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Why 'fair market valuations' are inappropirate for employee-owned firms and partnerships

David Ellerman

Faculty of Social Sciences, University of Ljubljana, Ljubljana, Slovenia

ABSTRACT

The usual formulas for the fair market valuation of a firm at time *t* include the profits accruing to the shares at time *t* from the use of wage or salaried labor in the future. But in employee-owned firms or partnerships, the future worker-members or partners are the residual claimants at those future times, so in those cases, the future residuals do not accrue to the current shareholder/residual-claimants. Hence any 'fair market valuation' of an employee-owned firm or partnership that assumes those future residuals accrue to the current shareholder/residual-claimants is inappropriate.

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1. Introduction

The basic argument of this paper can be easily outlined. The usual formulas for market or so-called 'fair' valuations of a firm are equivalent to the formula that breaks into two parts: (1) the present property rights, the net asset value of the firm, plus (2) the present value of the expected future profits. This formula assumes that the rights of the current owners of the firm include the residual or profit claims in the future time periods. But this is not true in a partnership or in an employee-owned firm such as an Employee Stock Ownership Plan (ESOP) (for simplicity, assume a 100% ESOP) or a worker cooperative. In both those cases, the future partners or the future employee-owners are the residual/profit claimants in those future time periods, so the present value of those profits cannot be imputed to the current partners or employee-owners.

In other words, the future partners or employee-owners are not the employees of the current ones. In a *conventional* firm, the claim of future workers on future revenues is capped at their wages or salaries, so the expected amount of future residual profits (revenues minus expenses including employee expenses) can be plausibly assigned to the current owners, at least in terms of expectations. But partnerships, ESOPs and worker cooperatives are not conventional firms in that respect. The future partners or worker-members are just as much residual claimants as the current partners or worker-members; their claims are not capped at wages or salaries. Hence, the residual profits in those future time periods are imputed or assigned to those future residual claimants, not the current partners or worker-members.

CONTACT David Ellerman david@ellerman.org
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It is a simple argument. But the predominance of conventional firms leads to the standard valuations being taken as 'objective' by professional or certified valuators. Their professional status as certified business valuators would be jeopardized by any major deviation from the standard 'objective' formulas.[1] Moreover, the full arguments depend on some of the mathematics of financial economics, e.g. by the Nobel laureates Merton Miller and Franco Modigliani (Miller and Modigliani 1961), that go far beyond the cookbook formulas taught to business valuators. Our treatment in the body of the paper will only use simple mathematics or heuristics with the Miller-Modigliani methods treated in the Appendix.

2. Fair market valuation of an asset

The relevant points can be made using a simple model. Production assets like a machine or building have passive or active uses. In the passive usage, the asset is rented out for (we assume) some going market rental rate. In competitive markets, the cost of the asset would be the discounted present value of rentals (net of maintenance costs) plus the salvage value. In the active use of the asset, the asset is combined with a set of complementary production services (various inputs and labor) into a going-concern firm and then the owner of the asset would value the asset at the discounted present value of the future net returns plus the salvage value.

2.1. The passive use of the asset

Consider a capital asset with a market cost of C which yields the annual stream of capital services $K, \ldots, K$ for n years (for simplicity, assume no depreciation) and then has a salvage value of S. The capital services can be rented or leased out for R per year and the interest rate is assumed to be r (e.g. 0.10 for 10%). Hence, the discounted present value of the services rendered by the asset on the rental market is:

$$\sum_{k=1}^{n} \frac{RK}{(1+r)^k} + \frac{S}{(1+r)^n} = RKa(n,r) + \frac{S}{(1+r)^n}$$

where $a(n,r)$ is called the *present value of an ordinary annuity of one* [Friedman and Nicholas 1988, 52]:

$$a(n,r) = \frac{1}{(1+r)} + \frac{1}{(1+r)^2} + \ldots + \frac{1}{(1+r)^n}.$$

Then competitive arbitrage between the buy and lease markets will enforce the equation:

$$C = RKa(n,r) + \frac{S}{(1+r)^n}.$$

2.2. The active use of the asset

In the active case, a supplementary set of inputs is purchased at the variable cost VC and L units of labor are hired at the wage rate of W per year, and outputs Q are produced

which sell for unit price P. Then the economic (i.e. pure) profits obtained at the end of each year are:

$$\pi = PQ - RK - VC - WL$$

(where RK is the implicit cost of tying up that asset in the going-concern firm). Hence the discounted present value of the economic profits is:

$$V_0 := \pi a(n, r).$$

The *capitalized value of the capital asset* is defined as the discounted present value of the income stream 'generated' by the capital asset. But we have seen there are two ways to generate an income stream from the asset, the passive and the active ways. In the active case, the cashflow stream generated by the asset is: $PQ - VC - WL$ per year plus the salvage value so the total discounted present value in the active case is:

$$\begin{aligned} V &:= (PQ - VC - WL)a(n, r) + \frac{S}{(1+r)^n} = (RK + \pi)a(n, r) + \frac{S}{(1+r)^n} \\ &= \left(RKa(n, r) + \frac{S}{(1+r)^n}\right) + \pi a(n, r) = C + V_0 \end{aligned}$$

This simple example illustrates the capitalized value of the capital asset formula that is behind the valuation formulas for valuing the shares in a corporation.

