DEPRECIATION IN VITRUVIUS

Vitruvius has something interesting to say at *De architectura* 2.8.8:[1]

Non enim quae sunt e molli caemento[2] subtili facie venustatis, non eae possunt esse in vetustate non ruinosae. itaque cum arbitrio communium parietum sumuntur, non aestimant eos quanti facti fuerint, sed cum ex tabulis inveniunt eorum locationes, pretia praeteritorum annorum singulorum deducunt octogesimas et ita – ex reliqua summa parte reddi pro his parietibus – sententiam pronuntiant eos non posse plus quam annos LXXX durare.

Those structures made of soft rubble, for all their subtle attractiveness, are not the ones that will resist ruin as time passes. And thus when assessors are appointed to evaluate party walls, they never assess soft rubble walls according to their initial cost, but rather, when they look at the price recorded in the original contracts, they deduct 1/80th of that sum for each subsequent year, and the remaining amount is fixed as the current value of the walls. They have rendered judgement, in effect, that such walls cannot last more than 80 years.

By contrast, mud-brick walls were not depreciated at all if they were standing when assessed (Vitr. 2.8.9). The calculation performed for concrete walls demonstrates clear understanding of what we call 'depreciation' or 'amortization' in ancient Roman thought. It appears to have been overlooked to date.[3]

Depreciation is an economic concept of some sophistication,[4] and its presence in late Republican Rome is significant for any discussion of economic and moral values at that crucial time in ancient history.

[1] In this paper the text used is that of C. Fensterbusch, *Vitruv Zehn Bücher über Architektur* (Berlin, 1964), and the translation of I.D. Rowland in id. and T. Howe, *Vitruvius Ten Books on Architecture* (Cambridge, 1999).

[2] This is walls with concrete fill. See below on the historical context of Vitruvius' comment.

[3] It is absent from every ancient economic history study I have checked, e.g. A. Bowman and A. Wilson (edd.), *Quantifying the Roman Economy* (Oxford, 2009); K. Verboven, K. Vandorpe and V. Chankowski (edd.), *Pistoi dia tèn Technèn: Bankers, Loans and Archives in the Ancient World. Studies in Honour of Raymond Bogaert* (Leuven, 2008); W. Scheidel, I. Morris and R. Saller (edd.), *The Cambridge Economic History of the Greco-Roman World* (Cambridge, 2007); D. Jones, *The Bankers of Puteoli* (Stroud, 2006); Z.H. Archibald, J.K. Davies and V. Gabrielsen (edd.), *Making, Moving and Managing: the New World of Ancient Economics 323–31 BC* (Oxford, 2005); S. Mitchell and C. Katsari (edd.) *Patterns in the Economy of Roman Asia Minor* (Swansea, 2005); J.-J. Aubert and B. Sirks (edd.), *Speculum Iuris: Roman Law as a Reflection of Social and Economic Life in Antiquity* (Ann Arbor, 2002); R. Macve, 'Some glosses on "Greek and Roman accounting"', in P. Cartledge and D. Harvey (edd.), *Crux: Essays Presented to G.E.M. de Ste. Croix on his 75th Birthday* (Exeter, 1985), 233–64; id., 'Insights to be gained from the study of ancient accounting history: some reflections on the new edition of Finley's *Ancient Economy*', *European Accounting Review* 11.2 (2002), 453–72; E. Lo Cascio, *Il Princeps e il suo Impero: Studi di storia amministrativa e finanziaria romana* (Bari, 2000); B.B. Price (ed.), *Ancient Economic Thought* (London, 1997); D. Rathbone, *Economic Rationalism and Rural Society in Third-century A.D. Egypt* (Cambridge, 1991); M.I. Finley, *The Ancient Economy* (Berkeley, 1973); M. Rostovtzeff, *The Social and Economic History of the Hellenistic World* (Oxford, 1942); and J. Toutain, *L'Économie Antique* (Paris, 1927). Vitruvius editors and commentators discuss it only in the context of Vitruvius' long debated attitude to new building materials and techniques: see e.g. Rowland and Howe (n. 1), 11–12, or M. Wilson-Jones, *Principles of Roman Architecture* (New Haven, 2000), 33–47, both excellent discussions, the former from the perspective of the history of technology and the latter of historiography.

