The Debate Over the Depreciation of Intangible Capital

Andrew Smithers

Key Points

- Spending on intellectual property (IP) is classed in national income accounts (NIA) as investment and represents a proportion of total investment as measured. It is, however, rapidly depreciated so that it has only a minor impact on gross domestic product (GDP).
- Some economists argue that the amount of such spending is being understated and the depreciation rate overstated. If these claims were correct, they would result in large increases in the measured levels of gross and net output and reduce the share taken by labour incomes.
- If correct the resulting changes would also be important for economic theories. Current data show that the labour share of output is mean-reverting, thus supporting the Cobb-Douglas production function, and that *q*'s mean reversion results from changes in share prices. The suggested revisions to the data would undermine both.
- These claims require an increase in profits after depreciation in the NIA. However, they cannot be correct because independently generated data on equity returns to shareholders show that profits are already overstated. Profits need to be reduced rather than increased.
- The change made to NIA in 2013, by the inclusion of IP expenditure as investment, has led to widespread misunderstanding about the economy and should be reconsidered.

Changing the Measurement of Investment, Income and Output

Both corporate and national income accounts (NIA) distinguish between investment and consumption and include in their capital stock data the accumulation of past investment that has not been scrapped, measured by its current value. In both the UK and the USA, the definition of investment was previously confined to the accumulation of tangible assets. This was first modified by the inclusion of expenditure on software, and more fundamentally in 2013 when the measurement of the investment and the capital stock were expanded by including a large amount of other expenditure on intellectual property (IP).

The previous exclusion of intangibles was considered by many to be unsatisfactory because growth seemed to be being underestimated and because the value of intangibles seemed to be largely ignored in corporate assets. Referring to the revolution in information technology it has been remarked that "While its effects are apparent in the marketplace, its manifestation in the macro economic statistics on growth has been slow to materialize".[1] When Stephen Wright and I first showed that the stock market can be valued by reference to the net worth of its constituent companies,[2] many people found this hard to accept as it seemed inconsistent with their understanding of the value of individual companies, which differed widely from their probable net worth. The extra value of those companies, which sold in the stock market at large premiums to the value of their tangible assets, was considered to lie in their goodwill, which reflected various attributes such as brand names, patents, know-how and management skill. Since those that sold at below-average premiums were not judged to have ill will, it was assumed that companies in aggregate must be worth more than their tangible capital.

One approach to solving this apparent dilemma is to assume that inflation is overstated, for example by the failure to include new products early enough in output data for their falling prices to be properly included in price

[1] *Intangible Capital and Economic Growth* by Carol A. Corrado, Charles R. Hulten and Daniel E. Sichel NBER Working Paper 11948.
[2] *Valuing Wall Street: Protecting Wealth in Turbulent Markets* by Andrew Smithers & Stephen Wright McGraw-Hill (2000).

indices or to make inadequate adjustment for quality changes. Another is to treat the cost of IP as being final rather than intermediate expenditure and thus to increase the measured value of gross output ("GDP"). This article is primarily concerned, however, with a third approach which claims that the depreciation applied to IP is too rapid. If correct, this would result in major changes to the capital stock, net output (net domestic product, NDP) and its labour share. (The case against a lower rate of depreciation also renders invalid claims that the level of intangible investment is underrecorded.)

Table 1: Impact on 2018 data of inclusion of intangible spending in investment

Increase in growth of GDP % p.a. over 10 and 20 years	0.05
% Increase in NDP	1.84
% Increase in GDP	5.86
% Increase in total capital stock	8.01
% Increase in business capital stock	15.63
% Increase in total investment	35.88
% Increase in total depreciation	43.28
% Increase in business investment	50.17
% Increase in business depreciation	56.54

Data sources: US Bureau of Economic Analysis (BEA) Fixed Asset Tables 1.1 and 1.3 and National Income and Product Accounts (NIPA) Tables 1.1.5, 1.1.6 and 5.2.5.

In 2013 US national data were significantly altered by the addition to the data on investment of much more IP expenditure than had previously been included, with the revisions being applied to all the years covered dating back to 1929. As Table 1 shows, the size of the impact varies greatly with the measure being considered, varying from the insignificant impacts on NDP and GDP growth, to increases of over 50% in business investment and depreciation. The largest rise is for business depreciation and is the combined result of the rise in intangible investment and the rapid rate at which it is depreciated. In 2018 the depreciation rate for IP was 21.3% of its capital stock compared with 3.9% for tangible capital.

Several economists have questioned this rapid rate of depreciation,[3] and if they are correct the impact on the measurement of net output and the capital stock would no longer be limited but would be of major significance; substantially changing the key data we use to measure the economy and judge its progress. The changes would not only include a much larger figure for net output, but also for the profit and labour shares of output and the size of the capital stock. It would also be important for several economic theories, including the *q*-relationship between the net worth and stock market value of companies and the Miller-Modigliani theorem.

The *q*-relationship

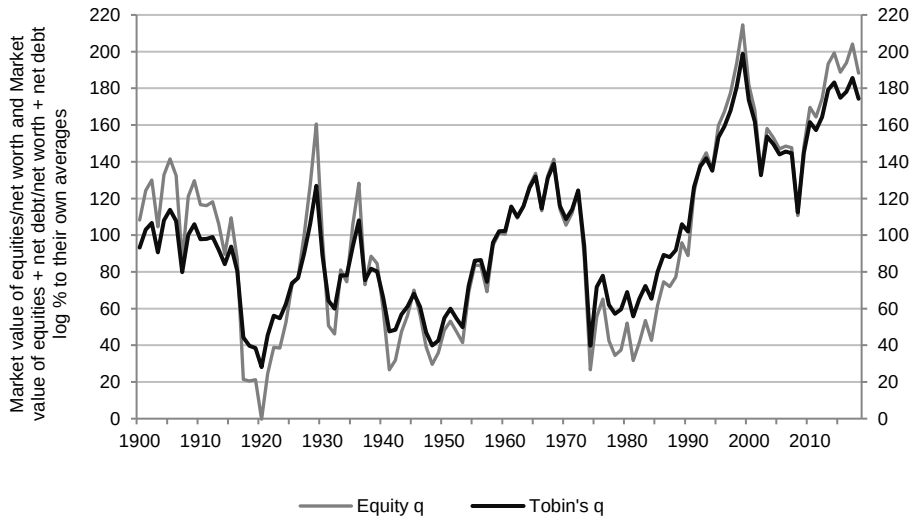
The advocates of a slower rate for IP depreciation have revived interest in James Tobin's general model of the interaction between the real and the financial economy, which has, I think, been unjustly overlooked in recent years despite its many virtues. George Akerlof has recently criticised the neoclassical consensus for oversimplifying Keynes's work by restricting the equilibria needed for a stable economy to one, namely the balance between *ex ante* savings and investment: "Neo-classical supply had resolved that the determination of the price level and assets prices (as the inverse of the interest rate) …"[4] This is not a criticism that can be levied at Tobin,[5] who specifically allows for multiple rates of return for different assets. He assumes that the ratio of stock market value to the second-hand value of the corporate assets, which he termed replacement cost, must be stationary and, if correctly valued, the ratio would be one.