> There, in valuing any specific machine, we discount at the market rate of interest the stream of cash receipts generated by the machine, plus any scrap or terminal value of the machine, and minus the stream of cash outlays for direct labor, materials, repairs, and capital additions. The same approach, of course, can also be applied to the firm as a whole, which may be thought of in this context as simply a large, composite machine. [15, p. 415]

Thus we see that Miller and Modigliani use the same (active case) capitalized value of the capital asset, i.e. the 'specific machine', since those net cash receipts are $(PQ - VC - WL)$ and the terminal value is S all discounted back to present value at the interest rate to give V. That is a standard formula for the capitalized value of a capital asset. As John Maynard Keynes put it:

> When a man buys an investment or capital-asset, he purchases the right to the series of prospective returns, which he expects to obtain from selling its output, after deducting the running expenses of obtaining that output, during the life of the asset. [Keynes 1936, 135]

2.3. Analysis of the standard valuation formulas

The same formula is applied to a corporation as a 'large, composite machine'. Then the net value of the 'machine' C is replaced by the *Net Asset Value* (NAV) of the corporation's assets and liabilities, e.g. on the year-end balance sheet of the corporation. The discounted present value of the future pure profits, i.e. V_0 in the model, is usually called the *Goodwill*. The usage of the word 'goodwill' to describe 'intangible assets' such as 'reputation' do not add to the capitalized valuation of the corporation unless they add to future profits. Hence the valuation formula $V = C + V_0$ is the 'NAV + Goodwill' version of the formula for V.

The valuation formula $V = (PQ - VC - WL)a(n, r) + \frac{S}{(1+r)^n}$ is the *discounted future cashflow* version of the valuation formula that is essentially used in cookbook versions by practicing business valuators. Thus we have the equivalence between two different ways to express the standard 'fair market valuation' of a corporation in our simple model:

Discounted Cashflow Valuation = Net Asset Value + Goodwill Valuation

The NAV + Goodwill formula is particularly important because it parses V into the actual owned assets and owed liabilities of the corporation NAV plus the anticipated or expected market contracts that the company 'expects to obtain' in the future (see (Ellerman 2008 Ellerman 2021, Chapter 3). But the corporation has no present property rights to force the customers to buy the outputs for PQ or the suppliers to supply the inputs and labor for $VC + WL$. Future expectations, no matter how carefully extrapolated from past data, are not present property rights. That seems to be the underlying reason why U.S. or international accounting standards do not allow ('internally generated') goodwill to be listed on the company's balance sheet as an owned asset.

This parsing of the 'fair market valuation' between actual assets and liabilities NAV plus anticipated or expected future assets and liabilities V_0 is behind an important distinction in the debates about corporate governance. If we abstract away all the future market contracts with customers and suppliers from a corporation operating as a going-concern (the active case), then we are left with the bare-corporation holding the actual assets and liabilities with the NAV valuation (the passive case). Some commentators have suggested the term 'firm' to denote the corporation embedded in the market relationships as opposed to the (bare) corporation itself, e.g. 'the firm – the organization built via contracts transferring control over resources to the corporations used to legally structure the firm' [Robé 2011, 4]. This difference between the (market-embedded) firm and the (bare) corporation is the anticipated future contracts with customers and suppliers to which the corporation has no present property rights. Hence, there is no present 'ownership of the *firm*' (Ellerman 1975), only the ownership of the (conventional bare) corporation by the current shareholders.

3. Property rights versus personal rights

In a conventional corporation, the owners (shareholders) are the claimants of the residual after all liabilities are met, i.e. the 'residual claimants'. But other types of corporations such as worker cooperatives, e.g. the Mondragon cooperatives (Whyte and King Whyte 1991), have residual claimancy determined in another manner. To understand the difference, we need to separate personal rights from property rights.

A *personal right* is attached to a person because they qualify for it by having a certain functional role. For instance, certain persons qualify for citizenship in a country (e.g. by being born there) or qualify to vote in city or town elections by being a citizen residing in the town or city. Personal rights defined by a certain qualifying role may not be bought or sold since the buyer may not have the qualifying role and would not need to buy the rights if they had the qualifications. By the same token, personal rights may not be bequeathed or inherited; the rights die with the person. Voting rights that are held as

personal rights are always one-person/one-vote since either the person qualifies or doesn't; there are no multiple qualifications.

