

Are Economic Profit and the Internal Rate of Return Merely Accounting Measures?

Melvin L. Roush^{*1}, Mohammed S. Khaled^{#2}, Stephen P. Keef^{#3}

^{*1}*Department of Accounting and Computer Information Science,
College of Business, Pittsburg State University,
1701 S. Broadway, Pittsburg, KS 66762
Email: mroush@pittstate.edu*

^{#2, #3}*SCHOOL of Economics and Finance, Victoria University of Wellington,
PO Box 600, Wellington, New Zealand
Email: Mohammed.Khaled@vuw.ac.nz, Stephen.Keef@vuw.ac.nz*

Abstract—This paper explores the proposition that economic profit and the internal rate of return are merely accounting concepts. They share a number of common aspects. These include an allocation of capital that is unrelated to market forces and a treatment in the literature that focuses on the mathematics rather than the economics. We show that the two measures have limited, if any, economic content. Therefore we conclude that they are devoid of compelling theoretical interest in the domain of wealth maximization.

Keywords— *Economic Profit, Internal Rate of Return, Net Present Value, Accounting, Economics*

1. Introduction

EVA[®], an acronym for economic value added, is a proprietary trademark of Stern Stewart and Company. The origins of economic value added are found in Stewart's (1991) book "The Quest For Value". Since that time, economic value added has achieved considerable popularity in the business world as a measure of financial performance. As a consequence, it is often an ingredient of executive performance plans. Stern Stewart's economic value added, although the most popular, is but one of a number of variants of a theoretical construct we shall term "economic profit". In the commercial world, the cognate performance measures marketed by other consulting firms are Cash Flow Return on Investment and Cash Value Added by the Boston Consulting Group and Holt Associates, Shareholder Value Added by LEK-Alcar Consulting Group, Economic Profit by McKinsey and Economic Earnings by AT Kearney (Chari, 2009). In the academic world, there is residual income which is discussed in most management accounting texts and earned economic income (Grinyer, 1995; Peasnell, 1995a, 1995b). Magni (2009, Table 2, p. 4) presents a list of the names used by other researchers. An improved version of EVA[®], called "EVA momentum" has been

recently suggested by Stewart (2009).

Market value added is the present value of the stream of future economic profits. Hartman (2000), Sullivan & Needy (2000) and Shrieves & Wachowicz (2001) examine the equivalence of market value added and net present value. These three studies establish the mathematical equivalence, but are essentially silent on the necessary assumptions to establish the relation. We detail these assumptions, which are generally known as 'clean surplus'. An explicit examination of these assumptions allows a clearer insight into the underlying economic content of economic profit.

Hartman (2000) argues that the conceptual difference between market value added and net present value lies in the allocation of capital over the life of the investment. Citing Lohmann (1988), Hartman (2000, p. 159) states "... *the net present value decision criterion assumes that the capital that remains invested in an opportunity grows at the internal rate of return (IRR), and the cash released by the project grows at the external rate of return ...*". Kierulff (2008) expresses similar sentiments. This statement links economic profit and the internal rate of return. We explore the validity of this statement, which pervades the literature. We show that neither the capital invested nor the internal rate of return on that capital nor economic profit are economically interesting. They are merely accounting concepts with questionable economic content.

The distinction between accounting numbers and economic numbers is an important theme of this paper. Examples of accounting numbers are profits and book values (see, for example, Shrieves & Wachowicz, 2001). Typical examples of economic numbers are cash flows and market values. Economic numbers are superior to accounting numbers when assessing the economic attractiveness of a proposed investment. In stark contrast, accounting numbers are superior to economic numbers when reporting to the stake holders of the entity within the constraints of generally accepted accounting practices. A vital point to acknowledge is

that, in general, accounting numbers differ from their economic counterparts. Twenty five years ago, the perception could be summarized as “never the twain shall meet” (Rudyard Kipling's *The Ballad of East and West*). Today, so it would appear, they meet in economic profit and market value added.

As our analysis will show, economic profit and the internal rate of return share a number of common features. First, there is a voluminous literature on these two measures. Second, they can, with varying degrees of efficiency and success, be used to assess the economic attractiveness of proposed investments. We say little more about these aspects. Third, they implore the property of zero net present value. Fourth, their focus is on an allocation of capital that shares no sensible relation to market forces. Fifth, they both exhibit symptoms of what we call a ‘put it in’ then ‘take it out’ syndrome. Furthermore, our analysis supports the proposition that the treatment of both metrics in the literature has suffered from the problem where the mathematical process dominates the economic logic. Herbst (1982, p. 92) levies this criticism at the treatment of the internal rate of return. We show that the very same criticism applies to economic profit.