q can be defined in two different ways: equity *q* is the ratio of the equity market value (MV) to corporate equity (net worth) (NW) and Tobin's *q* includes debt in the values for both the stock market (MV+D) and net worth

[3] *Intangible capital and the investment-q relation* by Ryan H. Peters & Lucian A. Taylor Journal of Financial Economics 123 (2017) 251-272. *Investment-less Growth: An Empirical Investigation* by Germán Gutiérrez & Thomas Philippon NBER Working Paper 22897, *The Great Reversal: How America gave up on free markets* by Thomas Philippon Harvard University Press (2019) and *Intangible Capital and Economic Growth* op. cit.
[4] *What They Were Thinking Then: The Consequences for Macroeconomics during the past 60 years* by George Akerlof Journal of Economic Perspectives Volume 33 Number 4 – Fall 2019.
[5] *A General Equilibrium Approach to Monetary Theory* by James Tobin Journal of Money, Credit and Banking Volume 1 No. 1 February 1969.

(NW+D), and can be defined either in terms of interest-bearing debt, net of interest-bearing assets, or, as in Figure 1, in terms of net financial liabilities.

Figure 1: Equity *q* and Tobin's *q*



Data sources: Stephen Wright and Z1 Table B. 103.

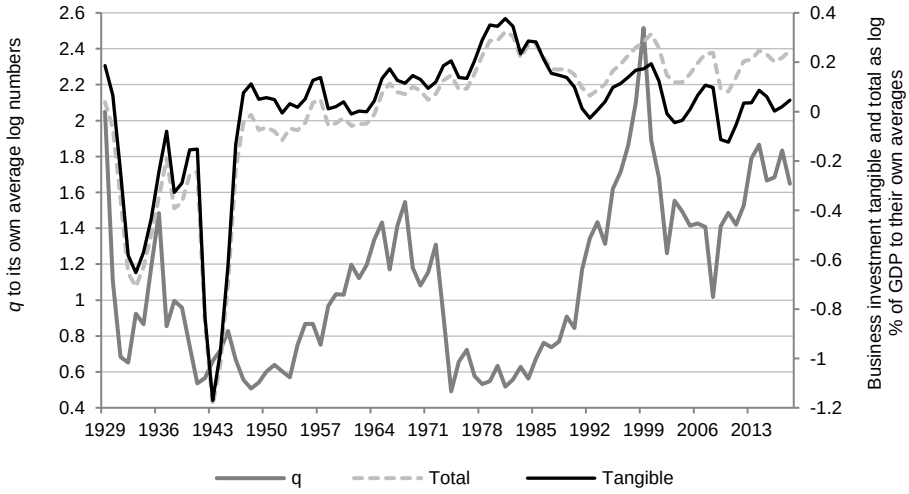
The long-term real returns on equity, for which we have data from 1801 to 2017, are strongly reverting around 6.4% due to their negative serial correlation,[6] and if, as it appears, equity *q* is mean-reverting, the long-term return on corporate equity is stable at that rate. The same cannot then be true also for Tobin's *q*, as interest rates and leverage are not mean-reverting and vary over the long term. The cost of equity thus fluctuates with equity *q*, but the cost of capital diverges from Tobin's *q*. As Tobin allows for different rates of return on different financial assets, there is a strong case that his model is more correctly formulated in terms of equity *q*. However,

[6] See *Building a New Testable Model to Estimate Total Factor Productivity* by Andrew Smithers World Economics Vol. 18 No. 7 (April-June 2017) Figure 3 for the negative serial correlation of real equity returns and Figure 14 for their mean reversion.

as Figure 1 shows, the two measures are too similar for there to be any practical difference from the viewpoint of this discussion whichever definition is used, though from the viewpoint of theory it is important to note that as equity *q* is mean-reverting Tobin's *q* cannot be.

Tobin was not precise about the mechanism that keeps *q* stationary but has been generally assumed to have favoured the idea of net worth responding to share prices rather than share prices to net worth. This interpretation may not be justified as his comment on the issue is qualified. He wrote "If the interest rate on money, as well as on all other financial assets, was flexible and endogenous…there would be no room for discrepancies between market value and reproduction cost. There would be no room for monetary policy to affect aggregate demand. The real economy would call the tune on the financial economy."

Figure 2: US: Business investment as % of GDP and *q*



Data sources: Z1 Table B.103 and NIPA Table 1.1.5.

It is not, however, a necessary condition of the model that the mean reversion arises through the impact of *q* on investment and, prior to these new claims that IP depreciation is overstated, it has been generally agreed that the data show that investment does not rise and fall with the fluctuations of *q* around its mean. It certainly does not do so quickly, if at all, as I illustrate in Figure 2, which compares business investment, both tangible and total, as a percentage of GDP with *q*. Given the negative serial correlation of equity returns and their stable long-term return,[7] the evidence points to share prices adjusting over time to net worth rather than net worth adjusting to share prices via their impact on corporate investment. Those who argue for a slower rate of depreciation appear to accept this. "Tests of the classic *q* theory using physical capital have been disappointing. Investment… is explained poorly by *q* (low R^2), and produces implausibly large adjustment-cost parameters (low *q* -slopes)." [8] The proponents of a reduction in the depreciation rate for expenditure on IP claim that the consequent changes in net worth are compatible with *q* affecting corporate investment.

The Value and Depreciation of Intangibles

An assessment of the impact that results from reducing the rate of depreciation requires a different approach, whether it is corporate or the national income and product accounts (NIPA) that are being considered. Corporate accounts do not normally give any value to past expenditure on R&D, management training or advertising, although they may include goodwill, particularly when assets have been purchased at above their current value through corporate acquisitions. US national accounts, however, include the BEA's estimate of the expenditure on IP.