A *property right* is a right that a person may have independent of any qualifications and in any quantity. Property rights are, in general, transferable by purchase and sale, by gift or by inheritance. The voting rights attached to common shares in a conventional corporation are property rights that may be held in any quantity.

How is residual claimancy determined in different business organizations? In a cooperative corporation, residual claimancy is a personal right based on the qualifying role called 'patronage' in the cooperative, e.g. working in a worker cooperative, purchasing in a consumer cooperative, banking in a credit union, and so forth. When residual claimancy is a personal right instead of a property right, then those persons are not properly called 'owners' since their rights do not have characteristics of property rights. They are typically called 'members' although shareholders in a conventional corporation are sometimes called 'members', e.g. 'the terms "shareholders" and "members" may be used interchangeably' [Hannigan 2012, 304]. One way to conceptualize the conventional corporation is to think of it as a 'cooperative' where there is no patronage requirement, the zero-patronage cooperative, so the residual claimancy rights become free-floating property rights.

A share in a partnership is quite unlike a corporate share; it is not a free-floating property right that may be bought and sold. A share in a partnership is more akin to a personal right since a partner needs to qualify by working in the partnership and being accepted by the partners – although there may be some hybrid characteristics such as unequal voting powers.

4. Why 'fair market valuations' do not apply to cooperatives, ESOPs or partnerships

4.1. ESOPs and worker cooperatives

Membership in a worker cooperative as well as other cooperatives is a personal right based on patronage in the cooperative. Employee Stock Ownership Plans (ESOPs) are sometimes billed as 'turning workers into capitalists' (Kelso and Hetter 1967) but the actual structure of the ESOP transaction is quite different. In the U.S. ESOP, there is a special type of pension trust associated with a company. All the employees of the company are automatically qualified to be members or beneficiaries of the trust *based on their qualifying role of employment* (usually beyond a probationary period) in the company. And being a member of the trust means the employees have an internal capital account (ICA) with a certain number of shares attributed to them. When the company makes a tax-deductible ESOP contribution to the ESOP to pay for the shares sold by shareholders (e.g. a retiring owner), then the paid-for shares are allocated to the members' ICA based on their labor as measured by their pay. Hence being a member in the ESOP and the distribution of the value of ESOP contributions within the ESOP are both based on the person's qualifying role as an employee in the company. Therefore, those are personal rights and, accordingly, the shares 'in' an employee's ICA cannot be sold, gifted, mortgaged or bequeathed. And when an employee exits the qualifying role of

working in the company, then their membership in the ESOP is also terminated. These are all the characteristics of personal rights.

The ESOP way for employees to get (indirect) ownership of company shares should be contrasted with the Employee Share Purchase Plans (ESPPs) where the employees buy shares from the company or other shareholders by paying for them out of payroll (often with discounts on company-supplied shares or company contributions). Aside from the discounts, that is basically an ordinary exchange of property rights like any other purchase and sale of company shares by outsiders.

Worker cooperatives (Ellerman and Gonza 2024) are an even simpler example of workers getting membership (i.e. voting and residual claimancy rights) as personal rights based on their qualifying role of patronage, i.e. working in the cooperative (usually beyond a probationary period).

In both ESOPs and worker cooperatives, the people working in the company get membership including their residual claimants status as personal rights based on them currently working in the company.

Hence, in the application of the standard 'fair market valuation' of the ESOP shares or worker cooperative memberships, the current members (qua *current* members) are not the residual claimants in the future time periods since the residual claimancy is then held by the *future* worker-members in the enterprise. In the formulas of our simple model, the future net cashflow $PQ - VC - WL$ is not assigned to the current members but to the future members of those firms in those future time periods. In other words, the future members are not the employees (with the capped claims WL) of the current members. Hence, the valuation of the shares in an ESOP by the standard discounted cashflow method is inappropriate. And, of course, the same holds if the standard valuation methods were (mis)applied to value 'membership shares' in a worker cooperative.

Since the standard valuation methods produce the value $V = NAV + Goodwill$, our analysis shows that the future profits, with the discounted value of $V_0 = Goodwill$, will be claimed in an ESOP or worker cooperative by the future members, so the net value held by the current members is the NAV, the net asset value as shown on the company's balance sheet.

When an ESOP is being first set up, the seller of shares in a non-public company may want a market valuation since they have the alternative of selling to other buyers. But once shares are inside the one-way trapdoor of the ESOP, those indirect owners get their shares as personal rights based on the role of being an employee in the underlying company, so the usual 'fair market valuation' is inappropriate. However, the current law for U.S. ESOPs in privately held companies requires an expensive annual valuation by standard methods. This regulation is not only expensive but inappropriate. No additional valuation or expense is required to extract the NAV from the company's year-end balance sheet. For an exiting or retiring employee, the company is legally required to repurchase the shares in the employee's ICA with this inflated and inappropriate market valuation. This seems to be one of the contributing factors to the number of ESOP sellouts necessary to meet their repurchase liability.

