*Economic Environment, Policies and Inflation in the Roman Empire up to Diocletian's Price Edict**

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Government deficits in the first three centuries A.D. are believed to have led to increases in money supply being facilitated by silver coinage debasements. In 284-305, Diocletian attempted to restore confidence in the coinage by issuing good quality gold and silver coins. However, he also issued significant quantities of bronze coins, which further increased the money supply. The resultant inflation rate has been estimated at 4%-5% per annum. In this article, we examine developments up to Diocletian's attempt to set price-ceilings, and suggest that the explanations offered in the past to rationalise this phenomenon are incomplete. Inflation rates have probably been underestimated too.

1. Introduction

The purpose of this article is to study the issues associated with the continuous price increases that occurred in the Roman Empire at the end of the third century A.D. This ancient episode of economic history is cited in the *New Palgrave* as one of the earliest documented inflations, after which, and for about the next thousand years, our knowledge of such economic events is non-existent.

Understandably, the episode has attracted the interest of historians and economists, especially since it has been considered a reason for the decline of the monetary economy in late antiquity. Parkin (1987) describes the inflation as rapid, Bowman (1980) as massive, Tomlin (1980) and Starr (1982) as severe, and Duncan-Jones (1982) as staggering. However, in considering price data from A.D. 150-301, Paarlberg (1993) estimates

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the annual rate of inflation at about 5.6%; and Fisher *et al.* (2002, relying on Paarlberg) suggest that the rate was perhaps less than 4%, possibly 3.6%. In this article, we re-examine the available evidence and the issues involved, and come to favour the view that the inflation rate was neither as modest nor as protracted, though the debasement period that preceded inflation was, apparently, lengthy.

In considering the basic aspects of this kind of study, it seems that (a) the numismatic evidence is quite robust (on account of the archaeological discoveries and spectral analyses)[1]; (b) the price evidence is less adequate (consisting of a rather small sample of recorded transactions preserved on Egyptian papyri and ostraca, as well as Diocletian's Price Edict); (c) the literary evidence pertaining to the state's fiscal conditions and monetary policies lacks continuity (though a number of issues have been inferred by modern historians)[2]; and (d) the elements of economic theory employed, namely, *Gresham's Law* and the *Equation of Exchange*, are among the most robust that the discipline of economics has to offer.

Naturally, the combined treatment of the above by a student of history or of economics poses a challenge in that it requires expertise on issues normally studied in the other discipline. For instance, the historian may often run the risk of missing economic links between events and making assumptions or offering explanations that, in the economist's view, may be either incompatible with or misrepresentative of economic thought[3]. Similarly, the economist may often run the risk of missing events and references (that are all too obvious to the historian) or combining scanty

[1] See Frank (1936), Walbank (1951), Jones (1953; 1964), Tomlin (1980), Bagnall (1985), Hendy (1985), Sutherland (1992), Bland (1996), Harl (1996), Rathbone (1996), Volk (1996), and the sources mentioned therein. On the basis of the above we carry the discussion on currency content, fineness and circulation, hereinafter.

[2] Indeed, the small body of circumstantial literary evidence provided by ancient authors such as Suetonius, Dion Cassius and Herodian takes us to the early decades of the third century. Subsequently, the quality in the testimony of literary guides decreases, and references to the state of the Roman Treasury disappear.

[3] For instance, in attempting to describe the operations in the *Equation of Exchange*, Hopkins (1980, p. 110) attributes a rise in the supply of money to a surge in the number of people using it for transactions, which in fact, describes not a rise in the quantity of money but, perhaps, a rise in the velocity of circulation. And Whittaker (1980, p. 4) employs the same

quantitative data from antiquity in a simplistic way, and reaching awkward or misleading conclusions[4]. The ambition of this article is to clarify the issue by avoiding the above problems (whether successful in this or not is for the reader to decide.). It does not offer new data. However, its aim is to offer a fresh perspective on the issue, especially since the impact of certain, fundamental, very obvious economic elements appear to have been missed or neglected in the literature on the subject. Indeed, in view of the fact that for the most part of the long debasement period (i.e., from the 60s to the 240s) price levels are reported to have risen very little (e.g., Harl, 1996), we ought to look for a good set of explanations in terms of developments in the other components of the *Equation of Exchange* (i.e., *M*, *V*, and *T*), before and during the inflationary spiral, instead of ascribing the price stability (or inflation) to the high (or low) level of public confidence created by the appearance and content of the coinage (e.g., Harl, 1996).

The rest of the article is organised as follows: Section 2 introduces the elements of economic theory that are most relevant to our analysis. Section 3 provides the historical context. Section 4 discusses the fiscal and monetary practices of the Roman government in the first three centuries A.D. Section 5 estimates an inflation proxy from the extant prices of Egyptian wheat from the same period. Finally, Section 6 offers a summary and conclusions.

2. Elements of economic theory

To dispel any misconceptions we must first clarify that the term *Gresham's Law* (mistakenly attributed to a statement made by Gresham in 1558) denotes the well-ascertained principle that is often - though not

equation as if it were a proper tool for explaining how a rise in the (monetary and non-monetary) supply of gold (not the total money supply, contra Whittaker, 1980, pp. 2-3) would mirror a rise in the overall quantity of commodities produced, and vice-versa.

[4] E.g., Paarlberg and Fisher *et al.*, who, as mentioned above, traced an average inflation rate spanning a century and a half, perhaps on account of broad comparisons between wheat prices 150-years apart, made by Jones (1953), Duncan-Jones (1990), and others. However, historians have, over the last decades, consistently suggested - though not in terms of compound annual rates - that prices rose considerably within a much shorter period of time, spanning perhaps the last three-quarters of a century or the last quarter of a century, e.g., Duncan-Jones (1982, 1990), Rathbone (1996).

adequately - expressed in the dictum "bad money drives out good money". The phenomenon was probably recognised as early as 404 B.C. by Aristophanes (§ *718-33*), while the issue was first discussed by Oresme (1360). In its complete form it may be stated as follows: when a government assigns the same nominal value to two or more forms of currency whose intrinsic values differ, payments will always (as far as possible) be made in the form of currency with the lower cost of production, and the more valuable (finer) form of currency will either tend to disappear from circulation or (in case the amount in circulation is not sufficient to satisfy the demand for currency) run to a premium (Kindleberger, 1993; Harris, 1987). According to Galbraith (1975), *Gresham's Law* stands as perhaps the only economic law that has never been challenged.

The *Equation of Exchange* (often referred to as the *Quantity Equation*) was first expressed by Locke (1691). Perhaps its best known variant is the one provided by Fisher (1922): $MV = PT$, relating the circular flow of money in a given economy over a specified period of time to the circular flow of goods, where M is defined as the total quantity of money in the economy; V represents the velocity of circulation (in the form of the average number of times a unit of currency turns over in the course of affecting a year's transactions); T is defined as the total physical volume of goods, services, and securities transacted for money; and P is the weighted average of prices of the items transacted in the economy. Consequently, the left-hand side of the equation stands for the money exchanged, and the right-hand side represents the goods, services and securities exchanged for money during the specified period of time. Obviously, although an important basis of monetary and macroeconomic theory, the *Equation of Exchange*, is not in itself a theory, but an accounting identity for a monetary economy (e.g. Bordo, 1987).

The above two concepts are clearly separate and very robust on their own. Consequently, they ought not to be confused or dismissed as some sort of modern theory or a collection of relationships and results pertaining to the highly monetised and industrialised economies, whose application in the Roman economy is perhaps questionable. Furthermore, with regard to *Gresham's Law*, currency debasements do not necessarily require that

(a) commodity prices have to increase or (b) all earlier and finer coins have to be withdrawn from circulation (so that their extra precious metal is extracted), for the principle to hold, as the reader of Rathbone (1996: 324-5,334,338) and Lo Cascio (1996: 283) may infer.

3. The historical background

The main historical developments pertaining to our study may be found in a number of specialised works dealing with the period under examination, such as that by Starr (1982). To ease the economist into the setting, we start by framing it in terms of an environment satisfying the assumptions of a simple macroeconomic model consisting of a monetised, largely self-sufficient agricultural society[5], with an almost-unchanging technology[6], a non-growing population,[7] and a labour force

[5] The received wisdom is that: (a) The Roman Empire was a *nearly-autarkic economy*, where foreign trade (confined mainly to some luxury items) played a rather insignificant role in relation to the size of the economy, especially as the volume and impact of foreign trade were probably reduced in the second and third centuries A.D. (b) The greater part of the Empire's labour force (perhaps 80-90%) engaged in low-level agriculture, and households lived slightly above the minimum level of subsistence, while industry depended, by and large, on a rather backward (by modern standards) technology. (c) The use of money, though well attested in the cities, is believed to have been less pervasive in the countryside, where the velocity of circulation was perhaps lower. See also Jones (1953, 1964), Hopkins (1980), Duncan-Jones (1982), Harl (1996).