The remainder of the paper is structured as follows. Section 2 seeks to clarify the economic rationale of a project's net present value. Section 3 discusses the importance of the internal rate of return on capital. Section 4 examines the theoretical construct of economic profit. The paper ends with brief conclusions in Section 5.

2. Net present Value and the Market

In this section we seek to explain the economic meaning of a project. The net present value method is the gold standard for assessing the economic content of a project. In order to develop the arguments it is necessary to invoke some simplifying assumptions and to carefully define the terms employed. For convenience we focus on an all equity firm formed to operate a single project in a world without taxation. The arguments naturally extend to the general case with appropriate adjustments that are orthogonal to the themes we explore. For convenience, we implore a market determined interest rate that is constant over time. We maintain homogeneous and perfect expectations as to the future cash flows and the discount rate. That is to say, the future unfolds exactly as was expected. There is little to be gained from the relaxation of this latter assumption.

2.1. Net Present Value

The net present value NPV_0 of a project is normally conceived as the present value of the expected cash flows $E(CF_t)$ less the initial investment, that is to say,

$$NPV_0 = \frac{E(CF_1)}{1+r} + \frac{E(CF_2)}{(1+r)^2} + \dots + \frac{E(CF_n)}{(1+r)^n} - Cost_0 \quad (1)$$

where $Cost_0$ is the cash outflow that occurs at time zero and r is the market determined, risk adjusted discount rate. For pedagogic convenience we use the shorthand notation $PV_0(E[\Phi_t])$ to represent the present value of the series denoted by Φ_t . Thus the net present value represented in equation (1) can be specified as

$$NPV_0 = PV_0(E[CF_t]) - Cost_0 \quad (2)$$

The economic content of the net present value of a project has an inexorable link with the market. The market is a theoretical construct. It is predicated on the economist's perfect market dream. In the real world, a semi-strong form efficient market is a practical surrogate. It is well recognized that investments in stock and bond markets in developed economies have an expected net present value of zero for both parties to the transaction. In the context of the market, NPV_0 represents the change in wealth accruing to the owner of the project at the time the project is instigated. This is time zero. The essence of the argument is that the project's cash flows could be sold in the market to reap the NPV_0 and the $Cost_0$.

It is a tautology to say that the cash flows invested in the market earn the market's rate of return. However, in the context of net present value, it is not compulsory to assume that the future cash flows generated by the project will be invested at the market's rate of return. Following the tutorial assignment set by Herbst (1982, p. 92), it is clear that the calculated net present value of a project is truly independent of the uses to which the future cash flows are deployed. A simple illustration will suffice to illustrate the point. Consider a single cash flow to be released by the project sometime in the future. There are myriad ways that this cash flow can be deployed. Let us focus on two. The cash flow could be invested wisely in the market or it could be squandered. No matter the destiny of this future cash flow, the net present value of the project remains unchanged. The argument naturally extends to the internal rate of return (see Karathanassis, 2004; Lohmann, 1988). The reinvestment assumption, pertaining to future cash flows being reinvested at the calculated IRR, is truly fallacious with the internal rate of return method.

3. IRR and Capital Invested

This brings us onto the concept of “capital”. The word needs careful definition. In the context of this paper there are two definitions that are appropriate. A financial accounting definition of capital is the

money invested in the project $Cost_0$. A strict economic definition of capital is the wealth currently invested in the market, that is to say, the market value.

There can be no doubt that Hartman's statement "... the capital that remains invested in an opportunity grows at the internal rate of return (IRR) ..." is true under the maintained assumption that the market's discount rate does not change. We show that it applies to both of the definitions of capital. We arrive at the conclusion that the statement is a tautology. The process of discounting (or compounding) leads unerringly to the fact that the capital invested in the project earns the rate of return used as the discounting (or compounding) rate if the resulting net present value is zero. This link is merely a mathematical fact. It is an alternative statement of the internal rate of return. Therefore it is not an assumption.