When the company makes an ESOP contribution to the ESOP to be passed through to pay off the credits to buy the shares, the principal portion of the loan payments is distributed between the member ICAs in accordance with their labor, not the number of shares already in the ICAs. But when the shares are revalued, either according to the

external market valuation or the increase in *NAV*, then that value is distributed between the share-denominated ICAs in accordance with the number of shares in the accounts, not according to the labor (however measured) of the account-holders.

This raises the question of share-denominated ICAs as in the U.S. ESOPs or value-denominated ICAs as in Mondragon-type worker cooperatives. In the Employee Ownership Trusts (EOTs) in the United Kingdom, there are no individual capital accounts, only collective ownership, so the question is moot. In Canada, legislation was passed for EOTs which follows the UK model except that it allows EOTs with ICAs. The first ESOP legislation (with mandatory ICAs) outside of the United States was recently (October 2025) passed in Slovenia. In that modified ESOP model, called the Coop-ESOP (Ellerman, Gonza, and Berkopec 2022) or EurESOP, it is recommended that the ICAs be value-denominated so the increases (or decreases) in *NAV* each year would be distributed between the ICAs in accordance with the labor of the members. Then, no further annual market valuations are needed – in addition to not being appropriate.

4.2. Partnerships

The residual claimants in a partnership are the partners. Since being a partner is essentially a personal right, the same arguments about the market valuation of shares in a partnership apply, *mutatis mutandis*, to partnerships. Moreover, partnerships have ICAs which are called 'partner capital accounts' or 'equity accounts'. The name 'equity accounts' is a bit of a misnomer since a party with more equity would have more votes and a larger share of the residual, but neither voting power nor shares in the net income are related to the size of the Partner Capital Accounts (PCAs).[2] The PCAs, like the ICAs in a worker cooperative, are really a subordinate form of debt no matter where accounting practice places them on the balance sheet.

When a new partner enters a partnership, they will typically make a capital contribution. The net value of the contribution (which could be a proprietorship with both assets and liabilities folded into the partnership), is added to the new partner's PCA. Each year the partner's share in the net income (as specified in the partnership agreement) is added to their PCA and any cash withdrawals are subtracted from the PCA.

When a partner retires or otherwise exits the partnership, then the terminal value in their PCA is the amount owed to them (usually with interest). Problems arise, however, when share-based reasoning enters into the matter. An exiting partner may think of their share in the partnership as being like a corporate share or the partnership may be legally structured as some variation on a limited liability corporation with shares. The exiting partner may argue that the 'name' (i.e. reputation) was little-known when they entered but is now a well-known entity so they should be paid for this increase in 'goodwill'. But the future partners, who would be paying the exiting partner for this 'goodwill', as in the standard market valuation, are residual claimants in their own right and thus do not need to buy those rights from the current partner (including the exiting one). Again, it is thus inappropriate to treat the future partners as having only the capped returns (e.g. *WL*) as if the future residual rights were owned by the current partners and as is assumed in the standard cashflow 'fair market' valuations.

> In such circumstances it is relatively easy for partners to move in and out of the ranks. The 'naked out' part of this means that a retiring partner does not realise a capital return for goodwill built up over time. What the partner gets is a share of profits over the time he or she was a partner. This business model can stand the test of time. There are no distracting discussions on what 'my equity' is worth and 'how will I get paid that increase in value'? (Fieldfisher 2015)

Thus the exiting partner goes out with the payout of their PCA representing the retained (i.e. not withdrawn) 'share of profits over the time he or she was a partner' but is 'naked out' concerning any additional payment for 'goodwill built up over time'.

5. Remarks on some related issues

The analysis given here applies to shares in an ESOP and to partnership shares. But prior to the establishment of an ESOP, there is the question of how the seller of shares potentially to the ESOP might value their shares. The analysis does not apply to that question since the seller has the option of selling in a market transaction where the buyer would be treating the future workers in the enterprise as just employees so a valuation method incorporating that assumption would not be inappropriate.

What should an ESOP law in the U.S. or elsewhere say? The analysis implies that the shares in an ESOP should be marked to Net Asset Value (NAV) as specified on the balance sheet of the associated company. The acquired shares are an asset of the ESOP so if they were purchased at a premium over NAV, then they should be marked down to NAV. The Individual Capital Accounts (ICAs) in an ESOP should be viewed as a form of subordinate debt of the ESOP to the employee-members. There should be another true equity residual account such as a Collective Account that is not individuated. On the Liability and Equity side of the ESOP's balance sheet, the markdown should be debited to that residual equity account. After the ESOP is established, the analysis given here implies that any market valuation of the shares in the ESOP is inappropriate (in addition to being costly). It is not a matter of doing a market valuation but then applying a non-marketable discount on the shares. Instead, the shares should be marked to NAV which incurs no cost since the NAV is available on the company's balance sheet. This would require a major change in U.S. ESOP law.