[6] It appears that, for the most part, the conservative and practically-minded peasant society opted to disregard advances that could increase productivity (such as the generalised use of the water-mill, etc.) in favour of the standard centuries-old practices (Duncan-Jones, 1982; White, 1984); and those who held the pools of capital often exhibited little interest in the entrepreneurial exploitation of resources and technology (an enlightening example is offered by Suetonius §18). The picture is not entirely complete insofar as Wilson (2002) describes a number of impressive capital-intensive technological applications in the agricultural and mineral extraction industries (developed and employed in a number of localities during earlier periods) that were left to die out in the uncertain political conditions of the third century (which is, after all, the period in which we are primarily interested).

[7] The occurrence of recurrent epidemics suggests that regional populations frequently declined (Duncan-Jones, 1996), though population numbers need not have decreased simultaneously in all localities and regions (Alston, 2001). Hopkins (1980), Duncan-Jones (1982) and Harl (1996) take the position that the empire's population was never much larger than 54-60 million in the first three centuries A.D., so the likely patterns of high fertility are explained and treated in a manner that preserves the overall population stability hypothesis (e.g., Frier, 2001).

with comparatively little mobility (by modern standards), due to institutional factors[8].

At that time, the Roman Empire stretched over the Mediterranean and a large part of south-eastern and western Europe. Yet, unlike during the relative tranquillity of the first and second centuries A.D., the state's eastern and northern frontiers faced serious external threats[9]. The situation was compounded by internal political instability. Indeed, the fifty-year period from the end of the Severan dynasty (A.D. 235) to the accession of Diocletian (A.D. 284) saw no less than twenty-six emperors and almost as many unsuccessful claimants. Furthermore, in the 260s and 270s, the Gallic provinces and Britain broke away, and a large region of the east became independent. Eventually, the military campaigns of Claudius II (A.D. 268-270), Aurelian (A.D. 270-275) and Probus (A.D. 276-282), on the whole restored central control and border security, though a number of peripheral areas were evacuated and many urban areas shrank. Considering that almost every reign saw one or more uprisings, each ruler's concerns revolved primarily around securing the loyalty of the armies and defending the frontiers. As a result, other matters, such as those relating to economic development, received less

[8] Towards the end of the second century, the jurists elaborated a theory of *origo*, according to which every inhabitant of the Empire had a specific attachment, which he, by inference, was expected to support. In subsequent decades we hear of people becoming tied to their parental communities, occupations, the municipal offices of their birthplaces, and so on. See also Finley (1985), Duncan-Jones (1990).

[9] Following a tradition established by Augustus around 27 B.C., permanent standing armies were stationed by the frontiers. In time, these large military formations became more static and fragmented (which is partly attributed to the reorganisation of Septimius Severus (A.D. 193-211), aiming to discourage revolts by ambitious generals). This reduced the possibility of coordinated defence. The situation was further aggravated in subsequent decades by the removal of units due to civil wars as well as internal and external security concerns elsewhere. On the European front, in particular, the organisation of defences in the rear were by and large ignored in the first two centuries A.D., perhaps on account of army self-confidence. Consequently, once the relatively thinly-held frontier line was broken, the invaders could slice through the civilian hinterland virtually as far as they wished. From the mid-third century onwards, the development of a mobile reserve corps (ready to march on the somewhat restored road network to any threatened zone in order to deal with invaders that moved and fought on foot) brought about an enlargement in the total military force of the Empire.

attention[10]. The successive changes in government, foreign invasions, and separatist movements, disrupted economic life (adversely affecting production and trade), and destabilised the state's fiscal/administrative system[11].

Moreover, in order to pay for raising or replenishing armies and financing other deficits, the policy-makers and the various contestants to the throne engaged in currency debasements that allowed them to exchange a given weight of silver for more goods and services[12]. It has been suggested that the volume of such coinage perhaps increased seven times from 238 to 274 (Callu, 1975), but even if that were not the actual level, it is widely accepted that the influx of new silver issues tended to increase over time, especially in the third century (Hopkins, 1980; Rathbone, 1996). *Ceteris paribus*, a net increase in the money supply ought to produce inflation. This, in conjunction with a couple of currency changeovers that were attempted towards the end of the period, is believed to have deepened the public's loss of confidence towards the currency as a store of value, and affected a shift to barter transactions (and Rathbone, 1996, suspects that several late third-century hoards reflect demonetisation). At the same time, government concerns over the declining value of tax

[10] Though Probus is reported to have taken measures to encourage the planting of vineyards in one province or to involve the army in large-scale landscaping projects to improve fertility in another province. Then again, the assumption of these activities could reflect the serious economic difficulties that the Empire was going through at that time, and a dire need to restore its production capability.

[11] For instance, the maintenance of the principal road network that was necessary to hold the empire together defensively and economically was, by and large, left to lapse; and maritime inter-regional trade seems to have experienced a downturn (Hopkins, 1980; Starr, 1982; Butcher, 1996).

[12] Unlike the ancient Greeks, who resisted currency debasement, the Romans had resorted to this practice as early as the Punic Wars (Schwartz, 1973; Galbraith, 1975; Lo Cascio, 1996). There is some evidence that segments of the Roman public were reluctant to accept the new issues that the government was pumping into circulation through the payment of salaries. However, as *Gresham's Law* predicts, eventually they would opt to pay their dues to the state and to each other using the debased coins, and retain or store the older, more valuable coins as reserve money (if they did not divert their content to non-monetary uses). And the hoard-findings are consistent with this picture. See also Johnson (1936), Jones (1964), Galbraith (1975), Hopkins (1982), Casey (1996), Lo Cascio (1996), Rathbone (1996). Paarlberg (1993) and Harl (1996) provide examples of citizens actively joining the debasement process.

revenue (paid in terms of debased currency) are believed to have caused the authorities to insist that more requisitions be made (and taxes be paid) in kind, in order to feed and clothe a growing number of troops and civil servants, and finance government projects and services[13]. Considering that most of the peasantry already lived at subsistence level and engaged in few monetary transactions, while people in cities continued to trade in terms of money, we can infer that there was no wide reversion from a monetary to a demonetised economy. However, the proliferation of transactions in kind must have posed a number of efficiency challenges with regard to government[14] and economic performance[15]. Indeed, if the introduction of barter practices always leads to inferior economic results *vis-à-vis* the performance achieved in a monetary economy, then one ought to expect that even a partial demonetisation would affect adversely the level of total output. At any rate, the general impression from the above is that in the course of the fifty-year period of political instability, the

[13] Indeed, although the payment of state expenses in terms of debased silver issues (pegged to gold), allowed the government to profit by capturing the difference between the official face value and the (relatively) lower cost of production, this *seigniorage* was lost insomuch as the government accepted the debased silver coinage in taxation under the prevailing official rate of exchange for gold. Consequently, the government had good reasons - whether gradually or in very few steps (Jones, 1953) - to resort to requisitions in kind and the commutation of money taxes to levies in kind. However, the perception of a switch in the manner of taxation is not universally accepted. Harl (1996) suspects that the increased documentation of taxation in kind, may reflect not so much a change in policy, but rather the ruthless efficiency of imperial officials.

Taxation in kind had always been a part of the system, and, indeed, is quite feasible where delivery to the point of consumption is viable. So, as the formerly large military formations had been reduced in size and dispersed in the form of regional tactical units (footnote 9), perhaps it was relatively easy to supply them with locally-raised taxes and requisitions in kind (Jones, 1953; Whittaker, 1980; Duncan-Jones, 1982, 1990; Fulford, 1996). Casey (1996) and Fulford (1996) suggest that there existed considerable know-how in coordinating both the pay and supply of distant units from the regional headquarters (particularly given that total reliance on the resources of the immediate province was probably the exception rather than the rule in the first two centuries). However, in the course of the third century the situation probably changed, although the continued existence of the long-distance supply routes from the Mediterranean to the northern provinces is occasionally attested (Fulford, 1996). This would be consistent with the general decline of inter-regional trade (footnote 11).

[14] Indeed, if the use of money makes the command of distant resources easy, but the central authorities can no longer transfer significant amounts of money from one end of a large territory to another, then their control is likely to break down (Hopkins, 1980). In the case

empire probably experienced a contraction in terms of total output and real transacted output, *T*.

4. Fiscal and monetary aspects

In considering how the Romans viewed their currency and its function, LoCascio (1996) points out that they very much perceived it as something created by the State and which functioned as a unit of weight for the needs of the State[16]. Indeed, it was mandatory to accept the genuine coins that carried the imperial portrait, while the production of imitation or counterfeit silver and gold issues was illegal[17]. However, throughout the period under consideration (King, 1996; Harl, 1996), the production of

of the Roman Empire, considering that over 65% of imperial revenues came from the eastern provinces, while two-thirds of the army were stationed in the (relatively more exposed) western provinces, the fiscal problems for western administrators would become insoluble in the long run, even if the eastern administration sought to support the western in subsequent centuries (through the occasional provision of money, troops and heads of government.).