The proof is straightforward. Consider a simple bank loan. The sum initially borrowed is equal to the present value of the expected repayments when discounted at the interest rate of the loan, that is

$$\begin{aligned} \text{Sum Borrowed}_0 &= PV_0(E[\text{Repayment}_t]) \\ &= PV_0(E[CF_t]) \end{aligned} \quad (3)$$

It is a well known fact that the repayments for each period can be separated into the components of interest and principal (or 'capital'). The mathematics of this process need not concern us at this time. Thus equation (3) can be written as

$$\begin{aligned} \text{Sum Borrowed}_0 &= PV_0(E[\text{Prin}_t + \text{Int}_t]) \\ &= PV_0(E[\Delta BV_t + r_{Loan}BV_{t-1}]) \end{aligned} \quad (4)$$

where the change in principal has been labelled ΔBV_t , and the accrued interest has been labelled $r_{Loan}BV_{t-1}$ with r_{Loan} being the interest rate. We use the term BV , which represents book value, for the very reason that it acknowledges the bank's accounting records. As we shall show later, the right hand side of equation (4) is an integral component of economic profit. The elements ΔBV_t and $r_{Loan}BV_{t-1}$ represent the difference between the cash flow and the resulting economic profit (see equation 14). Alternatively put, the reduction in the loan principal implicit in a given repayment is mathematically akin to an economic profit, that is,

$$\Delta BV_t = \text{Repayment}_t - r_{Loan}BV_{t-1} \quad (5)$$

A similar insight is used in the analysis of the internal rate of return (Magni, 2010).

The insight is that for the project's cash flows, these being the sum borrowed and the series of repayments, the property of zero net present value and the interest rate are necessary to determine the principal and interest component for each repayment. From the banker's point of view, the loan earns r_{Loan} .

This is (obviously) the rate of interest on the outstanding principal BV_{t-1} . Since the loan has a net present value of zero, this interest rate r_{Loan} is also the internal rate of return of the loan. The fundamental definition of the internal rate of return is the interest rate that sets the net present value to zero. We are unable to isolate the presence of an assumption in these purely mathematical relationships.

At this stage there are two things we can say about $Cost_0$. First, it is a sunk cost at the instant the project is instigated. It has, in a general context, no systematic bearing on the market value. Second, $Cost_0$ is of vital importance in the context of financial reporting. It is also, so it would appear, the crux of the internal rate of return. This latter perception casts a shadow of suspicion on the internal rate of return since $Cost_0$ is just one of the many cash flows of the project. That is to say, a focus on just one cash flow has the potential to be myopic and misleading. The market value $Cost_0 + NPV_0$ is the true economic wealth invested by the owner. It is the cash that could be immediately extracted by selling the project in the market. The net present value of the economic investment in the market is now zero - market value is equal to the present value of future cash flows. So this internal rate of return is the market's required rate of return. To say that the investment earns the internal rate of return of the market is the same as saying that the investment earns the market's rate of return. The tautology should not escape us.

Thus, we have two ways of looking at the internal rate of return. First, as clearly shown by Lohmann (1988), the project earns the internal rate of return on the original cost IRR^{Cost} . Second, we have shown that it also earns the internal rate of return on the current wealth invested by shareholders IRR^{Market} . So a project has two distinct internal rates of return! Surely, they both cannot be the fundamental truth? The answer as to which internal rate of return is the truth depends solely on whether one takes an accounting view or an economic view.

3.1. Capital Allocation

A common criticism levelled at the internal rate of return on accounting cost is that there is no rationale for the discount rate it employs to calculate a net present value of zero. Theory is clear that the risk adjusted discount rate in the net present value method is determined exogenously from the market. Hartman's (2000) statement which we cited earlier alludes to this important point. As its name implies, the calculated internal rate of return is internal to the cash flows of the project. Unlike the corresponding net present value, which is a function of the market rate of interest, IRR^{Cost} is unique to and a constant for each project. Thus, it cannot share a systematic relation to an exogenously determined interest rate.

IRR^{Cost} may characterize a particular financial facet of a project. However, this facet has well known defects in comparison to the net present value method. We are aware of two valid criticisms that can be leveled against internal rate of return on market value. First, it is just the market's required rate of return masquerading under a different name. Second, IRR^{Market} , in itself, does not say anything useful about the project. The latter criticism, of course, applies to all variants of the internal rate of return.

A strict economic view is that a cash flow is just a cash flow. There is no harm in separating it into principal and interest, although one must admit that such a view has a strong accounting emphasis. For example, generally accepted accounting practices demand a careful and considered distinction between capital items and non-capital items. But, as we illustrate, such a separation serves no useful purpose in the economic assessment of the economic attractiveness of a project. Notwithstanding, the enigmatic question is why do we frequently make use of the separation in our paper? The explanation is simple. Allocation of accounting capital is an integral component of economic profit.

Consider two mortgages with the same initial sum borrowed of \$100,000. These mortgages command an interest rate of 1% per month and are repaid by uniform monthly repayments. This interest rate need not be the same as the market interest rate. The mortgages differ only in their maturity. The shorter term mortgage has a maturity of 11 years whereas the longer term mortgage has a maturity of 20 years. Recourse to a standard spreadsheet shows that the monthly repayments are \$1,368 and \$1,101, respectively. The sum of the un-discounted repayments is \$180,548 and \$264,261, respectively.