The point that the future ESOP members are not the employees of the current ESOP members is independent of the degree of the ESOP's ownership of the company. It is to be expected that in a profitable company (i.e. positive goodwill), the external market valuation of the shares in the ESOP will be higher than the internal valuation at NAV and the same holds in a partnership. That is, it will typically be profitable to treat the future ESOP members or future partners as being employees of the current members/partners instead of being residual claimants in their own rights. In those circumstances, it will always be profitable for the current members of an ESOP to terminate the ESOP in a sellout. That is, the market valuation (as currently required in the US ESOP) is a sellout valuation – which is among several factors leading to many ESOP terminations in America.

This is not a new discovery. It is only a new technical perspective on an old factoid about ordinary human proclivities. In the old debate about why there are not more employee-owned firms, the rather obvious answer was expressed in the "founders'

decision". When one or more people found and co-own a new firm, they face the founders' decision about whether to treat all the later people to work in the company as co-owners or just as employees.

There is even a political version of the fact pattern. After a revolution, the leaders of the revolution face the decision to form a democracy where they would at best hold only delegated power and at worst be voted out – or would they form a new autocracy. For instance, America became a democratic republic because George Washington resisted the efforts of his officer corps to be an aristocracy with Washington as monarch and he followed the example of Cincinnatus by returning to his farm (Wills 1984).

The alternative to market valuation is individual capital accounts (ICAs) in some ESOPs and worker cooperatives or partner capital accounts (PCAs) in partnerships. These ICAs keep track of the value that should ultimately be returned to the account-holder. For example, in a partnership, a new partner may initiate their PCA with a substantial contribution and then at the end of each fiscal year, the partner's share of the profit is credited to their PCA and their cash withdrawals are subtracted from their PCA. In the world of worker cooperatives, the use of ICAs seems to have been pioneered by the Mondragon cooperatives (Whyte and King Whyte 1991). In American agricultural, producer and marketing cooperatives, there has long been the practice of having 'written notices of patronage allocations' for patronage dividends that were not paid out in cash (Zeuli and Cropp 2004). Thus one might think of the accumulation of a member's written notices as their ICA. But the overt introduction of ICAs in American worker cooperatives started in the late 1970's with the Model Bylaws of the Industrial Cooperative Association in Boston following the Mondragon example (Industrial Cooperative Association 1983).

The logic of these ICAs was identical to that of partnership capital accounts. There might be an initial (and usually nominal) 'membership fee' as the initial balance in a member's ICA. The residual claim of the cooperative members was to the value added, i.e. the revenues minus the non-labor costs. Part of the value-added is paid out in wages during the year – which Mondragon called 'advances' on a member's share of the value-added. At the end of each fiscal year, some profits are retained (or are already retained by net investments during the year) and there might be some cash distribution of profits. The division between members is based on their 'patronage' which is usually measured by their annual wages or salaries. Each member's share of the *retained* profit is added to their ICA. If losses were made, then the proportionate share is subtracted from their ICA. Thus each member shares in the *realised* profits made by the cooperative. Since there is no valuation by the conventional methods, there is no imputation to the member ICAs of the discounted present value of anticipated future profits – since those would be earned by the future members of the cooperative. And since the ICAs are essentially a form of subordinate debt to members, the ICAs should bear interest.

If we compare these ICAs in the Mondragon-type worker cooperatives and the ICAs in the U.S. ESOPs updated each year with market valuations, then both accounts go up with the realised profits that are retained in the company. The difference is that the Mondragon-type ICAs do not incorporate any discounted present value of expected future profits while the inappropriate market valuations used to update the U.S. ESOP ICAs involve some such estimates. The problem is not that the future profits are uncertain. The problem is that for both Mondragon-type worker cooperatives and

ESOPs, the future members are not employees of the current members but are residual claimants of those profits realised in the future.

6. Conclusion

The standard discounted cashflow method of valuation treats the (pure) profit rights in future time periods as the property rights of the current shareholders in a corporation. Of course, the size of future residual profits is uncertain and the contractual behavior of future suppliers and customers is not 'owned' by the current shareholders. But that is not our main point. Our argument is that in certain legal organizations such as worker cooperatives, ESOPs and partnerships, the future profit rights are not owned by the *current* residual claimants. Those future residual rights are held as personal rights by the future members of the cooperative, ESOP or partnership. Hence, the usual discounted cashflow valuation methods are inappropriate and wrong for those business organizations.

Notes

1. One is reminded of Upton Sinclair's famous quip: "It is difficult to get a man to understand something when his salary depends upon his not understanding it'.
2. See any accounting text with a chapter on partnership accounting such as (Warren, Reeve, and Duchac 2007) or (Wild and Shaw 2019), or simply do an internet search on "partner capital accounts".
3. This proof was first published in Chapter 12 of (Ellerman 1982).