[15] Especially in the Roman Empire, where (a) taxes paid in terms of money are believed to have stimulated trade, and (b) government expenditure is believed to have constituted the engine that drove the economy (Fulford, 1996; Harl, 1996). The argument is that the rich tax-exporting provinces in the inner empire recovered the means by which they could pay taxes by selling goods to the frontier provinces (such as the later-monetised provinces in western and central Europe) where the armies were stationed, i.e., where the government directed most of its revenue and newly-minted, increasingly debased, coinage. Consequently, to the extent that the provision of armies came to rely on increased taxation or requisitions in kind from local or regional resources (instead of money-taxes) the volume of long-distance trade would decline (see also Hopkins, 1982; Fulford, 1996; footnotes 11 and 13). And if the economy grew more fragmented (as a collection of regional, more autarkic economies) then, on the basis of international and interregional trade theory, we ought to expect an overall reduction in prosperity over time, especially in the provinces whose trade with all other provinces was affected.

[16] There is also a view, expressed by de Cecco (1987, attributed to T.Mommsen), that the Roman coin had always been taken at its face value, whatever its weight, for it represented the chief testimony of the credibility of the Roman state. Perhaps, we should be somewhat cautious about such sweeping views, by considering that the embracement and usage of a progressively debased currency, by any public, may - to some extent - reflect the operation of Gresham's Law (particularly if the phenomenon of currency acceptance and usage is observed across time and space, even in societies where the credibility of the state is not high). The issue of public trust towards the currency is also touched on again in footnote 33 and page 621.

[17] And severe penalties were imposed on the perpetrators and those who harboured them (Jones, 1964).

illecit or unofficial bronze coins (even issues which by their size, fabric, and style were unlikely to deceive anyone) was tolerated for it facilitated transactions when supplies of official bronze coinage were not locally available, especially in the frontier provinces in Europe.

In surmising the currency needs of the state over time, we may follow the examples of Hopkins (1980), Starr (1982), and Harl (1996), and consider the extant reports and records pertaining to the largest budgetary item, namely, military expenses, which perhaps consumed about between one half and two-thirds of the state's annual income (Harl, 1996). Since the exercise rests on a small number of extant testimonies and modern conjectures, we should not be preoccupied so much with absolute sizes as with the broad trend. *Table 1* shows that the annual budget for legionary salaries probably rose slowly over the first two centuries, but picked up in the reign of Commodus (A.D. 180-92), whose nominal budget was perhaps twice as big as the corresponding budget of the first emperor, Augustus (27 B.C. - A.D. 14). By the end of the Severan dynasty (A.D. 235), the budget had doubled again; and at the time of Diocletian (A.D. 284-305) it had risen further, perhaps by about three to seven times, compared to the legionary budget required half a century earlier[18]. Indeed, the overall rise in the nominal needs of the Treasury was probably even more marked than the escalation in the legionary component, considering that (a) the number of auxiliary troops increased over time, while their pay-rise was proportional to that of legionaries (Starr, 1982; Alston, 1994)[19]; and (b) the size of administrative staff rose further in the reign of Diocletian. However, albeit indicative, much like other such conjectures and exercises on the matter, the estimated trend-pattern is also somewhat speculative[20].

[18] We also note that the difference might be higher (ranging between 4 and 10 times, instead) if Rathbone (1996) is right in that there was no army-wide pay modification by Caracalla (A.D. 211-7).

[19] Especially, if there were no substantial reductions in the relative size of the navy and elite forces budgets, which Starr (1982) estimates to slightly less than a quarter of the legionary budget in the early third century.

[20] Harl (1996) suspects that (a) the overall military budget for the land forces (i.e., including pensions, equipment and supplies, but excluding the navy) rose 3.5 times during the period A.D. 9-230; and (b) Diocletian paid out in annual legionary, auxiliary, and elite soldier salaries between twice and four times more money than Severus Alexander (A.D. 222-35).

By contrast, the Roman fiscal system was rigid. The main sources of revenue were a capitation tax, tributes assessed on property, *ad valorem* customs duties (all at fixed-rates), along with a five per cent succession duty paid by Roman citizens - part of which was probably withheld by intermediaries and never reached the state coffers (Harl, 1996). Consequently, if the total revenue did not vary much from year to year, but the state incurred occasional additional expenditure on account of military, infrastructural, ceremonial, relief or other circumstances (including occasional payments or tributes to neighbours - not to mention treasure stolen by enemies or lost in transport), and given that the Empire lacked access to financial institutions that could voluntarily offer private wealth to bolster its finances in emergencies[21], the Government had the following options: (a) to spend reserves it may had stored away, (b) to sell public property[22], (c) to confiscate the estates of the rich found guilty of some charge[23], (d) to raise tax rates[24], (e) to abolish tax exemptions[25], (f) to engage in compulsory purchases below market prices[26], (g) to come up with innovative ways of extracting revenue from the public[27], all of which could – of course – only go up to a point; and/or (h) to finance the difference by issuing more money in the form of its tri-metallic (gold, silver, bronze) currency. In the first two centuries A.D. the latter could

[21] Indeed, unlike post-feudal Europe (where the growth of corporate financing and private money-lending to kings is considered to have been a fundamental element in economic growth), the financial sector in the period under consideration was less entrepreneurial and developed.

[22] As Trajan (A.D. 98-117) and Marcus Aurelius (A.D. 161-80) are reported to have done.

[23] As Nero (A.D. 54-68), Domitian (A.D. 81-96), Septimius Severus (A.D. 193-211) and Caracalla (A.D. 211-7) are related to have carried out.

[24] As Vespasian (A.D. 69-79) is understood to have done. Caracalla's increase of inheritance taxes was probably reversed by his successor, Macrinus (A.D. 217-8).

[25] A step taken by Caracalla.

[26] As Caracalla is reported to have carried out. By the time of Diocletian, in nearly all cases, the procedure had taken the form of requisition without payment (Jones, 1953; 1964).

[27] Such as imposing the offer of golden gifts from the communities to the emperor, even under the pretence of fictitious victories, in accordance with an Oriental and Hellenistic custom to offer the victorious emperor gifts in the form of gold. See also, Jones (1953; 1964), Starr (1982), Harl (1996).

be achieved by (i) the acquisition of war-booty and a hitherto unparalleled exploitation of mines (Harl, 1996:)[28], (ii) the revaluation of existing currency, and (iii) the production of new lighter currency or debased currency[29] by (preferably) recycling older, finer issues. However, as access to large foreign treasures became no longer possible, the great mines were exploited to exhaustion, and foreign invasions further interrupted production (to the degree that even the province of Dacia, which was rich in mines, had to be evacuated in the 270s)[30], Roman governments were increasingly forced to resort to solution type (iii) (Jones, 1953; Duncan-Jones, 1982; Harl, 1996; Rathbone, 1996; Wilson, 2002). Indeed, judging from the findings of progressively debased coinage, the practice seems to have been the solution to which nearly all governments from A.D. 64 onwards, resorted[31]. However, there is no surviving account indicating what portion of circulating coinage was re-minted or what the velocity of its circulation was.

Numismatic analysis, concerning the reign of Nero (A.D. 54-68), suggests that he reduced the precious content of the widely-used high-

[28] However, it is unknown what amount was absorbed in non-monetary uses (by the private sector and the state) or forwarded to the mints.

[29] I.e., coinage that maintained the traditional weight but contained more alloys and less precious metal.

[30] According to Jones (1953), as long as the Empire held the province (A.D. 100s-270s), it possessed a steady stock of precious metals, with new production being balanced by wastage (Wilson, 2002; Harl, 1996) and leakages (e.g., Berger, 1996; Bland, 1996; Harl, 1996; van der Vin, 1996; etc.). However, Harl (1996) suspects that, by the time of the Roman evacuation, the Dacian mines were probably worked out.

[31] Though, in several instances (perhaps after the extenuating circumstances were thought to have passed), a number of Roman emperors sought to restore the currency to its previous level, e.g. Domitian (A.D. 81-96), Pertinax (A.D. 193), Macrinus (A.D. 217-8), and the elder Gordians (A.D. 238). Lo Cascio (1996) considers the attempts to reverse the debasement of the *denarius* as appropriate actions of aware governments aiming to forestall the general loss of confidence (and perhaps build confidence) in the coinage (and, maybe, their rule). However, we have to note that of the three second- and third-century governments mentioned above, only Macrinus survived a year; and the numismatic analysis of the coins issued by him reveals a bewildering range of fineness (Bland, 1996). Harl (1996) notes all three governments found themselves outbid for the loyalties of the army, and swiftly went down in ignominious defeat. He also suggests that the Antonine and Severan emperors may have sought to inspire confidence in their coinage through the choice of currency iconography and design.

denomination silver issue, the *denarius*, minted in Rome, from about 3.65 to 3.0 grams of silver, presumably to help finance his projects and war expenses. Yet the extent to which the production of new currency exceeded the number of earlier issues recycled at the mint and/or withdrawn (per *Gresham's Law*) is unknown. So, in theory, the overall level of money in circulation may or may not have increased. Successive debasements further reduced the coin's silver content; and in the reign of Caracalla (A.D. 198-217) it came to contain 1.66 grams of silver, that is, a reduction of 1.99 grams of silver since the issue's first debasement. Caracalla also introduced a further issue, (often termed) the *antonianius*, as a double-*denarius* with only 1.6 times as much silver as the debased *denarius*, i.e., about 2.65 grams. His successors either switched from one denomination to the other or continued to produce both denominations[32]. The last to do so was Gordian III (A.D. 238-244), who issued some series of *denarii* containing 1.46 grams of silver, but for the most part struck *antonianii* of declining fineness, initially containing 2.19 grams of silver, then 1.98, and finally 1.73 grams[33]. The archaeological findings suggest that the new denomination ousted the old denomination from circulation, and that the quality of the *antonianius* deteriorated further. Indeed, the *antonianii* issued by Gallienus (A.D. 253-68) came to contain 0.16 grams

[32] On the basis of numismatic evidence, Hopkins (1980) suggests that, at the time, the monetary unity of the Empire almost disintegrated. In fact, he points to comparisons in the weight and fineness of first and second century coins from the city of Rome and the provinces which reveal that provincial silver coins were cheapened roughly to the same extent as, and sometimes before, silver coins minted in the city of Rome, as is the case in a coordinated monetary policy. However, this is not the case with several series of the third-century coins. Harl (1996) suggests that attempts were made to maintain uniformity in the 250s and 260s.