[4] See e.g. K. Cunningham, 'Which concept of depreciation should guide us? – trying to develop a consistent framework for the federal income tax system', *Virginia Tax Review* 14 (1994–5), 753–77.

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When Vitruvius was writing, in the second half of the first century B.C.,[5] houses were frequently collapsing, burning, being sold on, demolished and rebuilt.[6] Shocking stories of sudden tenement collapse may have motivated the arbitrators' allocation of a service life to concrete walls: when buildings collapsed, subsequent investigation into their construction would have revealed their age. Eighty years is likely to have been a convenient approximation based on whatever sample the arbitrators in question could find at the time they framed this accounting procedure. Building concrete walls had begun about 200 B.C. and is first mentioned *c*. 160 B.C.[7] As with any new technology, early efforts probably suffered from numerous defects, and it would have taken years or decades for concrete technology to stabilize and standardize. In due course the Romans really honed this technology: the best ancient concrete structures still survive thousands of years after their production, even exposed to the elements.[8] But early concrete was not so good, and not all concrete produced was of the same standard. That constructed with less care, of less well-prepared lime, mixed in less than perfect proportions, or in an unstable environment, has since disappeared.[9] The arbitrators allocated 80 years for the service life of concrete walls on the basis of their experiences and investigations, sometime before Vitruvius was writing (say about 30 B.C. for present purposes), so the tenement buildings whose early concrete walls had failed so spectacularly as to initiate awareness of the concept of depreciation, would have been constructed *c*. 110 B.C. or earlier.

Should we assume that, when legislating for the future, the arbitrators were aiming for worst-case scenario, the earliest age at which a concrete wall might collapse, or an average lifespan of such walls? The answer to that question largely depends on whether the arbitrators were concerned about the health and safety of the occupants of the buildings, or the balance sheets of the owners of the buildings: who were the consumers of these depreciation calculations? At this time and place in history, Late Republican Rome, the answer is probably the owners and potential owners of tenement buildings, who would want evaluations of party walls as part and parcel of estimations of the value of their estate, or if the building was needed as security or suchlike. Moreover, it is the owners, not the tenants, who would have possessed the construction contracts which recorded the original cost, with which the calculation necessarily began.[10]

Maintenance and repair of buildings was a major issue in the second and first centuries B.C., and the quality of the concrete used during the early years of its employment perhaps explains why.[11] It was not just tenement blocks that were affected. Extensive

[5] For present purposes the precise date of Vitruvius' text is not important. Wilson-Jones (n. 3), 34 attempts to reconcile all differences by supposing that he wrote the bulk of it between 28 and 23 B.C., while relying to a large extent on what he learned in the 50s and 40s B.C.

[6] Strabo 5.3.7 (C235). Strabo was approximately contemporary with Vitruvius.

[7] Cato, *Agr.* 14.1; cf. J.-P. Adam, *Roman Building: Materials and Techniques* (London, 1994), 79–80; the first certain example is the temple of Magna Mater on the Palatine, consecrated in 204 B.C.

[8] See e.g. L.C. Lancaster, *Concrete Vaulted Construction in Imperial Rome* (Cambridge, 2005).

[9] Adam (n. 7), 73. Hadrianic Ostia, which shapes many moderns' perceptions of an ancient city, was not a 'normal' site, and even within it, there is large variation in the quality of the mortar in particular, and the build in general; see J. DeLaine, 'The cost of creation: technology at the service of construction', in E. Lo Cascio (ed.), *Innovazione tecnica e progresso economico nel mondo romano* (Bari, 2006), 237–252, at 241–2.

[10] I am grateful to one of the referees for raising this point.

[11] D. Strong, 'The administration of public buildings in Rome in the late republic and early empire', *BICS* 15 (1968), 97–109, esp. 101.

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repair of public buildings was needed in Rome when Augustus started his programme of restoration.[12] His important civic reforms included reorganization of the administration of public building,[13] institution of the *cohortes vigilum*, and some specific statutes, including limitation of the height of buildings to less than 70 feet and the width of party walls to not more than one and a half feet.[14] Private houses suddenly falling down, as reported by Strabo, and the simultaneous review of public building theory and practice, offer a coherent historical context for the inclusion of a depreciation clause in Roman contracts on party walls.

