$$PV_0 = K_0 + \sum_{t=0}^{\infty} \frac{\frac{NOPAT_t \pm \sigma\sqrt{t}}{K_{t-1}} - cK_{t-1}}{(1+c)^t} \tag{8}$$

The second one is institutional risk, such as country risk. Country risk captures the overall risk of investing in a particular country. For instance, what is the likelihood that during the life of a project capital controls will be imposed, the regulatory framework will be changed, the firm expropriated without proper compensation, etc. The higher the risk, the higher opportunity cost and therefore the higher the *NOPAT* required to compensate the investors. This type of risk can be captured in the opportunity cost variable. Let σ_c capture the risk premium of investing in a given country, then:

$$c = c_N + \sigma_c\sqrt{t} \tag{9}$$

Where $c_N$represents the natural rate of equilibrium and the risk premium component is multiplied by the square root of time because the longer the time, the more likely capital controls, a change in regulation, or expropriation may take place. We can, in turn, imagine opening σ_C into sub-components like political risk, economic risk (i. e. exposure to external shocks), specific industry risk, etc. As a matter of illustration, σ_C can be conceptually opened into sub-components similar to those used in economic freedom or institutional indices. Equation 2 now looks like eq. 10]:

$$PV_0 = K_0 + \sum_{t=0}^{\infty} \frac{\left(ROIC_t - \left(c_N + \sigma_C\sqrt{t}\right)\right) K_{t-1}}{\left(1 + c_N + \sigma_C\sqrt{t}\right)^t} \tag{10}$$

The higher σ_C the lower the *EVA* values and the lower the *MVA* of each firm in the country. High risk countries evidence lower rates of value creation and a lower aggregate *D*. By contrast, low risk countries with market-friendly institutions, evidence higher values of *MVA* and a higher aggregate *D*. Equation 9 also shows the opportunities that arise in the case of a positive institutional shock that makes σ_C drop from high to low values opening the door to higher *MVAs* in a larger number of economic activities. A positive institutional reform not only increases the *EVA* spread, it also reduces the discount factor and this has a higher impact on long term and projects that require a larger *K*.

These two examples can be extended, for instance, to show how economic freedom impacts business profits and productivity. The Fraser Institute's *Economic Freedom of the World* index could be opened into its five sub-index (1) size of government, (2) legal system and property rights, (3) sound money, (4) freedom to trade internationally, and (5) regulation. Each of of these five components could be added to eq. 3 as done with eqs [7] and [9]. Since (Powell and Macera n.d.) paper included in this issue focuses on this particular issue I offer only a quick example when each one of these sub-indices show low values (low economic freedom).

Sub-index (1) can affect the NOPAT calculation either through higher taxes or interest rates if government finances its spending with debt (eq. 8]). Sub-index (2) captures country risk when property rights are not well protected, this is the scenario shown in eq. 10]. Sub-index (3) can increase price volatility, affecting the *NOPAT* as shown in eq. 8]. Sub-index (4) can result in higher costs of raw materials when the economy is closed to international trade; this affects the *NOPAT* as well. Finally, sub-index (5) implies higher costs of operation by the firm through the need to navigate a highly regulated environment. This will negatively affect the *NOPAT* as well.

Finally, another issue emphasized in the Austrian literature is that of Knightian uncertainty. While risk is a quantitative concept (and therefore measurable), uncertainty is an unmeasurable concept. A reason for the unmeasurability of uncertainty is that uncertainty can involve *unique* events from which a probability of occurrence cannot be inferred. In this case a "probability" value can be assigned to this unique event, but this value has a different meaning than that inferred from a repeated event.

Assume an investor who is facing two potential *states of nature* such as its country of operation becoming either a very free or a very repressed economy. The investor may assign a 70 % probability of the country becoming a very free economy and 30 % probability becoming a very repressed economy. We can call this type of uncertainty *regime uncertainty* (Higgs 2006). This is a unique event, which means that this change in the state of nature is not a repeated event (at least for a long period of time). The investor cannot rely on some years being on a very free economy and some years being on a very repressed economy. Once the state of nature is defined no change is foreseeable. If in a very free economy the firm perceives an *MVA* of \$100 and in the very repressed economy an *MVA* of negative \$100, then the expected *MVA* is \$40. The firm, however, will either go bankrupt or survive and grow. There is no middle (expected) value. It is, then, to be expected that an increase in *regime uncertainty* will freeze investments rather than reallocate resources according to the new expected value calculation.

Because Knightian uncertainty is unmeasurable, its presence in the calculation of the value of the firm is elusive. However, its impact can be shown as in the scenario just mentioned. Economic calculation happens in an institutional and economic context that needs to be assessed by the entrepreneur and the investor even if such contexts are not *inside* eq. 2.

5 Conclusions

This paper shows how issues and concepts distinctive to the Austrian literature can be captured in financial calculations similar to the ones actually used in the market. This exercise shows *how* such effects are going to manifest in the market process of resource allocation and by doing so it also shows that Austrian economics is consistent with real world problems. A well-defined calculation of the value of the firm shows that elusive concepts like *roundaboutness* or *APP* can be measured without the need to assume them away as in the conventional profit maximization problem of the firm.

I also used the microeconomic application to show how it can be directly translates into macroeconomic issues and variables. The specific way that Cantillon Effect distort profit calculation is shown, as is how complex the signal extraction problem can be. A representation that simplifies this issue by assuming a price level underestimates the signal extraction problem by construction. The ABCT becomes a clearer business cycle theory and its microeconomic foundations become more explicit. Finally, the impact of institutions on value creation, another topic present in the Austrian literature, can also be captured in the financial framework used in this paper.

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I thank valuable comments by the attendees to the symposium on Austrian Perspectives on Business Valuation. Errors and omissions are my own.

Notes

[1]For a more detailed discussion and expostion of EVA® see Ehrbar (1998), Koller, Goedhart, and Wessels (1990), Rappaport (1986), Stern, Shiely, and Ross (2003), and Young and O'Byrne (2000) .

[2]For a discussion of capital as financial term see Braun, Lewin, and Cachanosky (2016)Hodgson (2014) and Lewin and Cachanosky (2015) .

[3]See Cohen (2008 and 2010), Cohen and Harcourt (2003), Dorfman (1959), and Machlup (1935) .

[4]For a history on the treatment of the *APP* see Lewin and Cachanosky (2014) . For an analytical study of capital theory see Lewin (1999) .

[5]The association of *APP* to *duration* is hardly done. An exception I am aware of isHendrickson and Salter 2015). See also the discussion by Osborne (2014 and 2005).

[6]This result is well known. In continuous time Macaulay and modified duration are equal.

[7]There may be many types of (physical) captial and labor, in which case there would be a wage rate for each type of labor.

[8]See Lewin (1999, 73–75) for a Ricardian and neo-classical treatment of Böhm-Bawerk's time in production.

[9]Surely it is not totally accurate to imply that in the neoclassical theory time is completely absent. The value of time as another variable to optimize by the firm, however, it is not usually present in most textbooks.

[10]For a more detailed discussion see Baumol (2003), Boettke (2014), Horwitz (2010), and Kirzner (2000) .

[11]A more detaile discussion can be found in Cachanosky and Lewin (2016b) .

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