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ORCID

David Ellerman http://orcid.org/0000-0002-5718-618X

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Appendix the Miller-Modigliani model for valuations

Introduction

In Miller and Modigliani's seminal (and Nobel Prize winning) paper (Miller and Modigliani 1961), they derived four formulas for the fair market value of a corporation and proved that the four formulas were equivalent:

(1) the discounted cashflow approach,
(2) the current earnings plus future investment opportunities approach,
(3) the stream of dividends approach, and
(4) the stream of earnings approach.

None of the approaches parsed the value into the value of the current owned net assets plus the property the corporation expected to appropriate in the future, i.e. the NAV + goodwill approach.

Our purpose in this appendix is to prove the equivalence of that fifth approach with the discounted cashflow approach and thus the equivalence of all five approaches. We start with the stream of dividends approach to establish notation.

The balance sheet accounts of *Gross Asset Value* $GAV(t)$, the *Debt* $D(t)$ and the *Net Asset Value* $NAV(t)$ are *stock* variables that represent a value at a point in time t so the *balance sheet equation* at time t is:

$$GAV(t) = D(t) + NAV(t).$$

Other accounts such as the income statement accounts or cashflow statement accounts are *flow* variables that represent the change in the value of a stock variable. That change in the value of a stock variable is represented by a lower case d in front of the stock variable: $dGAV(t) = GAV(t+1) - GAV(t)$ and $dNAV(t) = NAV(t+1) - NAV(t)$. In our previous simplified model, we assumed that the fixed assets or 'machine' had a constant market value C, i.e. no depreciation, and then died after n years with salvage value S. Miller and Modigliani (MM) make the more realistic assumption that there is the market value $C(m)$ for a vintage m machine, i.e. a machine in use for m years. Thus the *depreciation* in a year is $C(m-1) - C(m)$.

MM assume only simple common shares in the corporation where:

- $n(t)$ = number of shares outstanding at time t,
- $v(t)$ = price per share at time t,
- $V(t) = n(t)v(t)$ = value of all outstanding shares at time t = value of the corporation at time t,
- $div(t)$ = dividends per share at time $t+1$ to shareholders at time t, and
- $Div(t) = n(t)div(t)$ = total dividends paid at time $t+1$.

The stream-of-dividends formula

The formulas for $V(t)$, the value of the corporation, were developed in the MM framework where arbitrage under conditions of perfect competition and assumed certainty, capital must be paid the same rate of return whether it is loaned out at interest or invested in corporate shares.

On one share at value $v(t)$ at time t, the end-of-period return is the dividends $div(t)$ plus the capital gains $v(t+1) - v(t)$. If that amount of money was loaned out at interest r, then the return is $rv(t)$. If the returns are unequal, then arbitrage under the assumed conditions will equalize the return to yield the *arbitrage equation*:

$$rv(t) = div(t) + v(t+1) - v(t).$$

Thus $v(t) = \frac{div(t)+v(t+1)}{1+r}$ so multiplying through by $n(t)$ yields:

$$V(t) = \frac{n(t)[div(t) + v(t+1)]}{1+r}.$$

To obtain the stream-of-dividends formula for $V(t)$, we use the arbitrage equation to expand the $v(t+1)$ term to obtain:

$$V(t) = \frac{n(t)div(t)}{1+r} + \frac{n(t)div(t+1)}{(1+r)^2} + \frac{n(t)v(t+2)}{(1+r)^2}.$$

Then repeating this use of the arbitrage equation yields the *stream-of-dividends formula*:

$$V(t) = \sum_{k=1}^{\infty} \frac{n(t)div(t+k-1)}{(1+r)^k}.$$

Thus the value of the corporation at time t is the discounted present value of the stream of dividends 'that accrues to the shares of record as of the start of period t'[15, p. 419], see also [Fama and Merton 1972, 87, formuila 2.19b]. The shares in a conventional corporation include the residual claimant rights, so the additional future residual claimants, i.e. owners of new shares purchased as property rights after time t, do not add to the value of the shares held at time t.

The usual cookbook valuation formulas as well as the MM formulas all assume that the corporate assets are used as in the active case. If instead we consider the *passive* use of the corporate assets by lending out the Gross Asset Value $GAV(t)$ at the interest rate r, then the gross return is $rGAV(t)$ so after paying the interest on the debt $D(t)$, the net return is: $r[GAV(t) - D(t)] = rNAV(t)$. To compute the discounted present value of the steady infinite stream of values $rNAV(t)$, we need to prove $\sum_{t=1}^{\infty} \frac{r}{(1+r)^t} = 1$ which is the present value of one dollar loaned out at the interest rate r. For $X := \sum_{k=1}^{\infty} \frac{r}{(1+r)^k}$, if we multiply through by $1+r$, then $(1+r)X = \sum_{k=1}^{\infty} \frac{r(1+r)}{(1+r)^k} = \sum_{k=1}^{\infty} \frac{r}{(1+r)^{k-1}} = r + X$ so solving for X yields: $rX = r$ or $X = 1$. Thus we have:

$$\sum_{k=1}^{\infty} \frac{rNAV(t)}{(1+r)^k} = NAV(t).$$

This is the MM version of our previous result in the simple model that the value of the machine *in the passive case* is C.