How sophisticated the Roman arbitrators' understanding of depreciation was can be appreciated through comparison with other times and places. The next reference to depreciation in historical sources known to me was written about sixteen centuries later, in Britain, and it reveals a simpler understanding of the concept than that preserved in Vitruvius. Robert Loder's farm accounts for 1612 appear to include a sum for depreciation of horses and their gear: 'Other charges which I was at aboutes my horses … the wearing out of my horses; with the wearing of other thinges, as followeth … Item I reckon my horses were the worse in the abovsaid time by iij*l*; Item I judge, that the wearing of other thinges, as forehorse halter, ring'd halters, collar halters, skipe, chafe seve, shovel, crippers, fetters, basten ropes, my plow, harrowes, etc. cost me xv*s* iiij*d*' (1612). In the following year he charged for 'horses the worse by wearing out, and in wearing other thinges: as for horse halter' [the list is repeated] '… in wearing out of the sayd horse which come to I iudge, v*s*', and 'Item for the wearing of [that horse] out some in the time I mowe, viij*s* iiij*d*'.[15] These charges are not expressed as a fraction of the anticipated service life of a horse, or of the estimated value of a horse, nor is there any attempt to relate the sum charged for depreciation of four horses in the next year to that charged for the four (or additionally for one that had performed extra work) in 1612. Further, Loder did not make similar allowances in eight out of the ten years for which accounts survive; normally he only charged his feed costs. His accounting practice, in short, was inconsistent, and his 1612 and 1613 behaviour appears to have been a short-lived awareness of depreciation (prompted perhaps by his recent purchase of these horses or, and this seems less likely given Loder's obvious concern for his horses' well-being, by their palpable exhaustion). In contrast, the more refined calculation of depreciation by the arbitrators mentioned by Vitruvius appears to have been routine.

Another example of depreciation dates to 1675, when Stephen Monteage devalued six horses by a sum that equates to one seventh each for 'their use and impairing'. Mason thought it likely that those 'regularly engaged in business' have always understood 'the fundamental facts of depreciation' and that, were the records available, we would 'find evidence of some understanding of the phenomenon of depreciation as far back in history

[12] Rowland and Howe (n. 1), 9–10. Howe observes (p. 184) that Vitruvius' text makes 'clear that the process of re-evaluating and improving concrete … was underway in the decade in which he was writing'.

[13] Strong (n. 11), 103–4.

[14] Strabo 5.3.7 (C235); Vitr. 2.8. 17.

[15] G.E. Fussell, *Robert Loder's Farm Accounts 1610–1620* f.23v, 24r, Camden Third Series 53 (London, 1936), 21, 22, 54, 56. These accounts are frequently cited in the literature on the rise of capitalism, e.g. by S. Toms, 'Calculating profit: a historical perspective on the development of capitalism', *Accounting, Organizations and Society* 35 (2010), 205–21 and references there. I wish to thank Bruce Gibson for finding the published version of this paper.

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as the origins of written records of business affairs'.[16] But I find no such evidence in Roman agricultural treatises, which have survived in relatively good quantity, or in the Heroninos archive.[17] Neither Vitruvius' contemporary Varro, nor Columella, about 50 years later, talk of depreciation with respect, for example, to animals, farm equipment or farm buildings, in the same clear way as Vitruvius does of concrete walls in 2.8.8; when talking of carting goods around the estate, for example, Varro notes a possible choice between donkey, cow and mule, and observes only that a donkey is cheaper to feed than a cow, but a cow is more productive (*fructuosior*, *Rust.* 1.20.4). Macve pointed out that thirteenth- and fourteenth-century writers 'were able to recognize, at least implicitly, the effect of depreciation on investment choices – e.g. in comparing horses and oxen they recognized that a horse's carcass was worth little, while an ox could be fattened for meat'.[18] But the fact remains that evidence for real understanding of the concept of depreciation is wanting through most centuries in most places. I have not been able to find evidence for it in Italian accounting up to and including Pacioli, who knew Leon Battista Alberti, who studied Vitruvius intensively and who thereby opens the door to the possibility of transmission of the concept directly from Vitruvius to Renaissance Italy.[19] In 1764 John Smeaton, writing an expense report for maintaining the Forth to Clyde canal and apparently without any link to Vitruvius, supposed that 'in 20 years' time many of the locks will want new gates, all of which will gradually fail in a few years after. I therefore suppose them all made at the end of 20 years and estimated the expense accordingly'.[20] American accountants did not get interested in the concept until the 1830s, when large capital investments were being made in the railway industry and stockholders required their business managers to account for the assets. As late as 1912, depreciation still received 'little or no systematic attention'.[21]

An essential feature of the method of calculating depreciation reported by Vitruvius is that depreciation is uniform over the life of the asset. It follows a straight-line pattern, so that depreciation in year 1 is the same as depreciation in year 2 and so on. As a verbal formula, this is:

> The current value of the asset = the original cost less the depreciation to date, where the depreciation to date = a fraction × the original cost × the age.