Those arguing for a lower depreciation rate for intangibles use corporate accounts and must first therefore estimate their value and then assume a rate of depreciation for them.

[7] *See Building a New Testable Model to Estimate Total Factor Productivity*, Figure 3 for negative serial correlations of returns and Figure 4 for their stationarity op. cit.
[8] *Intangible capital and the investment-q relation* op. cit.

> "We measure a firm's in-tangible capital as the sum of its knowledge capital and organization capital. We interpret research and development (R&D) spending as an investment in knowledge capital, and we apply the perpetual-inventory method to a firm's past R&D to measure the replacement cost of its knowledge capital. We similarly interpret a fraction of past selling, general, and administrative (SG&A) spending as an investment in organization capital, which includes human capital, brand, customer relationships, and distribution systems. It is easily computed for all public US firms back to 1975, and it requires only Compustat data and other easily downloaded data."[9]

For national accounts the value of tangible capital assets is measured by the BEA from surveys of second-hand values: as these have fallen over time, their rate of decline is used to assess the rate of depreciation. It has been argued that this overstates the rate of depreciation on the grounds that these values will be determined by lemons,[10] the term used when buyers are imperfectly informed about the quality of the products they are buying and assume that the quality of their individual purchases will be below average. But the BEA claims that this does not apply to their surveys as the second-hand equipment is purchased after thorough investigation and the market does not exhibit asymmetric information. In practice therefore the value that the BEA places on the produced tangible capital stock and the rates of depreciation they derive from it seem soundly based.

The value of intangible assets depends on estimates of their cost and the rate of depreciation assumed, which cannot be ascertained by surveys as the BEA acknowledges.

> "The premise of my model is that business R&D capital depreciates because its contribution to a firm's profit declines over time… Although important, measuring R&D depreciation rates is extremely difficult because both the price and output of R&D capital are generally unobservable. To resolve these difficulties, economists have adopted various approaches to estimate industry-specific R&D

[9] *Intangible capital and the investment-q relation* op. cit.
[10] *The Market for Lemons* by George Akerlof Quarterly Journal of Economics (August 1970).

> depreciation rates, but the differences in their results cannot easily be reconciled. In addition, many of their calculations rely on unverifiable assumptions."[11]

Estimates of value which are unverifiable and unreconcilable are, to put it mildly, questionable. The BEA is thus in effect acknowledging that its estimate of the rate at which R&D depreciates, which is based on assumptions about the return on it, are difficult to justify.

Those claiming that this approach causes the speed at which the value of intangibles falls to be too rapid, apply the same rate of depreciation to both tangible and intangible capital: "both types of capital depreciate at the same rate δ".[12] The result is a very large increase in the intangible and total capital of US corporations: "we define intangible intensity as a firm's ratio of intangible to total capital, at replacement cost. The mean (median) intangible intensity is 43% (45%), so almost half of capital is intangible in our typical firm-year."[13]

Testing Against Returns

Corporate net worth is the sum of past retained profits. For the net worth of corporations to be higher than that currently attributed to them past profits must have been higher than those previously recorded. As this does not change share prices it will raise the long-term average earnings' yield (earnings per share × 100 ÷ share price). We have data on earnings per share (EPS) from 1871 to 2018 and the average earnings' yield over the period was 7.35% (arithmetic) and 7.19% (geometric). These are above the real return on equities over the period of 6.6% and, as the stock market was significantly overvalued, they are even further above the probable average long-term return of 6.4%, which allows for the market's overvaluation at the end of 2018.[14]

---

[11] *Depreciation of Business R&D Capital* by Wendy C.Y. Li U.S. Bureau of Economic Analysis October 2012.
[12] *Intangible capital and the investment-q relation* op. cit.
[13] Section 2 and Section 3.5 of *Intangible capital and the investment-q relation* op. cit.
[14] See also Profits are Overstated (Chapter 17) of *Wall Street Revalued: Imperfect Markets and Inept Central Bankers* by Andrew Smithers John Wiley & Sons (2009).

Table 2: Comparison between implied and observed growth in US quoted company dividends 1871 to 2018

Average ratio of retained to published profits (A)	38.90%
Real returns to investors should equal average earnings' yield (measured over the next 12 months) (B)	7.19%
Implied real growth of dividends (B) × (A) ÷100	2.79% p.a.
Observed real growth of dividends	1.61% p.a.
Actual pay-out ratio in 2018 was below average; had it been average growth of real dividends would have been	1.90% p.a.

Data source: Robert Shiller. Data can be accessed from www.econ.yale.edu

The published profits of quoted companies have therefore been habitually overstated and additional evidence for this is provided by published retained profit ratios which imply a more rapid rise in dividends per share than the observed change, as shown in Table 2. This could have been the result of overstated profits or of a fall in the pay-out ratio. I demonstrate that it must have been the result of the former by showing that the real growth of dividends would have been much slower than that implied by the profit data even if there had been no change in the pay-out ratio.

Claims that the published profits of quoted companies have been understated are therefore incompatible with the stock market data, which show that they have been overstated.

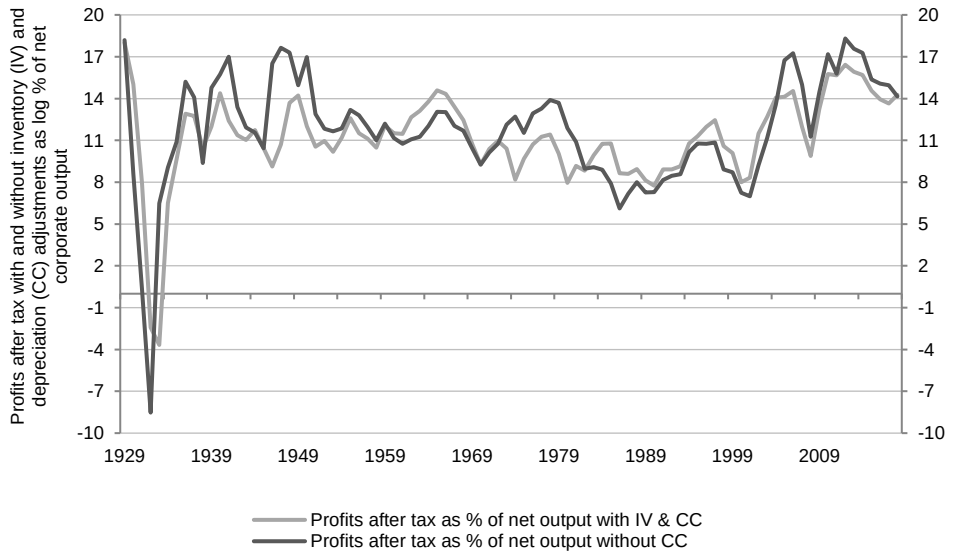
Profits in Corporate and National Accounts

There are many differences between profits as published in corporate and national accounts. Many of these, such as the consequences of write-offs to asset values, affect their timing rather than their long-term average. For example, the change in management remuneration in the 1990s led, *inter alia*, to a dramatic rise in the volatility of corporate profits relative to those in

the national accounts.[15] In bad years, such as 2008, corporate profits are depressed by write-offs which boost profits in subsequent years.