[33] Bland (1996) notes that, from about A.D. 238-40 onwards, and unlike the fashion of earlier-dated hoards, the *antonianii* show up in hoards with *denarii*. So he suspects that perhaps the latter were no longer treated as better stores of values to be removed from circulation, which - in turn - suggests that (by then) the *antonianii* commanded a more realistic tariff (perhaps valued at one and a half *denarii*). If that were so, and the production of more *antonianii* no longer affected (via the operation of Gresham's Law) the withdrawal of extant earlier issues, then perhaps the money supply did increase. On the other hand, the withdrawal of both *denarii* and *antonianii* may reflect the introduction of even baser *antonianii*.

of silver, and those of Claudius II (A.D. 268-70) about 0.10-0.04 grams. This corresponds to a reduction of 2.15 grams in the silver content since the issue's introduction[34]. As the state was effectively using copper to produce its 'silver' issues, it ceased issuing bronze coinage, and in many places in the eastern provinces, the age-old tradition of minting local silver issues came to an end[35].

As the Gothic invasions affected the evacuation of Dacia in A.D. 270-1 and exacerbated the situation, Aurelian (270-275) formally called in all previous silver issues in order to re-mint (presumably large amounts of)[36] a new series of silver-plated bronze coins, (often termed) the *aurelianianius*, with a silver content of 0.19 gram. It was an unconventional step that had the dual advantage of (a) resolving the immediate fiscal problems by extracting precious metal out of the 'silver' currency held by the public (unless only low-grade *antonianii* were turned in), and (b) affecting a homogenisation of the various series of currencies that had been issued over the ages and possessed

[34] It is likely that the drastic debasement reflects a disruption in the supply of silver caused by Frankish, Gothic, Moorish and Persian invasions or the decline or cessation of mining operations due to other reasons (Whittaker, 1980; Harl, 1996; Wilson, 2002). Indeed, a severe shortage in the production of Spanish silver in the western part of the empire would fit with the picture provided by King (1996) apropos the dearth of coinage leading to the production of forged *antonianii* during A.D. 260-285 with semi-official sanction or tolerance.

[35] These were supplanted in the 250s-270s by debased *antonianii*, coming out of new state-mints, the establishment of which has also been taken as reflective of the difficulties and costs in the supply of coinage from the central mint, and indicative of the urgent cash needs of the frontiers. At any rate, the suspension of many local currencies in the eastern part of the Empire, perhaps inadvertently, deepened its integration in terms of currency areas. However, the all-important mint in Alexandria in Egypt carried on issuing its own silver issue, the gradually debased *tetradrachm*, until the reform of Diocletian in the mid-290s, at which point the coin not only went out of production but also lost its status as legal tender (and given that it does not appear in hoards with post-296 coin, one suspects it was probably recycled at the Alexandria mint). Consequently, it is quite likely that Diocletian's reform would be perceived in Egypt as a currency changeover, which - in turn - may have produced a transitory inflationary effect that is reflected in the extant local prices. See also: Bowman (1980), Sutherland (1992), Butcher (1996), Harl (1996), Howegego (1996), Rathbone (1996).

[36] For how else would he replace all the money issued (whether circulating or stored) over the centuries?

different sizes and content. However, as the pressure on the mints led to a strike, it is doubtful whether the old issues were eventually demonetised in the way and scale Aurelian envisioned. Indeed, it is doubtful whether the reform was fully effected in the western provinces (Jones, 1964; Sutherland, 1992; Harl, 1996); Rathbone, 1996) suggests that damage to the credibility of the old issues led to their devaluation in relation to the new silver and gold issues, although there is also evidence that older issues survived as stores of value down to the time of Diocletian (Butcher, 1996). At any rate, as the reform was intended as a currency-changeover, it is conceivable that it caused (or contributed to) some confusion[37], and uneasiness regarding the use of currency. Consequently, the incident may have contributed to the adoption of barter practices by a segment of the population (Harl, 1996).

Aurelian's assassination initiated a new round of revolving emperors which ended in 284 when Diocletian ascended to the throne and engaged in a new set of reforms. In particular, he:

1. sought to provide a stable government by setting up a (diarchic and subsequently) tetrarchic, non-hereditary system which he coordinated, with each colleague concentrating on the security and stability of a specified territory, he himself securing the eastern region;
2. carried out an empire-wide census and prepared an annual budget (the first in history, according to Jones, 1964). In particular, he took measures to consolidate the fiscal changes and experiments of the previous century by systematising the state's assessments and requisitions in kind, whereby the tax-surpluses from one sub-region (province) were fed to another within the same region (diocese) in order to supply or reimburse state troops and officials in wheat-rations instead of money, while any residual surplus (in the form of gold and silver coinage, and - in certain circumstances - products) was passed to the central Treasury (Fulford, 1996);

[37] Which was perhaps accompanied by some short-term inflation - especially if the rounding up of commodity prices in the wake of the 2002 euro-changeover is any guide.

3. undertook a massive programme of building and reconstructing defensive works programmes on all frontiers that were to be held by sheer force of numbers. At the core of the military machine was a (newly established or enlarged) central-reserve corps which allowed Diocletian to tackle insurgencies, repel foreign invasions and reclaim Mesopotamia. However, the army's relative immensity (compared to the army-sizes of the first two centuries A.D.), in all likelihood, also put a strain on the manpower of the Empire[38]. Perhaps it is in this context (as the economy reached its production and tax-yielding limits) that the government sought to ensure or freeze its production structure by attaching the free peasants of earlier eras to the land as serfs, and others to their occupations and civic functions (see also footnote 8);
4. increased the numbers of administrative staff to (a) ensure a more detailed supervision of affairs in the (subdivided, newly established) ninety-six small territorial units of the Empire, and (b) run the new sophisticated regional and sub-regional system that monitored and directed the monetary and in-kind revenues and expenses, as well as the output of state factories of arms, textiles, etc.[39];
5. sought to restore confidence in the monetary transactions by reforming the chaotic state of the currency, and providing a united currency. So

[38] Yet, there is a debate as regards its pattern of growth. For instance, Starr (1982) suggests that Diocletian nearly doubled the Empire's military forces from about 300,000 men (which was as large a total as the empire's early third century resources could support without undue stress) to about 500,000. On the other hand, Harl (1996), though aware of even higher figures for the size of Diocletian's army, puts forward a lower estimate: he suggests that the Roman army numbered between 300,000 and 330,000 under the Julio-Claudians, between 360,000 and 400,000 under the Flavians and Antonines, between 450,000 and 470,000 under the first Severans, grew larger in the fifty-year period of political instability and civil war, and that its size was brought down to the Severan level (perhaps between 430,000 and 450,000) by Diocletian.

[39] The process involved more supervision than the collection of money taxes (as there were more problems over quality, quantity and delivery) and the collection of taxes in kind during earlier eras (see footnote 13, end of the first paragraph). Consequently, we ought to expect an increase in local bureaucracy (for instance, more accountants), even if the references to wheat-rations and the other taxes-in-kind (which did not require the supervision and delivery of vast amounts of goods) were merely a sophisticated system of paper transactions and local schemes for subsidised food.

without formally recalling the *aurelianiani*, Diocletian set out in A.D. 293-296 to issue new gold and silver coins of good quality, actually marked with their weight. Apparently, the fineness of the silver issue (perhaps called, the *denarius argentus* or *argentus nummus*) was raised to the old Neronian standard. It is therefore conceivable that he also aspired to recreate the old tri-metallic currency system, though he probably lacked sufficient precious metal to produce gold and silver issues in large numbers. To acquire the necessary metal he would have to somehow 'unfreeze' the stores of gold and silver held by private individuals and temples and, indeed, he appears to have levied a number of dues to be paid in gold – a policy that was followed by his successors too (Jones, 1953; 1964; Hopkins, 1980; Whittaker, 1980)[40]. However, on the whole, he probably financed the state deficit expenses, associated with his other policies, by minting significant quantities of new silver-plated and plain bronze issues through an expanded network of 15 mints. Numismatic analysis suggests that his silver-plated issue, perhaps called the *denarius communis*, contained 0.4 gram of silver, i.e., approximately 2.5 times more than the original *aurelianianius*. On the whole, there is little doubt that the economy of Diocletian's reign was a monetised, interconnected economy (Starr, 1982; Hendy, 1985; Sutherland, 1992; Harl, 1996)[41].