The discounted cashflow formula

Let $A(t)$ be the net accounting profit at time t (all cash transactions) so $A(t) = \mathcal{R}(t) - COGS(t) - Depr(t)$ where $\mathcal{R}(t)$ is the cash revenue, $COGS(t)$ is the costs of goods sold (including labor and debt interest) and $Depr(t)$ is the depreciation for the time period. Hence $A(t) + Depr(t) - DIV(t)$ is the cash available from operations for the gross investment $I(t) + Depr(t)$ where $I(t)$ is the net investment during the time period. The rest of the planned investment $I(t) + Depr(t)$ has to come from issuing $m(t+1)$ new shares at the price $v(t+1)$ per share for a total subscription $Sub(t+1) := m(t+1)v(t+1)$. Hence we have the equation:

$$Sub(t+1) = I(t) + Depr(t) - [A(t) + Depr(t) - DIV(t)] = I(t) - [A(t) - DIV(t)].$$

The total value of the corporation $V(t+1)$ is the total value of the old shares plus the subscription of new shares so:

$$V(t+1) = n(t)v(t+1) + Sub(t+1).$$

This can then be plugged into the previous equation and simplified:

$$V(t) = \frac{n(t)[div(t) + v(t+1)]}{1+r} = \frac{1}{1+r}[DIV\ (t) + V(t+1) - Sub(t+1)]$$

$$= \frac{1}{1+r}[DIV(t) + V(t+1) - \{I(t) - [A(t) - DIV(t)]\}].$$

Then the two $DIV(t)$ terms cancel out – which is the basis for MM's famous 'dividend irrelevance' thesis. The resulting formula is:

$$V(t) = \frac{1}{1+r}[A(t) - I(t) + V(t+1)].$$

Then by making the repeated substitutions for the $V(t+1)$, we have the formula:

$$V(t) = \sum_{k=1}^{\infty} \frac{1}{(1+r)^k}[A(t+k-1) - I(t+k-1)].$$

The *cash receipts* $\mathcal{R}(t)$ are the net accounting profits $A(t)$ plus the depreciation $Depr(t)$ and costs of goods sold $COGS(t)$ so: $\mathcal{R}(t) = A(t) + Depr(t) + COGS(t)$. The *cash outlays* are $\mathcal{O}(t) = I(t) + Depr(t) + COGS(t)$ so the $Depr(t) + COGS(t)$ terms cancel and we have the *discounted cashflow formula*:

$$V(t) = \sum_{k=1}^{\infty} \frac{1}{(1+r)^k}[\mathcal{R}(t+k-1) - \mathcal{O}(t+k-1)].$$

The NAV + goodwill formula

The net asset value $NAV(t+1)$ is the previous net asset value $NAV(T)$ minus the depreciation $Depr(t)$ plus the gross investment $I(t) + Depr(t)$ so the depreciation terms cancel in $dNAV(t) = NAV(t+1) - NAV(t) = I(t)$. Hence substituting into $V(t) = \sum_{k=1}^{\infty} \frac{1}{(1+r)^k}[A(t+k-1) - I(t+k-1)]$, we have the formula:

$$V(t) = \sum_{k=1}^{\infty} \frac{1}{(1+r)^k}[A(t+k-1) - dNAV(t+k-1)].$$

The *economic or pure profit* $\pi(t+k-1)$ is the accounting profit $A(t+k-1)$ minus the implicit interest cost of tying up the capital $NAV(t+k-1)$ for the time period so:

$$\pi(t+k-1) := A(t+k-1) - rNAV(t+k-1).$$

The *goodwill* $GW(t)$ is defined as the discounted present value of the future pure profit so the goodwill at time t is:

$$GW(t) := \sum_{k=1}^{\infty} \frac{1}{(1+r)^k}\pi(t+k-1) = \sum_{k=1}^{\infty} \frac{1}{(1+r)^k}[A(t+k-1) - rNAV(t+k-1)].$$

Then

$$NAV(t+k-1) = NAV(t) + dNAV(t) + dNAV(t+1) + \ldots + dNAV(t+k-2)$$
$$= NAV(t) + \sum_{j=0}^{k-2} dNAV(t+j)$$

where the sum $\sum_{j=0}^{k-2} dNAV(t+j)$ only begins for $k = 2, 3, \ldots$ so substituting into the formula for $\pi(t+k-1)$ gives:

$\pi(t+k-1) = A(t+k-1) - rNAV(t) - r\sum_{j=0}^{k-2} dNAV(t+j)$ for $k = 2, 3, \ldots$.