There are, however, two differences which affect the long-term averages, and which are readily quantifiable: the impact of inflation on the depreciation of tangible assets and inventories and the inclusion in national accounts of intangibles and their associated depreciation.

Figure 3: US: Corporate profits with and without inventory and depreciation adjustments



Data source: NIPA Table 1.14.

The depreciation charge shown in corporate accounts and the profits arising from changes in the value of inventories are largely based on historic-cost book values, whereas those in the national accounts allow for the impact of inflation. The latter also show profits without such an adjustment. Figure 3

[15] See Figure 45 and the accompanying explanation in *Productivity and the Bonus Culture* by Andrew Smithers Oxford University Press (2019).

shows that profits in the national accounts, when measured with and without the inventory adjustment (IV) and the capital consumption adjustment (CC) for inflation, have moved closely together. Profits measured without the adjustment were generally higher when inflation was positive and lower in periods of deflation, though the adjustments are also affected by changes in the rate of inflation.

On balance inflation has been positive since 1929 and so unadjusted profits, which approximate to those published by companies, have been on average 4.4% (0.5 percentage points) higher than those without, which are those generally used for national accounts. Inflation has averaged 2.0% p.a. since 1871 and 3.3% since 1929, so the extent to which profits in national accounts have been lower than those published by companies over the whole period is likely to be less than 4%.

In the national accounts the value of intangibles is depreciated rapidly with 23% of the ascribed value being written off in 2018. Even a small increase in the rate of depreciation would have a sharp impact on profits. As intangible expenditure is fully allowed as an expense for corporation tax any change in the assumed amount of depreciation would have a one-for-one impact on profits after tax.

Table 3: US relative sizes of quoted, unquoted and unincorporated businesses, by net worth and fixed investment

	Net worth $bn	% of total	Fixed investment $bn	% of total
Total	38,688	100%	2,112	100%
Total incorporated	25,762	66.60%	2,085	98.70%
Of which unquoted	3,367	8.70%	273	12.90%
Unincorporated	12,925	33.40%	27	1.30%

Data sources: NIPA Table 1.1.5 and Z1 Tables L. 223, B. 103 and B. 104.

Table 3 shows that corporations are responsible for nearly all fixed business investment. The data on non-residential investment in IP and the depreciation attributable to it are therefore almost 100% applicable to corporate accounts.

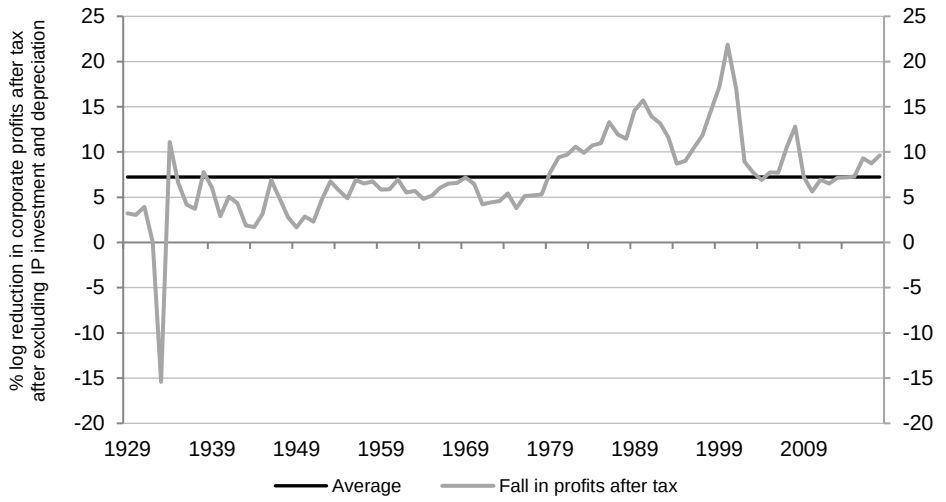
As IP costs, including R&D, are fully deductible as an expense for corporation tax, whether or not they are treated as final or intermediate output, corporate profits can be adjusted to the exclusion of intangibles from investment by adding the charge for IP depreciation and deducting IP investment from post-tax profits.

Figure 4 shows the adjustment to post-tax profits that would result from the exclusion of IP investment and depreciation. Since 1929 profits would on average have been 7.5% lower had IP spending been treated as intermediate rather than final output and 10% lower in 2018.

In comparing NIPA and corporate profits after tax from 1929 to 2018 it appears that the former have been depressed by 4.4% due to the inflation adjustment and raised by 10% due to the inclusion of IP investment. Unless there are other significant differences in accounting practice it is likely that the overstatement of NIPA profits is at least as great as that for corporate profits which, as Figure 4 shows, is likely to be well above 5%.

The claim that intangible depreciation is overstated or that intangible investment is underrecorded is thus incompatible with the independently generated data on equity returns to shareholders.