A strict accounting view would say that the principal returned to the bank over the life of each mortgage is \$100,000, that is, the initial sum borrowed. Thus, the total interest paid on each mortgage is the sum of the un-discounted repayments less the initial principal. The total interest paid over the life of each mortgage is \$80,548 and \$164,261, respectively. The difference in interest paid is quite substantial in our example. The un-discounted interest for the long loan is twice the size of the un-discounted interest for the short loan. However, what is the true economic import of this difference? Our conclusions are not encouraging.

We can separate the monthly repayments into their implied principal and interest components. Thus the two mortgages are defined by

$$\begin{aligned} \$100,000 &= \text{Sum Borrowed}_0 \\ &= PV_0(P_t^S) + PV_0(I_t^S), \\ &= PV_0(P_t^L) + PV_0(I_t^L) \end{aligned} \quad (6)$$

where P_t and I_t represent the principal and interest components of the repayment and the superscripts S and L differentiate between the shorter term loan and the longer term loan. Simple rearrangement gives

$$PV_0(I_t^L) - PV_0(I_t^S) = PV_0(P_t^S) - PV_0(P_t^L). \quad (7)$$

In present value terms, the savings in interest associated with the shorter term loan are exactly offset by the savings in principal associated with the longer term loan.

It is impossible to escape the conclusion that interest, in this context, has no economic meaning. We can see little reason as to why the same perception should not hold in general for any other series of cash flows. Since the principal component is linked to the interest component through the equation $CF_t = P_t + I_t$ it is reasonable to conclude that, in isolation, principal also has no economic content. These arguments obviously apply to an economic view of the world, but would not sit easy in a financial accounting world.

3.2. The Assumptions -- Revisited

We believe we can explain how the statement (Hartman, 2000, p. 159) "... the net present value decision criterion assumes that the capital that remains invested in an opportunity grows at the internal rate of return (IRR), and the cash released by the project grows at the external rate of return ..." arose. Our reading of the economic engineering literature reveals a perverse propensity to focus on future wealth, sometimes called terminal value. This construct must, of necessity, introduce the notion of reinvestment into the final analysis. Herbst (1982, p. 89) illustrates the concerns that can arise from such an approach. In contrast, the finance literature exhibits a far stronger emphasis on present value. We surmise that the reason for this latter view is found in the belief that markets, in the real world, value securities and projects using the net present value method.

Lohmann (1988, p. 309, equation 8) explicitly defines the net present value of the project as the present value of the net future wealth, that is,

$$NPV_0 = \frac{\text{Future Value}_n}{(1+r)^n}, \quad (8)$$

where Future Value_n represents the net terminal value at time n. Although the mathematical precision is unquestionable, it raises the question of whether this is tantamount to being an inefficient process of 'putting in by compounding' followed by a 'taking out by discounting'. To illustrate, consider the present value of a single cash flow expected to occur at time t, namely,

$$\begin{aligned}
 PV_0 \text{ of } E[CF_t] &= \frac{E[CF_t](1+r)^{n-t}}{(1+r)^n} \\
 &= \frac{E[CF_t]}{(1+r)^t} \times \frac{(1+r)^{n-t}}{(1+r)^{n-t}} \quad (9) \\
 &= E[CF_t](1+r)^{-t}
 \end{aligned}$$

The discounting counterbalances the compounding by bringing the terminal value back to its original value at time t and then discounts further to a value at time zero. We believe that the emphasis on terminal wealth led initially to the fallacious reinvestment assumption.

4. Economic Profit

In this section, we examine the proposition that the Herbst (1982) criticism can be levelled at economic profit. The manifest outcome of our analysis is that the literature exhibits an unwarranted focus on capital allocation, from an accounting perspective, combined with an unnecessary focus on the mathematics. As a result, we contend, insufficient attention has been paid to the economics.

Economic profit EP_t is conventionally viewed as the profit for the period less the opportunity cost of the assets employed to generate that profit. It is defined as

$$EP_t \equiv P_t - rBV_{t-1} \quad (10)$$

where P_t is the profit for the period ending at time t and BV_{t-1} represents accounting book value at time $t-1$. The theoretical construct we call economic profit is also known as residual income and economic value added. As illustrated by equation (10), the concept is intuitively appealing and relatively straightforward, but the devil is in the detail (Keys, Azamhuzjaev & Mackey, 2001; Young, 1999).