Using the identity $\sum_{k=1}^{\infty}\frac{r}{(1+r)^k}=1$, $\sum_{k=1}^{\infty}\frac{1}{(1+r)^k}rNAV(t)=NAV(t)$ in sum for $GW(t)$. The tricky part is the double-sum term in $GW(t)$:

$\sum_{k=2}^{\infty}\frac{1}{(1+r)^k}r\sum_{j=0}^{k-2}dNAV(t+j)$. The way to attack it is to pick out all the occurrences of $dNAV(t)$, $dNAV(t+1)$, …. For instance, the $dNAV(t)$ occurs with $j=0$ for $k=2,\ldots$ so the sum of those terms is:

$$\sum_{k=2}^{\infty}\frac{r}{(1+r)^k}dNAV(t)=\sum_{k=1}^{\infty}\frac{r}{(1+r)^k}\frac{dNAV(t)}{(1+r)}=\frac{dNAV(t)}{(1+r)}.$$

Similarly, the term $dNAV(t+1)$ occurs with $j=1$ for $k=3,\ldots$ so the sum of those terms is:

$$\sum_{k=3}^{\infty}\frac{r}{(1+r)^k}dNAV(t+1)=\sum_{k=1}^{\infty}\frac{r}{(1+r)^k}\frac{dNAV(t+1)}{(1+r)^2}=\frac{dNAV(t+1)}{(1+r)^2}.$$

The general term $dNAV(t+T-1)$ occurs with $j=T-1$ for general $k=T+1,\ldots$ so the sum of those terms is:

$$\sum_{k=T+1}^{\infty}\frac{r}{(1+r)^k}dNAV(t+T-1)=\sum_{k=1}^{\infty}\frac{r}{(1+r)^k}\frac{dNAV(t+T-1)}{(1+r)^T}=\frac{dNAV(t+T-1)}{(1+r)^T}.$$

Finally, the double sum in $GW(t)$ is:

$$\sum_{k=2}^{\infty}\frac{1}{(1+r)^k}r\sum_{j=0}^{k-2}dNAV(t+j)=\sum_{k=1}^{\infty}\frac{dNAV(t+k-1)}{(1+r)^k}=\sum_{k=1}^{\infty}\frac{I(t+k-1)}{(1+r)^k}.$$

Collecting terms, we have:

$$GW(t)=\sum_{k=1}^{\infty}\frac{A(t+k-1)}{(1+r)^k}-NAV(t)-\sum_{k=1}^{\infty}\frac{dNAV(t+k-1)}{(1+r)^k}$$

so moving the $NAV(t)$ term to the other side, we have the *NAV + Goodwill formula*[3] for the value of the corporation at time t:

$$NAV(t)+GW(t)=\sum_{k=1}^{\infty}\frac{1}{(1+r)^k}[A(t+k-1)-I(t+k-1))]$$

$$=\sum_{k=1}^{\infty}\frac{1}{(1+r)^k}[\mathcal{R}(t+k-1)-\mathcal{O}(t+k-1)]=V(t).$$

MM give four equivalent formulas for $V(t)$ and this is a fifth equivalent formula (see also (Edey 1962) where the pure profits are called 'super profits'). Moreover, it is the only formula that parses the property rights into the actual net property rights at time t, namely $NAV(t)$, plus the discounted present value of the expected property rights appropriated in the active case in the future time periods. MM assume in their idealized model that the future values are known with certainty (so they don't have to consider risk-adjusted discount rates), but such an assumption does not change the legal fact that the present corporation at t does not have legally enforceable contracts with all future suppliers or customers, i.e. no present property rights to future *pure* profits. The future claims from the net property owned by the corporation at prior times is recognized by the $rNAV(t+k-1)$ term subtracted from the accounting profits $A(t+k-1)$ to get the pure profits $\pi(t+k-1)$.

Our main point is that the shareholders at time t do not own the future pure profits that will accrue to the residual claimants at all those future time periods.

In spite of the complications in the proof of the NAV(t) + Goodwill formula, there is a certain logic to the formula. The value $NAV(t)$ is owned by the shareholders at time t. In

each future time period, the net accounting profit $A(t+k-1)$ is the value created during that time period after subtracting explicit expenses and depreciation but it does not subtract the implicit cost $rNAV(t+k-1)$ of tying up that capital for the time period so it is really the pure or economic profit $\pi(t+k-1) = A(t+k-1) - rNAV(t+k-1)$ that represents the *new* value created in the time period. The discounted present value of those new values is the goodwill so the total value creation in the active case is $NAV(t) + GW(t) = V(t)$. In an ESOP, worker cooperative or partnership, those future new values accrue to the then future residual claimants so the proper value accruing to the current residual claimants is $NAV(t)$. Hence, the standard 'fair market valuation', obtained either using shorthand cookbook formulas or using the full MM framework formulas is inappropriate for those types of firms.