Figure 4: US corporate profits after tax, adjusted for exclusion of IP investment and depreciation

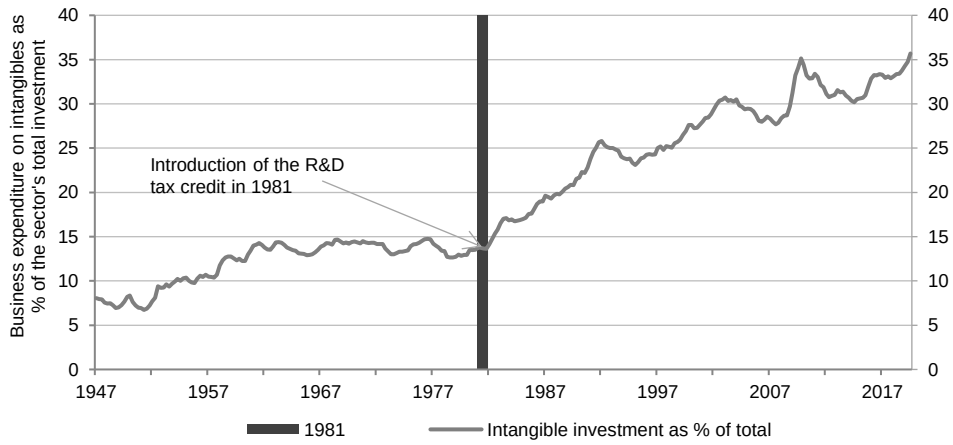


Data sources: NIPA 1.14 and BEA Fixed Asset Tables 1.3 and 1.5.

Should IP Expenditure be Categorised as Investment?

Although the inclusion of IP expenditure as a form of investment has had little impact on GDP or its growth rate, it has had a marked impact on the data for investment and the labour share of GDP. This has caused public perception to underappreciate the extent to which tangible investment has fallen and often wrongly to assume that the labour share of income has fallen relative to profits. This does not mean that the change was necessarily a mistake, but it increases the importance of correcting these misapprehensions and underlines the importance of the way in which economic data are presented. If IP expenditure is to be properly classed as a form of investment, it must be measured correctly in practice and justified in theory.

Figure 5: US: Intangibles as % of total business investment



Data source: NIPA Table 1.1.5.

There is a large tax credit in the USA for R&D, which was introduced in 1981. Figure 5 shows that business spending on IP averaged 12% of its total investment for 25 years before that and has since risen to over 36%. Over the same period total factor productivity (TFP), which measures the contribution to growth from improvements in technology has seriously declined, however, this is measured.[16]

We are therefore left with a choice between believing that companies have devoted more and more resources to R&D over the past 32 years for increasingly lower returns or that the rise in the amount attributed to R&D investment in the national accounts does not represent the extent to which expenditure on research has actually increased, but a renaming of spending. Anecdotal evidence points to companies reducing their tax, without any real increase in expenditure on IP, by categorising an increasing part of the salaries and other costs of employees, which were previously treated as general expenditure, as investment in R&D. There is therefore a strong

[16] See Figure 45 and the accompanying explanation in *Productivity and the Bonus Culture* by Andrew Smithers Oxford University Press (2019).

possibility that investment in IP is mismeasured. The tax credit encourages companies to redefine as R&D expenditure which was previously allocated to general management and if this is done and accepted by the tax authorities and the national accountants as representing a true rise in such expenditure, the data will be distorted.

The argument in favour of including IP expenditure as investment rests on several assumptions, one of which is that it is designed to increase future consumption.

> "Any use of resources which decreases current consumption in order to increase it in the future qualifies as investment. This result argues for *symmetric* treatment of *all* types of capital, so that, for example, spending on R&D and employee training should be placed on the same footing and spending on plant and equipment. Moreover, this symmetric principle requires that most business expenditures aimed at enhancing the value of a firm and improving its products, including human capital as well as R&D and employee training should be placed on the same footing as spending on plant and equipment. Moreover, the symmetry principle requires that most business expenditures aimed at enhancing the value of a firm and improving its products, including human capital development as well as R&D, be accorded the same treatment as tangible capital in national accounting systems."[17]

The assumption that these expenditures are "aimed at enhancing the value of the firm" is surely invalid as they will often be aimed at preventing the value of the firm from falling. The same objection can be made to tangible investment, but the results of such expenditure have value, as shown in the second-hand market for equipment, and are the property of the company which made the expenditure, which is clearly not the case for expenditure on human capital and employee training.

Some of the objections to the inclusion of IP expenditure as investment are considered and dismissed by those who argue for a slower rate of IP depreciation. These include verifiability, *visibility*, *non-rivalness* and

[17] *Intangible Capital and Economic Growth* op. cit

appropriability.[18] The first two raise the practical issue of whether it is possible to assess the value and depreciation rates of IP and are rebutted on the grounds that difficulty of measurement should not be a criterion. The problems of non-rivalness and appropriability apply to knowledge and skills which can be used by those who did not pay for them and it is argued that firms would only pay for something if it provided them with a benefit.

> "In sum, the various characteristics that cause tangible and intangible assets to be different—verifiability, visibility, non-rivalness and appropriability—are all important features that distinguish one type of capital from another. However, none of these differences is relevant to the issue of whether to treat intangible expenditures as capital. This is determined by whether or not the expenditure is intended to yield output in some future time period. This is the conceptual analog on the production side to symmetry criteria of whether expenditure was made in order to increase future consumption. Many intangibles satisfy these criteria and must therefore be treated as capital."[19]

Both the practical and the theoretical arguments against the inclusion of intangibles seem to me to be impervious to these assertions. On the practical side intangible IP should not be included in national accounts if its value cannot be measured and particularly when the values placed by those who attempt to measure it are incompatible with the data on equity returns. The theoretical argument relies on the claim, which is unlikely to be true and incapable of being tested, that the purpose of such expenditures is to enhance future output. Furthermore, the issue of appropriability would not be settled even if the purpose of companies when making IP expenditure could be known. The assumption that investment undertaken by a company increases the value of the corporate sector is open to the objection that it involves a potential fallacy of composition. If an individual company makes a successful investment in R&D it will add value by improving its productivity, either by reducing its costs of production or improving the quality of its output. The increase in the individual company's value will,

[18] I set out the definitions of these terms in the Appendix.
[19] *Intangible Capital and Economic Growth* op. cit.

however, be offset by a fall in that of all other companies because the value of the existing stock of capital falls as labour productivity rises.[20]

When applied to advertising the assumption that it is undertaken to improve profits rather than defend them, requires that national output rises with the amount spent on advertising.

It has also been argued that R&D should be treated as a form of investment because it is necessary for technical progress, which is essential for growth in productivity.

> "Neoclassical growth models assume that innovation is an exogenous process, with the implication that investments in R&D have no systematic and predictable effect on output growth. But can it really be true that the huge amount of R&D investment was made in recent years without any expectation of gain? A more plausible approach is to abandon the assumption that innovation is exogenous to the economic system and recognise that some part of innovation is, in fact, a form of capital accumulation."[21]

This argument strikes me as naïve. The claim that vast amounts have been spent on R&D is justified in two ways. One is the benefit of a reduction in tax even if it has not been successful in advancing technology. The other is the benefit from staying in business which is threatened by the spending of others in a variety of ways including R&D and advertising. R&D is vital, if not always essential, for the growth of productivity but this does not make it a form of investment. Education is essential for R&D, but it is not a form of it.