In order to establish the mathematical equivalence between net present value and market value added, it is necessary to explicate a robust link between each of the cash flows and the concomitant profit figures. Our reading of Hartman (2000), Sullivan & Needy (2000) and Shrieves & Wachowicz (2001) is that they implicitly use the relation

$$P_t = CF_t - Dep_t \quad (11)$$

where Dep_t is the depreciation for period. However, depreciation is but one of a host of accruals and deferrals used in financial reporting. It is fair to say that these three studies implicitly assume the clean surplus relation. If they did not employ this relation, then the mathematical equivalence just would not hold. Thus, an explicit and comprehensive statement of clean surplus serves a valuable purpose.

We assume, for simplicity, that surplus cash flows are immediately paid out as dividends. This acknowledges that the dividend decision, which is a

part of the funding decision, is orthogonal to the investment decision. For pedagogic convenience, clean surplus can be perceived as having two features. The first feature is that changes to book value are taken through the profit statement. This can be represented as

$$P_t \equiv CF_t - (BV_{t-1} - BV_t) \quad (12)$$

The identity in equation (12) serves a valuable purpose. It establishes the only formal, yet generalized, link between accounting profit and the concomitant cash flow. The difference between cash flow and profit $BV_{t-1} - BV_t$ is known as an accounting accrual or deferral. Following the matching concept, revenue is recognized when a good or service is provided to the customer and an expense is recognized when the firm receives the service or uses the good. Such accounting recognition will invariably differ from the cash flows of the transaction (see equation 12). We define an 'accounting accrual' as an accounting entry that does not directly involve a cash flow. Two examples that come immediately to mind are an increase to Accounts Receivables when a good or service is sold on credit and an accrued interest expense associated with borrowing from a bank.

The point to appreciate is the underlying economic phenomenon is the period's cash flow. Profit is a reflection of the cash flow to the degree of the accounting accrual. It is fair to comment that this is the only plausible causal relationship. It is just not possible that the profit can be a determinant of the cash flow. That is to say, it is impossible, in general, for a change in accounting policy to result in a change in the cash flow. The only exception is where taxation is levied on accounting numbers. Even so, legislators are fully aware of this and thus exhibit a propensity to carefully specify the accounting rules for taxation purposes. We could muse upon the myriad reasons as to why accountants adjust cash flows to achieve profit. The answer lies in the mores underpinning accounting concepts and conventions and is thus well beyond the scope of our paper.

The second feature of clean surplus is that the book value is zero $BV_0 = 0$ before the first transaction is recorded and the book value at the end of the venture is zero $BV_n = 0$. Consider an investment in a depreciable asset with a finite economic life of n years. The first entry in the book value of the asset is the cost, that is, $BV_{0+\lambda} = Cost_0$ where the notation $+\lambda$ signals the first entry in an empty account. The cost of the asset is fully depreciated over its life -- the terminal book value is zero. That is to say, $BV_n = 0$. This leads to the statement that

$$\sum_{t=1}^n \Delta BV_t = Cost_0 \quad (13)$$

where $\Delta BV_t = BV_{t-1} - BV_t$, that is, the change in book value for period t . A simple loan, see equation (4), obeys the rules of clean surplus.

The combination of equations (10) and (12) leads to the definition of economic profit EP_t frequently adopted in comparisons with the net present value method (Egginton, 1995; Peasnell, 1982). This is given by

$$EP_t = CF_t - \Delta BV_t - r_m BV_{t-1} . \quad (14)$$

The elements ΔBV_t and $r_m BV_{t-1}$ are analogs of the allocation of capital and opportunity cost as found in the internal rate of return (see equation 4).

4.1. Properties of Economic Profit

There are three insights associated with the mathematical properties of economic profit. The first insight, as ably detailed by Hartman (2000) and Shrieves & Wachowicz (2001) in a mathematical context and Sullivan & Needy (2000) by worked example, is the net present value of the project NPV_0 is mathematically identical to the present value of future economic profit $PV_0(E[EP_t])$, that is to say,

$$NPV_0 = PV_0(E[EP_t]) = MVA_0 , \quad (15)$$

where MVA_0 represents market value added. Hartman (2000, pp. 163-164) raises the important question of whether the series of expected economic profits are truly cash flows, although at one stage he actually uses the enigmatic words "EVA cash flows". However, he does not develop this idea to its full capacity. If the stream of future economic profits does not fully consist of cash flows, then there is prima facie evidence that the mathematics of the process is driving the economic logic (Herbst, 1982, p. 92). The next two insights that we offer explore the validity of this proposition.