The fraction in this case, concrete walls, is 1/80th. In general, the precise fraction is chosen to reflect the anticipated life of the asset, and may be rather arbitrary.[22]

The accounting method described by Vitruvius is in essence the same as accounting procedures for depreciation used (with many added refinements, of course) in the developed world until the 1990s, when the U.S. Bureau of Economic Analysis switched to a geometric pattern for most assets. Using a geometric pattern, depreciation is reckoned a

[16] P. Mason, 'Illustrations of the early treatment of depreciation', *The Accounting Review* 8.3 (1933), 209–18, at 209.
[17] See Rathbone (n. 3), esp. 376–7 for discussion of the Heroninos archive.
[18] Macve (n. 3 [1985]), 241 n. 24.
[19] See A.W. Crosby, *The Measure of Reality: Quantification and Western Society 1250–1600* (Cambridge, 1997), esp. ch. 10 (199–223). Historians of that period are better qualified than am I to pursue that possibility.
[20] Cited in P.D. Woodward, 'Depreciation – the development of an accounting concept', *The Accounting Review* 31.1 (1956), 71–6, at 71.
[21] P.D. Leake, *Depreciation and Wasting Assets* (London, 1912).
[22] See Macve (n. 3 [1985]), esp. 247–8 and Cunningham (n. 4).

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little higher in the early years of an asset's life than in the later years.[23] Ancient historians and classical archaeologists may be amused to learn that the service life expected of new residential structures in the United States is 80 years,[24] the same as concrete walls in Vitruvius' time.

Another perspective on how advanced the Romans' understanding was of the concept of depreciation emerges from consideration of the particular asset being depreciated in Vitruvius' account: walls. Unlike, say, horses working on a farm or lock gates moving back and forth to retain and release water, in which cases wear and tear is ongoing, cumulative and usually visible, walls do not significantly decline in useful service gradually but, like lightbulbs, typically work without problems until they fail suddenly and completely.[25] It is quite remarkable that in such circumstances, in the first century B.C, the value of the anticipated loss was being averaged out over the years of expected service.[26]

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[23] B.A. Fraumeni, 'The measurement of depreciation in the US national income and product accounts', *Survey of Current Business* 77 (July 1997), 7–23. See also Cunningham (n. 4).
[24] Fraumeni (n. 23), 18 table 3.
[25] As distinct from buildings as a whole, which may be (and in the modern world, are) subject to declining serviceableness arguments; see Cunningham (n. 4), 767–9.
[26] I am indebted to the editors and anonymous readers for their constructive comments on the first draft of this paper.

VIRGIL, *ECLOGUE* 4.53–4: A QUANTUM OF *SPIRITUS* IS NOT ENOUGH*

In a recent contribution to this journal, D. Kovacs addresses the following passage from the fourth *Eclogue* (cited here from the OCT of Mynors):[1]

> o mihi tum longae maneat pars ultima uitae,
> spiritus et quantum sat erit tua dicere facta!

Kovacs takes it for granted that the meaning of l. 54 should correspond to the Loeb translation, 'and inspiration enough to hymn your deeds!'. Starting from this assumption, he rejects the reading *spiritus*, arguing that a genitive is required (with a postponed *et*); the possible solution he suggests is *pectoris*, used metaphorically in the sense of 'poetical ability'. That seems a clever conjecture, restoring excellent style. Nevertheless, we have to assume that *spiritus* replaced *pectoris* as a gloss, but I cannot see any reason why somebody would have wanted to explain *obscurum per obscurius*: other words (such as *ingenium*) would have been far more appropriate. On the other

* I am grateful to J. Diggle, B.Gibson, M.D. Reeve and the two anonymous referees of *CQ* for their comments, but it should not be assumed that they agree with what I say.
[1] D. Kovacs, 'Virgil, *Eclogue* 4.53–4: enough of what?', *CQ* 61.1 (2011), 314–15.

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