Miller-Modigliani and The Mean Reversion of *q*

The incompatibility of accelerated IP depreciation with the data on equity returns to shareholders leaves the evidence pointing firmly to the mean

[20] *Neo Classical Growth with Fixed Factor Proportions* by R.M. Solow, J. Tobin, C.C. Weizsacker & M. Yaari The Review of Economic Studies Vol 33 No 2. Shows that the rate of depreciation depends on the growth of real wages, which change in line with labour productivity if the profit and labour shares of output are stationary. I show later in Figures 6 & 7 that they are.

[21] *Total Factor Productivity: A Short Biography* by Charles R. Hulten NBER Working Paper 7471.

reversion of *q* coming from the tendency for the value of the stock market to move towards the net worth of its constituent companies rather than vice versa.

Equities are, at least in aggregate, irredeemable and as they have a stable long-term return, the cost of equity must fluctuate with *q* and, as companies appear indifferent to its fluctuations, they must ignore the cost of capital when making investment decisions. This is contrary to the implications of the Miller-Modigliani theorem, if the value of companies is considered to be their net worth rather than their stock market value. But it is with the latter rather than the former with which shareholders are concerned, so they do not like new issues which tend to depress share prices. Managements have to please shareholders, not economists, so in the interests of self-preservation they habitually favour buy-backs rather than new issues, even when the stock market sells, as it does in January 2020, well above the real net worth of its constituent companies.

By preferring the market price to net worth investors can be accused of myopia, as over the long term the latter determines the former. It should, however, be noted that this does not indicate that investors are irrational. Shareholders are not a homogeneous group; those saving for their retirement have longer time horizons than pensioners and investors are not irrational to prefer share prices to underlying value if they believe share prices are unlikely to fall in the shorter term or that they are unable to time, with sufficient accuracy to improve their returns, when to leave and when to return to the stock market. It would be irrational if the correct timing of the market could be forecast, but it is unlikely that markets would then be ever misvalued.

Shareholders' concern with stock market value rather than net worth does not generally apply to unquoted and unincorporated businesses, though it may influence management decisions for those companies which are considering a listing. For the purpose of modelling the equity market it seems reasonable to separate businesses into quoted companies, whose shareholders are primarily interested in the stock market value, and others which are concerned with their long-term wealth. These will often be unquoted and their managements will be less myopic and concerned with

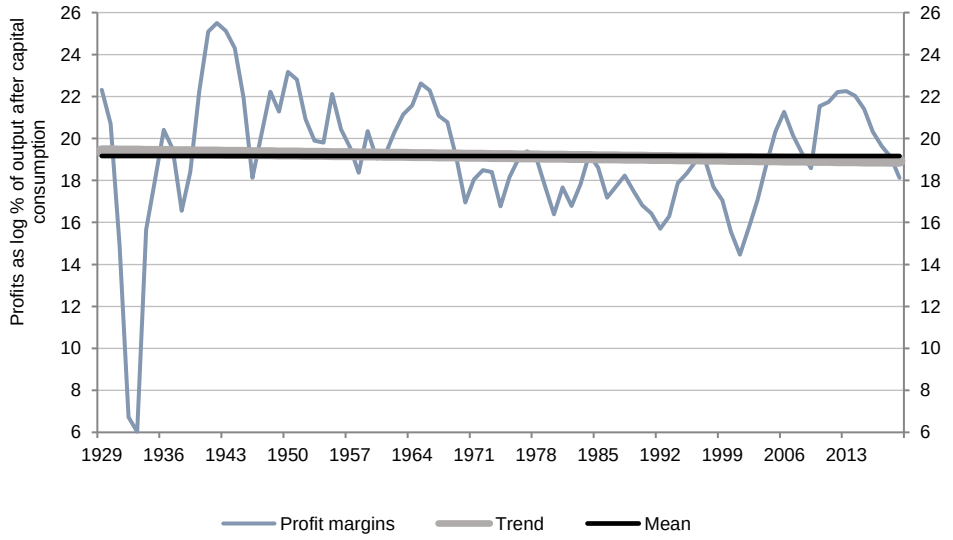
the long-term value of their businesses, which over time will reflect, at least on average, their net worth. Over the long term the investment by unlisted businesses may be encouraged by a high q value, but unquoted and unincorporated businesses do not have ready access to new equity and those that do are often discouraged from seeking it by the wish to retain control of their businesses, so the impact on the mean reversion of q is likely to be small. As Table 3 shows, businesses which are not quoted on the US stock exchange account for 42% of total non-financial net worth, but only 14.2% of total private sector non-residential fixed investment.[22]

The Labour and Profits Shares of Output

As Figure 6 and Figure 7 illustrate, the US national data show that profit margins are mean-reverting, as explained by the Cobb-Douglas production function. As all income which does not accrue to the owners of capital accrues to employees, Figure 6 and Figure 7 show that the labour and profit shares of output are stable over time.

[22] The calculation assumes that the market value ascribed in Table L 223 to unquoted companies reflects their proportionate share of total incorporated net worth. I have been unable to find out from the Federal Reserve whether unquoted companies are valued at a discount to quoted ones. If they are, for example, valued at a 25% discount, unquoted and unincorporated businesses would constitute almost 50% of total non-financial companies' net worth.

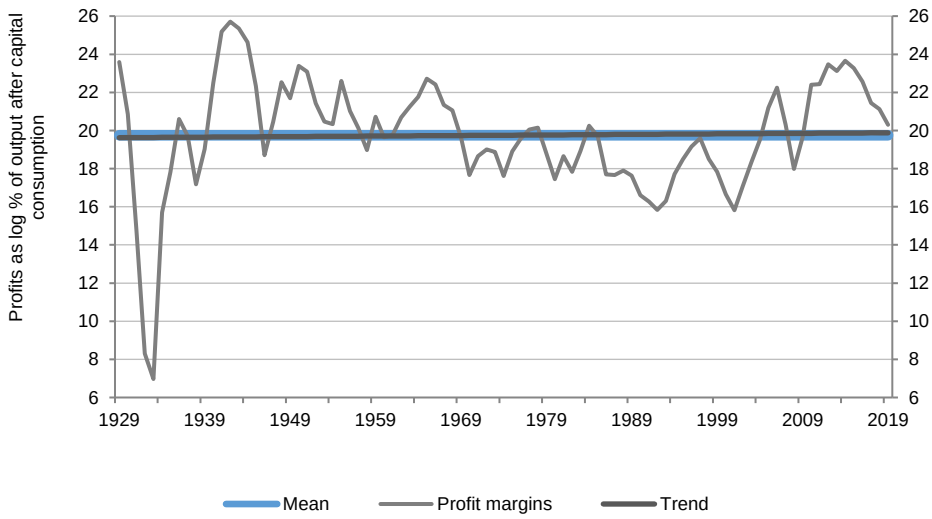
Figure 6: US Non-financial companies' profit margins



Data source: NIPA Table 1.14.