4.1. Assessing the monetary aspects prior to the reign of Diocletian. Having obtained a good picture of the Empire's circumstances and policy development, we draw attention to the following aspects.

Although the state budget appears to have increased over time, we are not certain of its size and composition. In all likelihood, requisitions

[40] Jones (1953) and Bowman (1980) also give a very nice example, dating to A.D. 306-8, of how this worked. Bowman (1980) and Bagnall (1985) suggest that Diocletian may have set the gold and silver issues at an artificial peg, whereby the *denarius argentus* was overvalued in relation to the uncoined silver (or perhaps the gold issue was undervalued compared to uncoined gold and silver?).

[41] This is well illustrated by the discovery, in the westernmost province, of bronze coins from Diocletian's reign, minted before and after A.D. 295-6, from nearly all the mints of the empire (Abad, 1996).

in kind grew in importance, especially in the fifty-year period of political instability and the civil war that preceded the reign of Diocletian. However, the production of more currency (debased or not) suggests the presence of imbalances between monetary incomings and outgoings; while the production of debased currency, in particular, implies a dearth of sufficient amounts of newly-mined precious metals and/or perhaps some economising by the state via the recycling of the existing monetised stock of precious metals (amassed through taxation or confiscation). Indeed, it is conceivable that currency debasement was the most attractive option to policymakers to finance the state deficit.

Throughout the long debasement period, the authorities did not alter the long-standing peg between the new 'silver' coins and the gold pieces[42], until it was abandoned by Aurelian (A.D. 270-5). Thus, in theory, the debased 'silver' issues could be exchanged for the same number of gold pieces, as if they were as good as the old silver coins. However, in practice, through the operation of *Gresham's Law*, this policy induced the diversion of gold from coinage to plate and jewellery. So it is not surprising that, at some point, the Treasury ran out of gold and could not support the minting of proper gold coins on several occasions. Indeed, it appears that some governments did not strike gold coins at all, and gold coins became scarce[43], while other governments resorted to arbitrary confiscations and new ways of extracting gold from the public to build up state reserves, until Diocletian and his successors formally levied a number of dues to be paid in gold.

In addition to triggering the transfer of gold to non-monetary uses, the repeated debasements of silver currency also drove successions of earlier, less-debased silver issues out of circulation (perhaps, as stores of value that commanded a premium), until, as Galbraith (1975) observes,

[42] Though they, too, did become lighter.

[43] Jones (1953; 1964), Whittaker (1980), Sutherland (1992). Consequently, even the gold issues found in hoards ought to be considered as prestige objects and gifts rather than currency - not to be fitted into a series of declining weight and purity gold currency standards (Bland, 1996). In other words, at some point after A.D. 235, the government split the functions of its gold issues from its 'silver' and copper coinage (Harl, 1996).

the Empire effectively converted from a tri-metallic monetary standard to a (nominally silver, yet) bronze monometallic standard.

As the actual production of bronze currency was, for the most part, discontinued by the authorities in the second half of the third century until Diocletian's reform, we need not attribute any surge in the price levels from the 260s to the 280s to a rise in the supply of low-denomination bronze currency[44].

We cannot quantify how much silver (or gold) coinage was supplied by any one emperor. Consequently, we can only write in impressionistic terms of heavy or light minting of certain issues by particular emperors. The money supply would tend to increase to the extent that the regular payment of salaries to the military and civil service personnel necessitated the production of debased silver currency (for, undoubtedly, a part, possibly an increasing part, could be paid – and was paid – in kind), However, the recycling of earlier issues at the mint in order to produce the debased coins out of the existing stock of currency, and/or the withdrawal from circulation of previous, finer issues, in accordance with *Gresham's Law*, would counterbalance – partially or wholly – the initial increase in the money supply.

At any rate, it is possible that, over time, there was a gradual increase in the stock of coinage in circulation (Rathbone, 1996; Harl, 1996), even if not all of it was genuine and accepted by the state. However, to the degree that government salaries were by and large directed to army personnel stationed in the later-acquired, sparsely populated, previously non-monetised or least monetised, frontier territories of the empire, the impact of an increase in the money supply would be tempered by the relatively low velocity of money in the particular provinces[45]. Consequently, perhaps we should not expect significant rises in the left-hand side of the

[44] We may hypothesise that the overall stock of bronze coinage in circulation remained more or less constant, and did not decline (although bronze issues were more likely to be lost compared to more valuable issues, e.g. Reece, 1996), for if the public's (presumably constant) needs in a province were not satisfied by the supply of genuine bronze issues, forged coins would circulate until such time as genuine issues re-entered the province.
[45] The issue of velocity is separate from monetisation, which – incidentally - may have occurred to a larger extent than in previous centuries, e.g., in Egypt (Rathbone, 1996).

Equation of Exchange (i.e. the sum of weighted regional products of *MV*) before the share of population engaging in very few transactions declined on account of (a) the loss of the outer/peripheral imperial territories, and (b) the abandonment of money, especially overvalued currency, by infrequent/unaccustomed users, especially about the time of Aurelian's reform. Both developments would affect a rise in the average number of times a typical unit of currency was used, and perhaps took place within the 50-year period that preceded the reign of Diocletian, especially as the crisis deepened.

The contraction of the Empire, along with the devastations and the disruption in production brought by foreign invasions and civil war, the fragmentation and regionalisation of the economy and the decline in interregional trade, in conjunction with the expansion in barter transactions, ought to have brought about an overall reduction in the physical volume of goods and services transacted for currency. In conjunction with a rise in either *M* or *V* or both (or even if the left-hand side of the *Equation of Exchange* did not rise much), this would necessitate an escalation of *P*. So, perhaps we should expect the inflation to occur at a time when the above conditions prevailed, which is the fifty-year period that preceded the reign of Diocletian, especially when the situation deteriorated.

Indeed, there are sufficient indications of price surges for a number of goods in the 270s-280s (Johnson, 1936; Rathbone, 1996).

4.2. The reforms of Diocletian. As already mentioned, Diocletian took steps to provide internal stability, security and domestic production, which probably allowed the economy to grow, and then operate at full capacity. So, perhaps, we ought to expect that the economy enjoyed a period of escalating total output until it stabilised. He also carried a number of expensive, defensive and administrative reforms. If a substantial part of the salaries associated with these programmes was directed in the form of monetary payments to recipients (such as administrators and the central-reserve corps) living in cities and provinces where the velocity of circulation was above the average, then the monetary expansion would produce a rather obvious rise on the left hand side of the *Equation of*

Exchange[46]. Consequently, although M would continue to increase, the conditions might yield an ambivalent effect (or no effect with regard) to the direction of P, up to the time that the overall production of the Empire (including T) reached its upper limits. In this respect, Rathbone (1996) notes that prices in Egypt were stable during the early period of Diocletian's reign, up until the mid-290s. At any rate, the received wisdom is that, overall, the overwhelming and unprecedented increase in the money supply (especially 'silver' and bronze issues) in the reign of Diocletian eventually brought about pronounced price increases (Schwartz, 1973; Duncan-Jones, 1982; Harl, 1996).

But this is not the full story; though the second part of it is perhaps not widely known or recognised for its inflationary impact. In 301, Diocletian apparently issued a Currency Edict, effective from 1 September, doubling the face value of the silver and copper issues (Erim *et al.*, 1971; Whittaker, 1980; Bagnall, 1985; Lo Cascio, 1996; Rathbone, 1996; Harl, 1996; and the literature mentioned therein). Perhaps he hoped to raise the purchasing power of his (military and administrative) staff or make the possession of these coins more attractive and influence the 'unfreezing' of the outstanding precious metal (gold) that was held in private stores[47]. Nonetheless, what he achieved was to double the money supply in one single stroke. With V and T nearly fixed in the very short term, the only variable left to absorb the shock within the *Equation of Exchange* framework was P. Rathbone (1996) maintains

[46] This might be further induced if the Treasury retrieved less currency due to (some or considerable) commutation of money taxes to levies in kind. According to Jones (1964), a greater portion of the budget involved stored non-monetary surpluses. We also note that Diocletian's monetary expansions did not involve debasements. Consequently, they did not generate the simultaneous, yet opposite, *Gresham Law*-type currency withdrawals that tended to soften the inflationary pressures of the monetary expansion of previous Roman governments.

[47] Such an intent would be consistent with the overall policy of extracting gold from the public via alternative means (footnote 27). If the author of the Edict aspired to affect or induce the return of hoarded gold back to the market, which the government could then purchase in exchange for the 'high value' coins it had created by imperial fiat, then the attempt should probably be considered as the most imaginative in a long succession of earlier and subsequent government endeavours.

that the prices of several goods jumped up immediately afterwards, as a consequence of the Edict[48].