The second insight is that expected economic profit is zero for all future periods if the inputs to equation (14) are based on market values. Market based economic profit is denoted by EP_t^{Market} . Consider an investment which commands the market's rate of interest denoted by r_m . Using the corresponding analog of equations (3 and 4), we obtain

$$\begin{aligned} Wealth_0 &= MV_0 \\ &= PV_0(E[CF_t]) \\ &= PV_0(E[\text{principal}_t + \text{interest}_t]) , \quad (16) \\ &= PV_0(E[\Delta MV_t + r_m MV_{t-1}]) \end{aligned}$$

where ΔMV_t represents 'true economic depreciation' (Shrieves & Wachowicz, 2001, p. 49), which is defined as the change in the market (or present) value of the future cash flows, and $r_m MV_{t-1}$ is the opportunity cost. Noting from equation (16) that

$$E[CF_t] = E[\Delta MV_t] + E[r_m MV_{t-1}] , \quad (17)$$

it is apparent, using equation (14) for $E[EP_t^{Market}]$, that

$$\begin{aligned} E[EP_t^{Market}] &= E[CF_t - \Delta MV_t - r_m MV_{t-1}] . \quad (18) \\ &= 0 \end{aligned}$$

Equation (18) holds for all $t > 0$ and for all projects fairly priced in the market. In our example EP_0^{Market} (the expectation sign is unnecessary as there is no uncertainty) is zero since the project is zero net present value when valued at market price. In general $EP_0^{Market} = NPV_0$. If the project is assumed to be unexpected by the market, then NPV_0 or EP_0^{Market} can be viewed as an (unexpected) abnormal return expressed as a dollar value.

Equation (18) is derived from a simple conceptualization of an investment which is fairly priced in the market. The elements in the squared brackets on the right hand side of the equation, namely,

$$CF_t - \Delta MV_t - r_m MV_{t-1} \quad (19)$$

are the market's analogs of the accounting counterparts found in the conventional definition of economic profit, see equation (14). So, what role does the translation from market values to accounting values play? If we maintain that the project proceeds according to unbiased expectations, as would be expected in a semi-strong form efficient market, then the observation that $E[EP_t^{Market}] = 0$ for all $t > 0$ indicates any ex-post EP_t^{Market} is nothing but a random error. This follows from the definition of unbiased expectations, that is $x = E(x) + \text{random error}$. The implication is that any ex-post economic profit, based on accounting numbers, is quintessentially a function of the difference between market values and accounting values. We cannot conceive of any alternative rational explanation.

A cynic would be tempted to suggest that economic profit is just a reflection of the accountant's inability, either by choice or by prescription, to record market prices. This view is a little unfair since the accounting numbers must, of necessity, reflect generally accepted accounting principles. However, it is clear that accountants cannot have their cake and eat it too. If they follow accounting conventions, then they must accept that reported economic profit does not measure true economic performance for the period in question. If we are right in this view, then the vexing question is: "What does ex-post economic profit actually measure?" Sullivan and Needy's (2000, p. 167) review of the economic value added literature indicates that the orthodox view is that "... a positive EVA indicates that shareholder wealth is created ..." and vice versa. Our analysis casts

considerable doubt over the veracity of this business world view. Indeed, additional support for this view is found in the numerical examples provided by Hartman (2000, p. 161) and Sullivan & Needy (2000, p. 171). In each case the economic value added for the first accounting period is negative even though the project has a positive net present value. Does this mean that all profitable projects make an economic loss in their first year of operation?

The third insight seeks to develop upon the theme that expected economic profit, based on market values, is zero. Let us now distinguish between accounting adjustments based on the depreciation schedule and other accounting accruals, denoted by the superscripts *Dep* and *AA*, respectively. Examples of the latter are adjustments to Accounts Receivables. Thus expected economic profit is specified as

$$E[EP_t] = E[CF_t] - E[\Delta BV_t^{Dep} + rBV_{t-1}^{Dep}] - E[\Delta BV_t^{AA} + rBV_{t-1}^{AA}] \quad (20)$$

where $BV_t = BV_t^{Dep} + BV_t^{AA}$ acknowledges that book values are additive. Thus, the mathematical mechanics of the discounting process can be individually applied to each element of equation (20) to give

$$PV_0(E[EP_t]) = PV_0(E[CF_t]) - PV_0(E[\Delta BV_t^{Dep} + rBV_{t-1}^{Dep}]) - PV_0(E[\Delta BV_t^{AA} + rBV_{t-1}^{AA}]) \quad (21)$$