This is frequently disputed, and the proponents of accelerated depreciation have been among those who have done so. To show, for example, that profits have been on a rising trend, it is necessary to use different ratios to the ones shown in Figure 6 and Figure 7.

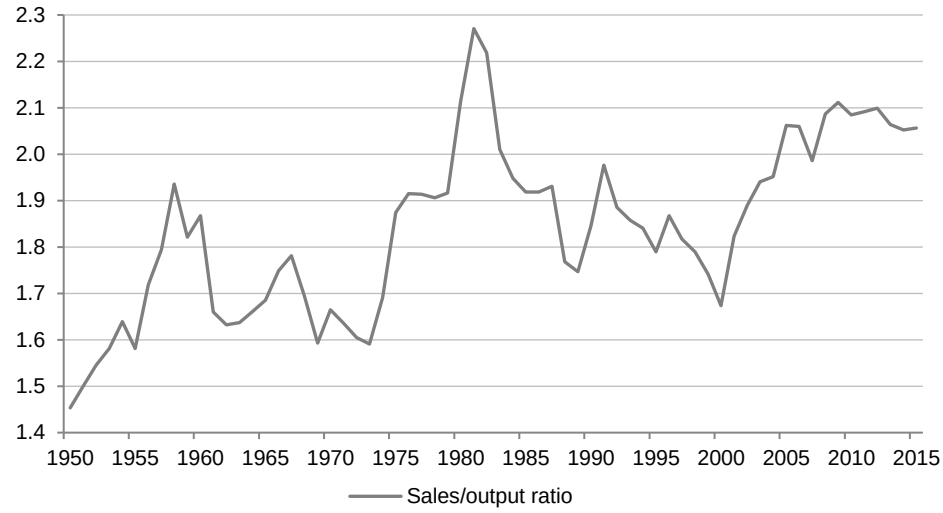
Figure 7: US companies' net profit margins



Data source: NIPA Table 1.14.

One approach is to compare profits with sales rather than output. But the former does not have a stable relationship to output, as I illustrate in Figure 8, and the ratio is not determined by the shares of profit and wages, because the ratio of intermediate to final output fluctuates with changes in corporate structure. As the ratio shown in Figure 8 has no stable average, the level of sales' margins at any time provides no information, though the long-term rise in the ratio shown is consistent with anecdotal evidence that companies have increasingly "outsourced" i.e. purchased goods and services which they had previously provided internally.

Figure 8: US non-financial companies' estimated ratio of sales to output



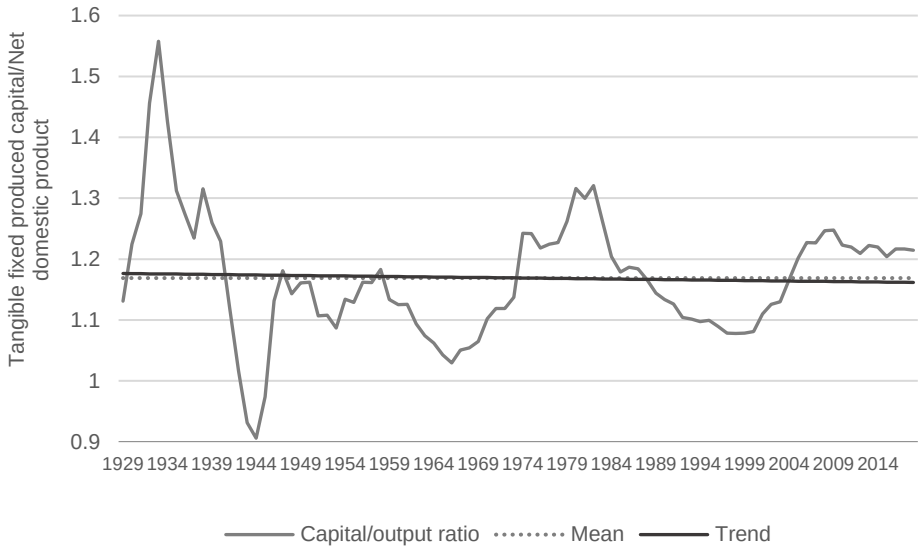
Data sources: Standard & Poor's and NIPA Table 1.14.

Other misused ratios are those using GDP, gross corporate output and those which measure profits after deductions for interest costs and corporation tax. The division of profits between equity and debt does not affect the relative shares of output taken by labour and capital, as the amount taken by capital includes the returns to both debt and equity capital; furthermore, the share of corporations in national output is not stable and is today considerably higher than it was in 1929.

Most importantly, depreciation is not part of the profit share, which must only be measured relative to net output. When the division of income between the labour and capital shares of output is being considered it is vital to use a sensible definition of income and that proposed by Sir John Hicks eighty years ago has, to put it mildly, stood the test of time. Hicks defined income as "The maximum a man can spend and still be as well off at the end

of the week as at the beginning".[23] While this leaves the definition of "well off" open to debate, it is clear that spending all profits before depreciation will leave the owner of capital worse off.[24] It is therefore important to consider the income shares of business output after and not before deducting capital consumption. (This is another reason why sales margins, in which depreciation is included as part of profits, should not be used in assessing changes in the labour share or competitive conditions.)

Figure 9: US tangible fixed produced capital/output ratios



Data sources: BEA Fixed Asset Tables 1.1 and 1.3 and NIPA Table 1.1.5.