So, in late November - early December of 301, Diocletian attempted to counter the inflation by setting (a) price ceilings through a Price Edict, covering 900 commodities, 130 grades of labour and various freight rates, and (b) the death penalty for the transgressing buyer and seller (Frank, 1936; Walbank, 1951; Jones, 1964; Lauffer, 1971; Schwartz, 1973; Barnes, 1981; Duncan-Jones, 1982; Paarlberg, 1993; Harl, 1996)[49]. A number of economic historians have noticed that the Edict's prices of commodities against gold maintain an astonishing, even suspicious, stability compared to those of much earlier eras (Whittaker, 1980); and that the stipulations of the Edict do not allow for regional variations, seasonal fluctuations, wholesale and retail differentials, and are incompatible with transportation costs[50]. So it is conceivable that, at the very least, the Edict's price figures (a) served as indicators of what the administration would pay for goods and services to supply the army and the court, and (b) were intended to secure the compliance of state-purchasers and government suppliers, thus 'inoculating' the government from the inflationary effects of its Currency Edict.

One suspects that the price ceilings were set below the equilibrium levels of prices in a number of urban, and therefore monetised, centres

[48] Rathbone (1996) is also of the opinion that the reform (the third in a row after Aurelian's and Diocletian's 293-295/6 currency reform) destroyed the currency's credibility and perhaps amplified the public and private tendency to revert to a non-monetised economy in the fourth century.

[49] The action was not very coordinated for society (Harl, 1996). Whittaker (1980) notes that the language employed in the preamble (attacking extortionate prices by profiteers who strip soldiers of their pay) provides evidence not only of the persistence of inflationary pressure, but also that the market refused to accept the soldiers' coins at their face value. On the other hand, a scapegoat would have to be invented, especially if the government's military salaries had failed to keep pace with silver coinage prices (Whittaker, 1980; Duncan-Jones, 1990).

[50] See Duncan-Jones (1982). In considering the Edict's sea transport rates for 57 specified trips between five named ports in the eastern half of the Empire and every port in the Mediterranean, he concludes that the sea transport cost figures of the Edict are so low that they appear unrealistic in view of what is known of the slowness and ineffectiveness of Roman shipping.

in the east (such as Nicomedia, Diocletian's headquarters). This is consistent with the testimony of Lactantius (§ 7.6-7), who had served in Diocletian's court, that the goods disappeared from the market. Consequently, it is quite likely that the law soon turned into a dead letter[51]. Indeed, the policies of (a) increasing the money supply to pay for more salaries (thus, effectively pushing up the aggregate demand schedule) and subsequently doubling it by imperial fiat, while (b) setting price ceilings, are economically inconsistent – although this was unknown to the Roman policymakers of the time.

As a final point, we should probably expect price levels to increase in at least three stages: (a) in the period of political instability; (b) in the period of Diocletian's restoration and policy-driven monetary expansion; and (c) in the wake of his instant monetary expansion (through the Currency Edict). We now turn to the price data.

5. The estimation of a price inflation proxy from the accounts of Egyptian wheat

As students of economic history are well aware, the calculation of inflation rates from antiquity is subject to a number of limitations. First and foremost, we do not deal with figures collected at regular intervals through representative and properly weighted statistical samples. We do not even have very many prices from various centres or annual prices to review.

[51] It is unclear whether the Price Edict was even promulgated in the western part of the Empire for no fragments of it have been found there, although Diocletian issued it in the name of all his colleagues. One would think that the West was also affected by the initial doubling in value of the *denarius*, given that the legal claim of a civilian or an official at a shop or a tavern for the new purchasing power of his *denarius* ought to be as valid in Marseilles as it was in Antioch. And if the Price Edict was intended to provide consumer protection, the circumstances were such as to warrant its application, publication and reproduction throughout the Empire (indeed, the clarifications would be most zealously plastered and quoted everywhere). However, if the Edict was primarily intended to provide instructions for a small number of imperial financial officers and regional Treasury department heads, then perhaps less durable copies would suffice. It is also unclear as to whether the Price Edict was enforced after Diocletian's retirement in A.D. 305. At any rate, a papyrus dated A.D. 335 gives a wheat price 63 times higher than the wheat price mentioned in the Price Edict.

The only plentiful source of commodity prices is Egypt, the famous bread-basket of the ancient Eastern Mediterranean, on account of the recovery of a good number of ancient records written on papyri and ostraca, dated by the archaeologists[52]. Thus, to derive a measure of the price change, it is necessary for us to rely on commodities whose prices are encountered several times in the records, and this happens mainly with wheat. Unfortunately, wheat prices were prone to seasonal fluctuations and local price variations. On the other hand, wheat formed the basic diet of the vast majority of the people, and was the largest item in their food bill, while it reportedly exhibited little variation in quality – which is not the case with other goods such as wine, oil, and meat, or real estate (Jones, 1953; Duncan-Jones, 1982; 1990; Rathbone, 1996; Harl, 1996).

The surviving data on wheat prices come from a variety of sporadic sources, years apart, such as a list of a day's private transactions in Lower Egypt, an officer's account of purchases (that might be below market prices) in Upper Egypt, and so on. To get a sense of the trend, we take the average price encountered in a specific year, construct an average for a three-decade period (thus reducing the effect of seasonal or transitory fluctuations), and compare it to similar averages over time. The method of index-construction is slightly different from other attempts, though the

[52] There is some doubt about the representative aspect of Egyptian prices in relation to the rest of the Empire. Indeed, for a long time Egypt formed a different currency area (see footnote 35), though (a) as Rathbone (1996, following E.Christiansen) shows, the silver *tetradrachm* imitated the debasement of the *denarius*; and (b) as Duncan-Jones (1982) points out, Egypt's trade with the other provinces ought to have brought about some price correspondence (if not equalisation). Rathbone (1996) goes to some length to argue that Egypt was not so exceptional a province but was an integral part of the Empire's economic system; and one has to take into consideration that it was home to perhaps about 10-12% of the Empire's population (Harl, 1996). I am inclined to accept the notion that the Egyptian price trend for wheat would not be atypical (even if Egypt exhibited some of the lowest wheat prices in the Empire due to the abundant local supply) on the grounds that the rough rate of price changes at the place of an item's origin is likely to be replicated at the place of its consumption (especially considering that the item was essential for consumers and, therefore, did not indicateany elasticity of demand). This is not to say that the price changes in other commodities (which would also largely contribute to inflation) in Egypt and elsewhere in the Empire were mirrored in Egyptian wheat prices. However, the finding is consistent with the general impression and received wisdom that about this time other provinces experienced inflation.

body of data is by and large the same. We also note that this kind of data may at best help us recover a very crude proxy of price levels and changes.

According to the extant set of prices, usually given in Greco-Egyptian *drachmas* per *artaba*[53], it seems that, on average, the price of wheat generally rose very slowly. Indeed, from the reign of Augustus to the mid-second century, the estimated annual rate of 'inflation' was probably less than 2% (certainly below the 5.6% rate purported by Paarlberg), and it possibly rose to about 8.6 - 8.8% for the rest of the period under consideration (though the Edict's price-ceiling may actually be a conservative or low price). Consequently, we are inclined to revise the perception of a modest inflation, and conclude that the rate of the inflation-proxy in Egypt during the later part of the third century, although not extreme, was at least serious, and quite comparable to the serious inflation experienced in the industrialised countries in the 1970s and early 1980s (Parkin, 1987). However, a more detailed consideration of the events indicates that prices probably doubled within the last trimester of 301. The consequential adjustment of inflationary expectations and the resultant prolongation of price increases would certainly be perceived as disturbing by contemporaries.

6. Summary and conclusions

It seems that throughout the first three centuries A.D., Roman governments financed their deficits through the production of more money. Modern estimations of that era's inflation rely on a very small sample of extant prices, especially the prices of wheat coming from Egypt, so we ought to be cautious of the results. A number of economic analyses have produced a view that the inflation was prolonged, though modest, between 3.6% and 5.6% P.a. However, a period-by-period treatment of the same evidence suggests that the phenomenon was much shorter in

[53] The *artaba* used to be a common grain-measure in ancient Egypt, equivalent to 3.33 *kastrensis modii* or 22.41 kilograms in Alexandria. The Greco-Egyptian *drachma* was equivalent to ¼ of a *denarius*. It was subdivided to six *obols* before the third century and to seven *obols* thereafter (Johnson, 1936; Jones, 1953; Duncan-Jones, 1990).

duration (appearing in the last quarter of the third century) while its rate of 8.6% - 8.8% would be considered serious by modern-day standards. A more detailed consideration of the events suggests that prices probably doubled and the inflation rate perhaps exceeded 100% during the last trimester of A.D. 301.