Now take the net present value versus market value added equivalence, namely,

$$MVA_0 = PV_0(E[EP_t]) = NPV_0 = PV_0(E[CF_t]) - Cost_0 \quad (22)$$

and substitute the right hand side of equation (22) into the left hand side of equation (21) to give

$$PV_0(E[CF_t]) - Cost_0 = PV_0(E[CF_t]) - PV_0(E[\Delta BV_t^{Dep} + rBV_{t-1}^{Dep}]) - PV_0(E[\Delta BV_t^{AA} + rBV_{t-1}^{AA}]) \quad (23)$$

which upon the canceling of the two $PV_0(E[CF_t])$ terms results in

$$Cost_0 = PV_0(E[\Delta BV_t^{Dep} + rBV_{t-1}^{Dep}]) + PV_0(E[\Delta BV_t^{AA} + rBV_{t-1}^{AA}]) \quad (24)$$

Hartman (2000) and Shrieves & Wachowicz (2001) show that

$$Cost_0 = PV_0(E[\Delta BV_t^{Dep} + rBV_{t-1}^{Dep}]) \quad (25)$$

That is to say, any depreciation schedule, however conservative or outrageous, that meets the requirements of clean surplus, conforms to equation (25). Our second insight, see equation (18), shows that expected economic profit is zero if the change in market value is used as the depreciation schedule. We again arrive at the conclusion that ex-post economic profit is a function of the differences between accounting numbers and market values.

Thus, it must follow from equations (24) and (25) that

$$PV_0(E[\Delta BV_t^{AA} + rBV_{t-1}^{AA}]) = 0 \quad (26)$$

We feel it is important to acknowledge that an essentially similar analysis is found in Shrieves & Wachowicz's (2001) treatment of working capital. However, our reading of their paper is that they conceive working capital as a cash flow. Our focus is on the accounting adjustments, other than depreciation (see equation 12), which are obviously not cash flows. Mathematically, equation (26) also applies to the depreciation schedule as portrayed in the financial accounts. This is evident from equation (25) when $Cost_0$ is replaced by ΔBV_0 .

Equation (26) is both startling and banal. The mathematical and economic robustness of the statement is beyond question. The net present value of the series of accounting accruals and their associated opportunity costs must always be zero under the innocent clean surplus assumption. The relation has a number of interesting implications. First, if the net present value of the accounting accruals and their associated opportunity costs is zero, then it is patently clear that they have no economic content in present value aggregation. This conclusion, which is largely self evident, has been given little explicit attention by proponents of economic profit.

Second, since accounting accruals, by construction in this paper and as a matter of fact in real life, are not cash flows, then it is not unexpected that their present value is zero. It would indeed be ironic if the net present value of a stream of non-cash flow accounting items could be shown to contain economic content.

Third, it is clear that an accounting adjustment is added to (or subtracted from) the cash flow of one period to create the economic profit (see equations 10 and 14). The accounting adjustment is then reversed, in present value terms, at a later date. One has to question the fundamental rationale for this 'put it in' and then 'take it out' process. The potential arbitrariness of the initial step in the process indicates that the economic signal over and above that contained in the underlying cash flow is, at best,

questionable. As we say before, a singular cash flow does not tell us much, if anything, about the project.

4.2. A Worked Example

In this section we provide a worked example which illustrates the points alluded to above. Consider a transaction, agreed at time zero, that results in the provision of a service worth \$200. For simplicity we assume that there are no costs involved, thus the profit is \$200. The service will be supplied to the customer towards the end of the first year. The cash flows of the contract are \$150 at the end of the first year and \$50 at the end of the second year. All cash flows are immediately paid out as dividends. The appropriate discount rate is 10% per annum.

Table 1 presents the analysis of the economic profit. The elements of the transaction, denoted by superscripts, are as follows:

- The profit of \$200 is acknowledged upon the provision of the service to the customer;
- The cash received at the end of the first year is \$150;
- The accounts acknowledge that Accounts Receivable have increased by \$50. This is the only book value involved;
- The accounts acknowledge the receipt of the \$50 cash flow in the second year and the Accounts Receivable account is credited with this sum and this returns the book value to zero (clean surplus).

The net present value of the cash flows is

$$NPV_0^{Cash\ Flows} = \frac{CF_1}{1.1} + \frac{CF_2}{1.1^2} = \frac{\$150}{1.1} + \frac{\$50}{1.1^2} = \$177.69.$$

Economic profit is defined as

$$EP_t = CF_t - \Delta BV_t - rBV_{t-1}.$$

Application of the accounting data gives the economic profits as

$$EP_1 = \$150 + \$50 - 0 = \$200$$

and

$$EP_2 = \$50 - \$50 - \$5 = -\$5.$$

Hence the present value of the economic profits is given by

$$PV_0^{Econ\ Profits} = \frac{EP_1}{1.1} + \frac{EP_2}{1.1^2} = \frac{\$200}{1.1} + \frac{-\$5}{1.1^2} = \$177.69.$$

Thus, as is well documented in the literature, $NPV_0^{Cash\ Flows} = PV_0^{Economic\ Profits}$.