Those who call for lower depreciation rates for IP have also argued that the fall in investment after 2000 has been the cause of the subsequent slow

[23] *Value and Capital: An Enquiry into Some Fundamental Principles of Economic Theory* by J.R. Hicks Oxford University Press (1939).
[24] Sir John Hicks also remarked that many people found it difficult to distinguish between capital and income, to which Sir Dennis Robertson replied that the jails were full of those who failed to do so.

growth in productivity and was the result of a decline in competition.[25] It is clear that there has been a marked fall in business investment since 2000 and,[26] if output has a stable long-term relationship with the level of the capital stock, as Figure 9 shows it does,[27] then this reduction will have caused the subsequent weakness in labour productivity.

However, the evidence does not support the view that monopoly power has risen nor that in the past such changes have been associated with low investment. If monopoly power were above average in the USA, this would be likely to show up in high profit margins. However, as I show in Figure 6, non-financial profit margins for the nine months of 2019 for which we have data are below their strongly mean-reverting average.[28] A reduction in competition is not the only thing that produces temporary fluctuations in profit margins around their average, so the chart does not prove that monopoly power has not increased, but profit margins tend to be high when demand is strong and unemployment low, so below-average margins are unexpected when, as today, unemployment is exceptionally low. On the other hand, a high exchange rate tends to depress profit margins and the dollar is likely to be high today as US interest rates are above those of most currencies. One reason why profit margins are likely to fluctuate is the different speeds at which prices and wages respond to a recovery in demand, with prices doing so more quickly than wages. This fits with the recent pattern in which margins expanded in the first five years of the recovery after 2008, but since 2013 they have narrowed as wages have caught up. Short-term fluctuations in profit margins are not therefore evidence that competitive conditions have changed, nor are the latest data, which show profit margins in the first nine months of 2019 to be below average, conclusive evidence that competition has not weakened, but they are strong evidence that if there has been any increase in monopoly power it has been mild.

[25] *Notably in The Great Reversal* op. cit

[26] Illustrated in Figure 4.1 of *The Great Reversal* op. cit.

[27] For the theoretical explanation of why the ratio of the value of fixed produced capital to output is stable see *Building a New Testable Model to Estimate Total Factor Productivity* op. it. The long run stability of the capital/output ratio appears to be accepted by Thomas Philippon (page 65 of *The Great Reversal* op. cit.)

[28] Appendix 8 of my book *Productivity and the Bonus Culture* explains why profit margins should be mean reverting in theory and Figure 6 shows that this works in practice.

Summary

Claims that investment in IP has been understated due to an excessively rapid rate of depreciation are clearly incompatible with the data on equity returns.

A reduction rather than an increase in profits is needed to bring them into line with these data on returns and this raises the issue of whether the inclusion of IP spending as investment has been a sensible change in the measurement of GDP and other national income metrics.

My own view is that the change has been a mistake for both practical and theoretical reasons. The practical case against is that the data on IP spending are suspect and its subsequent value and thus depreciation unmeasurable. The theory for its inclusion is based on the improbable assumption that all IP spending is made to increase future output or profits. Those who make this assumption agree that advertising expenditure should therefore be classed as investment. Without doubting the value of advertising, I think that many economists would agree with me that it belongs in a separate category from investment.[29] I also point out that the fact that, while an individual company can add to its value by successful spending on IP, including that on R&D and advertising, this does not mean that the value of the business sector's capital has risen. One company's successful R&D reduces the value of other companies' net worth and one firm's advertising reduces the value of another's spending.

It would be useful to have good data on spending on R&D and other forms of IP, but their inclusion as part of investment seems to me to be a category error. It has led to understating the fall in investment, which has occurred since 2000 in the UK and the USA, and contributed to the mistaken belief that the labour share of output is historically low.

[29] For example, by the authors of *Intangible Capital and Economic Growth* op.cit

Appendix

Definitions of verifiability, visibility, non-rivalness and appropriability for IP

The lack of *verifiability* for intangibles is because they are seldom acquired by market transactions. The lack of *visibility* makes it impossible to attribute any existing value from past expenditure in IP to the date when it was incurred i.e. its vintage. *Non-rivalness* is a general attribute of knowledge, as its amount and value are not reduced by the extent to which it is employed. Output is usually increased the more the existing level of knowledge is fully used in an economy. The benefits of expenditure on R&D or employee training may not be captured by the firm that undertakes the expenditure or in aggregate by the business sector if the benefits flow to labour.

I am indebted to William White, senior fellow at the CD Howe Institute and former Economic Advisor to the Bank for International Settlements, for his help with this paper. If it has virtues, they will owe much to him, while its faults are entirely mine.

References

Akerlof, George (1970). *The market for lemons.* Quarterly Journal of Economics 84, 3.

Akerlof, George (2019). *What they were thinking then: the consequences for macroeconomics during the past 60 years.* Journal of Economic Perspectives 33, 4.

Corrado, Carol A., Hulten, Charles R. and Sichel, Daniel E. (2006). *Intangible capital and economic growth.* NBER Working Paper 11948 (Cambridge, MA: National Bureau of Economic Research).

Gutiérrez, Germán and Philippon, Thomas (2016). *Investment-less growth: an empirical investigation.* NBER Working Paper 22897 (Cambridge, MA: NBER).

Hicks, J.R. (1939). *Value and Capital: An Enquiry into Some Fundamental Principles of Economic Theory* (Oxford: Oxford University Press).

Hulten, Charles R. (2000). *Total factor productivity: a short biography.* NBER Working Paper 7471 (Cambridge, MA: NBER).

Peters, Ryan H. and Taylor, Lucian A. (2017). *Intangible capital and the investment–q relation.* Journal of Financial Economics 123, pp. 251–72.

Philippon, Thomas (2019). *The Great Reversal: How America gave up on Free Markets* (Cambridge, MA: Harvard University Press).

Smithers, Andrew (2009). *Wall Street Revalued: Imperfect Markets and Inept Central Bankers* (Chichester: John Wiley & Sons).

Smithers, Andrew (2017). *Building a new testable model to estimate Total Factor Productivity.* World Economics 18, 7.

Smithers, Andrew (2019). *Productivity and the Bonus Culture* (Oxford University Press).

Smithers, Andrew and Wright, Stephen (2000). *Valuing Wall Street: Protecting Wealth in Turbulent Markets* (McGraw-Hill).

Solow, R.M., Tobin, J., Weizsacker, C.C. and Yaari, M. (1966). *Neo classical growth with fixed factor proportions.* The Review of Economic Studies 33, 2.

Tobin, James (1969). *A general equilibrium approach to monetary theory.* Journal of Money, Credit and Banking 1, 1.