To summarise the situation, we bring together in *Figure 1*: (a) the chronology of the government's rising legionary expenditure (based on *Table 1*) to get a sense of the evolution of the size of the state deficit and the need to issue more money; (b) a rough outline of the successive debasements in the silver coinage; and (c) the evolution of the extant and dated wheat-prices from Egypt (based on *Table 2*, though for illustrative purposes we provide the pre- and post-Currency Edict prices of A.D. 301 separately). The nominal rise in military expenditure and the successive debasements (which facilitated the production of more coinage) underscore the chronic influx of new currency from the late second century onwards. However, it is highly likely that the consecutive increments in the quantity of (new) money circulating in the economy were counterbalanced, whether partly or wholly, by the operation of *Gresham's Law*. In addition, as government spending was for the most part directed (in the form of salaries) to armies stationed in the less-monetised provinces in the periphery, where the velocity of money was in all likelihood low, the left-hand side of the *Equation of Exchange* may have changed little or not at all. This could help explain the low rate of pronounced price increases in basic goods in the course of the first two and a half centuries. Consequently, both the currency debasement and the changes in the size of the state budget were probably not highly correlated to the long-term price inflation, at least until the last third of the third century.

It would appear that, at the time, devastations caused by civil wars and foreign invasions (which led to loss of production and infrastructure and the decline in inter-regional trade), along with a rise in barter transactions, adversely affected the physical volume of transactions, *T*. This development would have certainly stimulated price increases, within the *Equation of Exchange* framework. Other factors that could have further boosted price increases are (a) an increase in the velocity of circulation, a slight or modest rise of which is conceivable; and/or (b) an

influx of currency (by the government or rival governments), which has to be explained in terms of (i) pay-rises, (ii) pay-compensations for equal reductions in provisions in kind, (iii) an expansion in the number of administrative staff, (iv) an expansion in the size of the army. Of these, item (i) is unattested, (ii) and (iii) seem unlikely during the climax of political instability or anarchy, and (iv) is plausible (even somewhat attractive) in that it allows for Diocletian to have found a larger-than-usual standing army instead of nearly doubling it (alluded to in footnote 38). In short, we propose that the price increase that transpired a few decades prior to the reign of Diocletian ought to be attributed to a decline in T, and, perhaps (unmeasured, though conceivable) rises in V and M.

In the reign of Diocletian, the restoration of internal security and production capacity led to more output and, possibly, to more transactions. However, directing large amounts of newly-minted currency, in the form of salaries, to areas where the velocity of money was higher (as armies were established or redeployed in more monetised areas and a new and larger government bureaucracy was established in urban centres), would eventually induce a rise in price levels, which is the generally agreed cause of this ancient inflation. However, this is not the whole story. A monetary reform that instantly doubled the money supply in A.D. 301 brought about (hyper-) inflation. Diocletian sought to contain it later in the year, by issuing a severe Price Edict. Nevertheless, the measure was insufficient, given that it neither addressed nor hindered the economic forces producing the phenomenon.

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Appendix

Economic Environment, Policies
and Inflation in the Roman Empire
up to Diocletian's Price Edict

TABLE 1: Estimations of the annual legionary expenses during the 1st - 3rd centuries A.D. in order to determine the pattern of change

	Emperor	Reported annual pay of a legionary soldier (in *denarii*) (1)	Estimated annual cost of a legion (in thousand *denarii*) (2)	Reported number of legions (3)	Estimated annual cost for the legions (in million *denarii*) (4) = (2) x (3)
1	Augustus (27 B.C. – A.D. 14)	150 → 225	559 → 838	28 → 25	15.6 – 20.9
2	Tiberius (14– 37)	225	838	25	20.9
3	Claudius (37– 41)	"	"	27	22.6
4	Nero (54-68)	"	"	28	23.4
5	Domitian (81-96)	250, 300	930 – 1117	"	26.0 – 31.2
6	Trajan (98-117)	"	"	30	27.9 – 33.5
7	Antoninus Pius (139-61)	"	"	30-33	27.9 – 36.8
8	Marcus Aurelius (161-80)	"	"	30	27.9 – 33.5
9	Commodus (180-92)	300, 375	1117 – 1396	"	33.5 – 41.8
10	Septimius Severus (193-211)	400, 450, 500, 600	1489 – 2234	33	49.1 – 73.7
11	Caracalla (211-17)	600, 675, 750, 900	2234 – 3351	30-33	67.0 – 110.5
12	Severus Alexander (222-35)	"	"	34?	75.9 – 113.9
13	Maximinus Thrax (235-38)	1200, 1350, 1800	4468 – 6702	"	151.9 – 227.8
14	Diocletian (284-305)	7500, 12400	4654 – 7695	68	316.5 – 523.2

continue

continued

TABLE 1: Estimations of the annual legionary expenses during the 1st - 3rd centuries A.D. in order to determine the pattern of change

Note: According to this exercise, the annual legionary budget in the reign of Severus Alexander was perhaps between 3.6 and 5.4 times larger than the corresponding budget in the later period of the reign of Augustus and the reign of Tiberius. Despite the different point of departure in terms of assumptions and figures, Harl's (1996: 219) estimate of the annual legionary budget in A.D. 230 is 3.6 times larger than the corresponding budget of A.D. 9.

Sources:

i. Figures in column (1): The lower value in row 1, the higher value in row 9, and the values of 500 and 750 in lines 10 and 11 respectively, are based on Frank (1936: 86). The value in row 2 and the higher value in row 5 are based on Frank (1936: 86), Jones (1953: 295) and Alston (1994: 115). The lower value in row 5 is given by Casey (1996: 115). The lower values in rows 9-11 are based on Starr (1982: 87). The high values in rows 10-13 are given by Alston (1994: 115) and Bland (1996: 68), which are based on the rates provided by M.A.Speidel. Jones (1964: 623) considers the high value in row 13 to be a low estimate for the reign of Diocletian and provides an estimate of 7,500, and Duncan-Jones (1990: 116) an estimate of about 12,400. The other values are based on Alston (1994: 115).

ii. The calculations in column (2) are based on (a) Starr's (1982: 87) estimate of 2,234 *denarii* as the cost of a legion for a year in the reign of Caracalla, and (b) on the assumption that officers' pay-raises were proportional to those of soldiers earning 600 *denarii*. Alternatively, in considering Casey's (1996: 115) calculations of the probable cost of Hadrian's Wall garrison in terms of the lower-figure payment rate in row 5, it would appear that at the turn of the first century, the annual cost of a legion might be circa 1,300 denarii. However, at this stage (given that we are interested in the trend) it makes no difference which of the alternative aggregation measures is used as the basis for our calculations, as long as it is consistent. Following Duncan-Jones (1990: 114-6,214-6), the legionary unit in row 14 is taken to be 1/6 in terms of size compared to earlier legions, although officer-soldier differentials could be lower in the reign of Diocletian.

iii. Figures of column (3): The numbers in rows 1, 6, 8 and 10 are based on Starr (1982: 110). The lower figure in row 11 is implied by Starr (1982: 87-8) and the higher figure by Frank (1936: 86). The numbers in rows 2 and 7 (the higher figure) are given in Lewis and Reinhold (1955: 490-2). The numbers in rows 3 and 4 are based on the formation of the *XV-XXII Primigenia* and *I Italica* respectively, and the number in row 4 is cross checked with Harl (1996: 216). The lower figure in row 7 is based on Parker and Watson (1992: 591), and the numbers in rows 12 and 14 on Jones (1964: 59).

TABLE 2: Egyptian wheat prices in Greco-Egyptian drachmas per artaba, 18 B.C. – A.D. 301

years		prices	years	prices	years	prices	decade	average price	estimated annual change)
B.C.	18	9.3	78	10.0	154 mean	8.0	B.C. 1 - 10s	4.64	
	13	4.0		10.0	155	8.0			0.8 %
	10	2.5		10.0	160	7.1	A.D. 0s - 20s	5.66	
	9	2.5	78 mean	10.0	162	8.0			0.1 %
	6/5	1.9	79	8.0	169/70	20.0	30s - 50s	5.95	
	5	8.8		11.0	191	18.0			1.0 %
	4	3.5		11.0		20.0	60s - 80s	9.16	
		3.5		11.0	191 mean	19.0			2.2 %
		3.5		11.0	192	18.0	90s - 110s	12.00	
4 mean		3.5	79 mean	11.0	246	24.0			- 1.5 %
			99	16.0	250	20.0	120s - 140s	7.45-7.61	
A.D.	3	3.0	99/100	16.0	253 or 256	16.0			1.5 %
	16	9.0	99 mean	16.0	254?	12.0	150s - 170s	11.87	
	22	5.0	100	8.0	255	16.0			1.4 %
	33	3.0		7.0		24.0	180s - 200s	18.50	