The example also illustrates the fact that the present value of the accounting accruals, when combined with the opportunity cost, is zero. That is to say,

$$\begin{aligned} PV_0^{Accounting\ Accruals} &= \frac{[\Delta BV_1 + rBV_0]}{1.1} + \frac{[\Delta BV_2 + rBV_1]}{1.1^2} \\ &= \frac{-\$50 + 0}{1.1} + \frac{+\$50 + \$5}{1.1^2} = 0 \end{aligned}$$

This result, as must be the case, is consistent with equation (26).

5. Conclusions

We have taken the stance that market price is the fundamental (economic) truth. We accept that an alternative position could be adopted. We leave it to others to show the errors that arise from our stance. Finance focuses on future cash flows and current market values. Accounting focuses on profits and book values. In general, there exists a difference between market value and book value as well as a difference between cash flow and profit for each period. The mathematical link between these two pairs of differences is economic profit. The present value of the latter is known as market value added. The observation that market value added is the net present value of the project would appear to be the answer to the dreams of some accountants. As a review of the literature will reveal, much has been made of this ex-ante mathematical equivalence.

A simple bank loan meets all the requirements of the clean surplus assumption. It has an additional property of having a net present value of zero at its specified interest rate. This raises the interesting question of whether clean surplus and opportunity cost (accrued interest) must, of necessity, have a net present value of zero. The mathematics shows that this must always be the case. This insight is an important aspect of our analysis of market value added.

We have shown that a “put it in” and then “take it out” syndrome occurs in two situations. The first is found in the use of future value as a device for assessing the economic attractiveness of a proposed investment. The second is found in the accounting accruals embedded in economic profit. The syndrome has two characteristics. First, it clearly represents inefficiency. Second, it is amenable to sophisticated mathematical processes. The risk here, as Herbst (1982, p. 92) recounts, is that “... the superficial aspects of the mathematics ...” may obscure “... the economic interpretation ...”.

We have argued that the internal rate of return on capital cost is an accounting measure. Thus it is not a true economic measure. There can be little dispute that accounting numbers differ from economic numbers. As a consequence it should come as no surprise that IRR^{Cost} has a number of defects when

assessing the economic attractiveness of a proposed project. These defects, which are traversed to varying degrees in any current finance text, arise from an inappropriate allocation of capital. The allocation is based on an accounting conceptualization of capital. When calculated on market values, IRR^{Market} is merely the market's required rate of return. On its own, it clearly cannot be used to rank investment!

It is clear that economic profit, as conventionally portrayed in the literature, is also an accounting measure. There can be no doubt of this - before the metric was commercialized it was called residual income and was discussed, almost exclusively, in accounting texts. Like the internal rate of return, economic profit is based on an accounting conceptualization of capital. When economic profit is calculated on market values it is zero for all future periods provided the project progresses according to expectations. Economic profit is seductive. It has a number of attractive properties. We have shown that these properties are merely mathematical artifacts since they do not involve cash flows. They have no economic content. We are left with the impression that the mathematics process is driving the economic logic.

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Table 1: Economic Profit Analysis of the Transaction

	End of Year			$PV_0^{r=10\%}$
	0	1	2	
Cash flow, CF_t	0	\$150.00 ^(b)	\$50.00 ^(d)	\$177.69
Profit, P_t	0	\$200.00 ^(a)	0.00	n/a
Accounting adjustment, ΔBV_t	0	-\$50.00 ^(c)	+\$50.00 ^(d)	-\$4.13
Opportunity cost, rBV_{t-1}	0	0.00	+\$5.00	+\$4.13
$\Delta BV_t + rBV_{t-1}$	0	-\$50.00	+\$55.00	\$0.00
$EP_t = CF_t - \Delta BV_t - rBV_{t-1}$	0	\$200.00	-\$5.00	\$177.69

Notes:

- (a) The profit of \$200 is acknowledged upon the provision of the service to the customer;
- (b) The cash received at the end of the first year is \$150;
- (c) The accounts acknowledge that Accounts Receivable have increased by \$50. This is the only book value involved;
- (d) The accounts acknowledge the receipt of the \$50 cash flow in the second year and the Accounts Receivable account is credited with this sum and this returns the book value to zero (clean surplus).