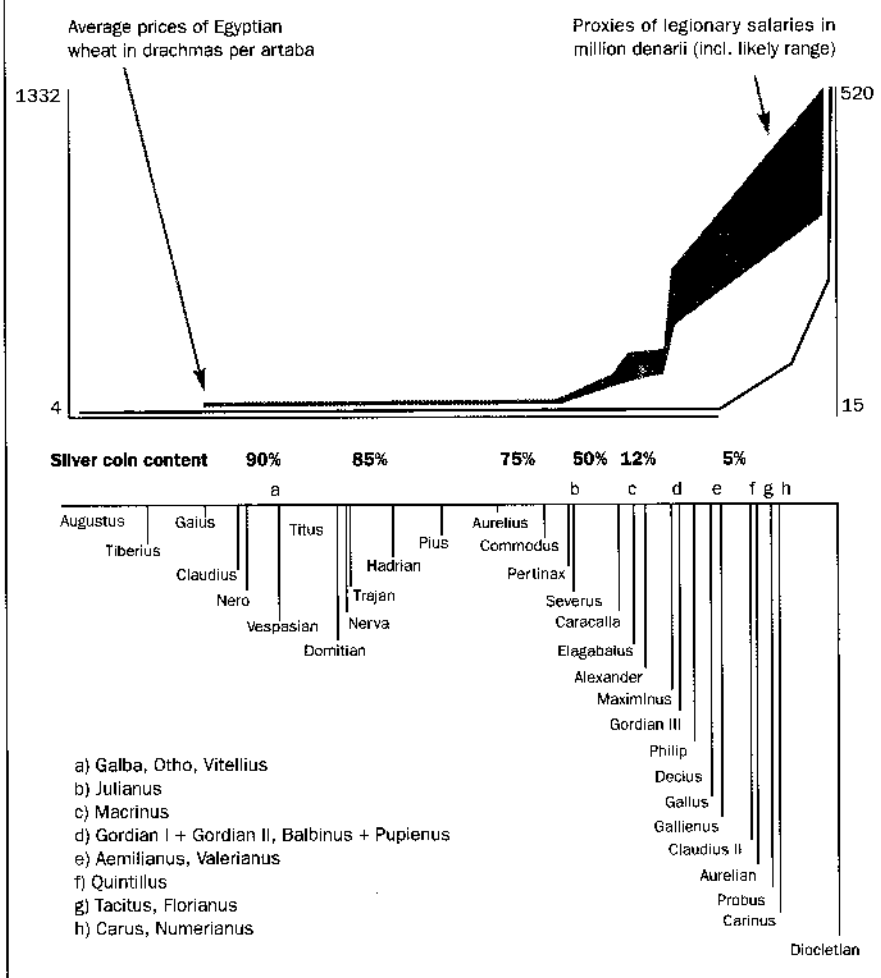
continue

continued **TABLE 2: Egyptian wheat prices in Greco-Egyptian drachmas per artaba, 18 B.C. – A.D. 301**

years	prices	years	prices	years	prices	decade	average price	estimated annual change)
45/6	4.4		9.0	255?	20.0			
	5.7	100 mean	8.0	255 mean	20.0	210s - 230s	...	
	7.3	112	12.0	256	12.0			
	7.6	124	9.0	260	12.0	240s - 260s	19.00	
	8.0	125	7.1		16.0			8.8 %
	8.0	128	8.0	260 mean	14.0	270s - 290s	240.00	
	8.0	137	8.0	269?	24.0			8.6 %
	8.0	138	5.6?	276	200.0	301	982.00	
45/6 mean	7.1	149	7 or 8	293	300.0			
47	8.7	152	8.0	294	220.0			
56	5.0	153	24.0?	301	640.0			
65	2.2	154	8.0		1332.0			
68	13.8		8.0	301 mean	982.0			
70	8.8		8.0					

Source: Most of the above prices are listed by both Duncan-Jones (1990: 151-4) and Drexhage (1991: 13-8) except for the following: The last two prices for 45-6 A.D., the first price for 79A.D. and for 100 A.D., along with those for 99, 99-100, 128, 137, 149, 152, 154, 155, 162, 246, 293, and 294 A.D. are provided by Duncan-Jones; the last two prices for 255 A.D., the first for 260 A.D., along with those for 5 B.C, and 22, 68, 70, 125, 160, 169-70, 250, 253-6 A.D.are provided by Drexhage. The price for 3 A.D. is provided by Preisigke and Bilabel (1915: # 7341), that of 33 A.D. by Wilcken (1899: # 1372), the second price for 100 A.D. by Grenfell and Hunt (1901: #133); that for 138 A.D. by the Italian Society of Papyri Research (1912: 281); the low price for 301 A.D. by Rathbone (1996: 239) and the high price for the same year, listed in the Price Edict, by Jones (1953: 295,299-300) and Bagnall (1985: 28). Most of the prices dating from 45-6 to 269 A.D. are mentioned in Rathbone (1996: 239), though a few are placed at slightly different dates.

FIGURE 1. Wheat prices, legionary costs (and likely ranges of cost), the precious content in silver coinage, 1st-3rd centuries A.D.



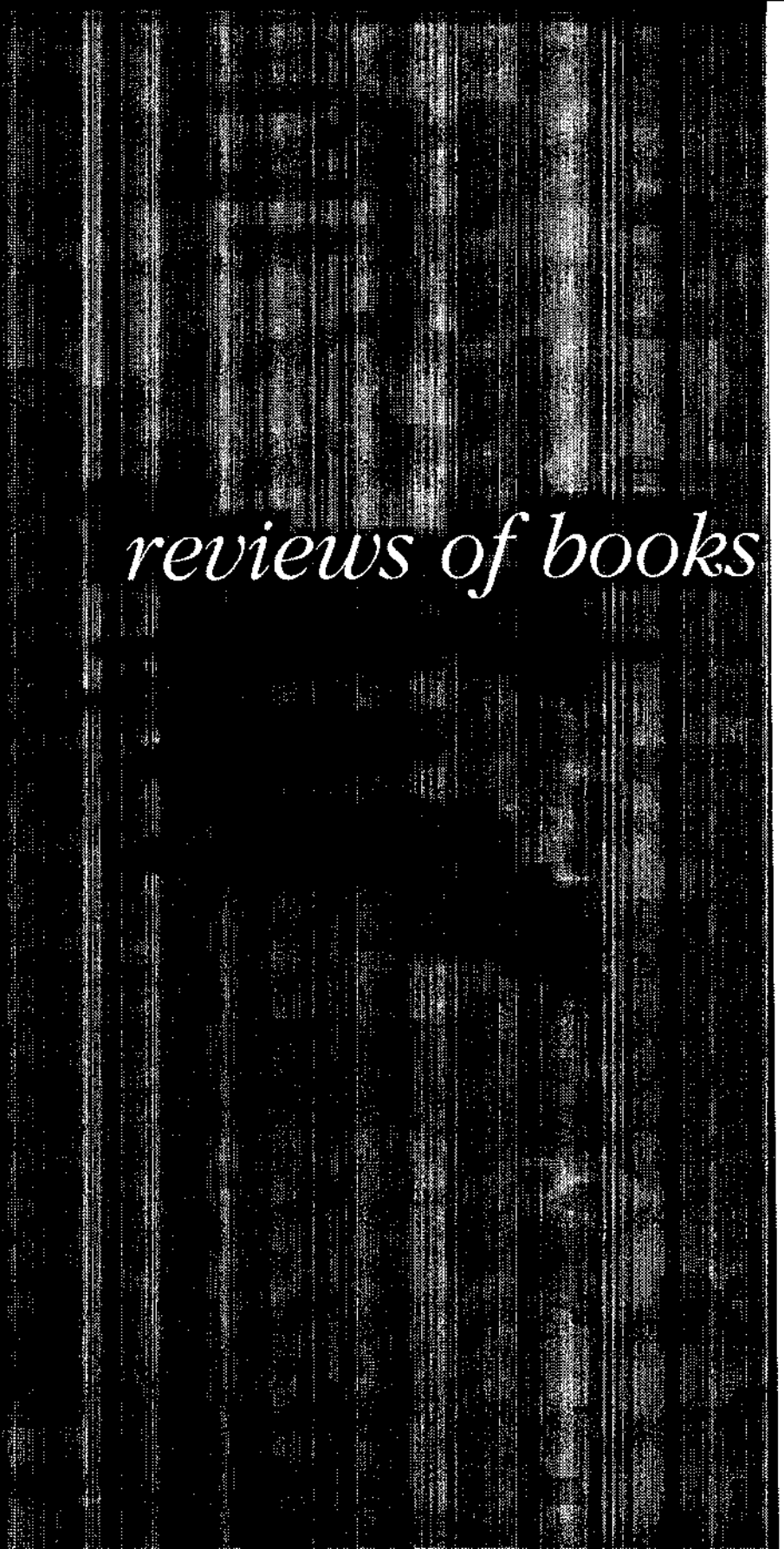
Notes:

i. The average prices of wheat are set out on the left-hand vertical axis. All values are based on the penultimate column of Table 2, except for the two pertaining to 301 A.D., which are separated in order to depict better the change in the last trimester.

ii. The proxies and range figures of legionary costs are set out on the right-hand vertical axis. The values are based on the estimates of the final column of Table 1.

iii. The silver coinage fineness provided in the form of a percentage, below the graph, is approximate and pertains to the average fineness of the issues minted in Rome. The values are based on the sources mentioned in footnote 1.

iv. The horizontal axis denotes time and provides the succession of emperors from Augustus to Diocletian.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