

## INDEX

For named coin hoards, the number in italic refers to the list on pp. 261-8. For the few hoards below not in that list, references are given in the notes.

```
Aartrijke hoard, 35
                                                 Allerton hoard, 133, 194n
                                                 Alpine region, 72
Abergele hoard, 194
abrochos, 252
                                                 Ambenay hoard, 1
accession minting, 127, 134, 138, 142, 238-40
                                                 Amphictionic coinage, 155n; die productivity,
accession dates and coin hoards, 86-7, 89, 90
                                                      163
accusers, see delatores
                                                 Andalucia hoard, 85
Acre hoard, 70
                                                 Annecy hoard, 24
Adamclisi hoard, 195, 194n
                                                 annona civilis, 58
                                                 Antaeopolis, 50, 57, 58
adclamationes, 15n
Aelius Caesar, father of Lucius Verus, 18;
                                                 Anthemius, 172n
    early death, 88; estimated die totals, silver
                                                 Antioch, era, 59n; heavy aurei under
     types, 152, 153-4; gold types, 155-60;
                                                      Elagabalus, 101, 213n
                                                 Antium, 8, 36, 39n
     obverse and reverse silver dies, 154-5;
     Concordia, tr. pot. cos.II, 151-3; Pietas,
                                                 Antoninianus, see radiate
     tr. pot. cos.II, 151-3; Concordia trib. pot.
                                                 Antoninus Pius, 77; grants immunity, 4n;
                                                      building, 14; alimenta, 14; handouts, 14,
     cos.II, 151, 155-60; Pietas trib. pot.
     cos.II, 151, 155-60; cross-strikings, 151
                                                      88, 91, 249-50; tax-remission, 59n, 60;
Aemilius Saturninus, 56
                                                      surplus, 14; minting, annual variation,
aerarium, 43
                                                      126, 141; dual minting standards, 109,
Africa, 6, 12, 25n, 37, 38, 41n, 54, 103, 172;
                                                      243-4; minting for Empress and princess,
                                                      131; die study, 160n; coinage decline, 14,
     Imperial estates, 55; taxation, 55; coin
     hoards, 74, 74n, 85n, 132n; coin finds,
                                                      101; gold, silver and bronze parallel for
     low correlations with NW Europe, 132-3
                                                      five years, 131-2; sestertius, reduced
agents provocateurs, 6n; soldiers, 6n
                                                      weight and zinc-content, 187, 236-7;
Agri Decumates, 76n
                                                      silver fineness, 224, 227; minting in
Agricola, will, 7
                                                      Egypt, 30, 211
Akandzilar hoard, 219
                                                 Antony, Mark, plunders temples, 9n;
Alba Iulia hoard, 170, 194n
                                                      legionary denarii allowed to survive, 105,
Albacete hoard, 84
                                                      196–7; silver content, 200; some reminted
Alban legion, 257
                                                      in 160s, 197; cistophoroi, 170
Albani, 44
                                                 Apamea, 61
Aldborough, stray finds, 106n
                                                 Apetlon hoard, 144
                                                 aphoros, 253
Alexander, Ti. Iulius, decree, 6n, 54, 58
Alexander the Great, coinage, 155n
                                                 Aphrodito, 50, 57, 58
Alexandreia Troas, 254
                                                 Apollo, gold offerings, 9
Alexandria, 51; tax-privileges, 4n; fiscus
                                                 Apollonopolite Heptakomias, 49, 50, 56n
     Alexandrinus at Rome, 177n; temples,
                                                 aqueducts, 11, 18; cost, 41
     9n; mint, 28, 30n; minting discontinuous,
                                                  Aquitania, 76n, 121n
                                                 a rationibus, 103n
     211n; deteriorating fineness, 233; weight
     more stable, 233n; some coin produced
                                                 archives, commercial, 20n
     for use in Syria, 174-5n; see also Egypt
                                                 argenteus, 213n
alimenta, 13, 14; payment suspended, 4n
                                                 aristocracy, loans, 4n, 24; expenditure, 24; see
allaĝe, 48n
                                                      also senators, knights
```



INDEX

Arles mint, 172n Armenia, 44 army, 78; size, 34; cost, 3, 33-7, 45-6; pay-increases, 12, 29, 32, 33-5; payments, 196; cutbacks, 12; discharge-bonuses (praemia), 35-6, 78; suspended, 4n; or limited, 11; their cost, 11, 35-6, 78n; payment in kind, 29; veteran colonies, 36-7; recruitment, 29, 33; outside Empire, 94; annual intake, 35; furlough, 84n; retirement, 84; Rhine, 99; Danube, 99; Gaul, 83; coin ownership, 70n; pay promotes coin circulation, 121; recycling coin, 176; underweight hoards, 246-7; coin preferences, 83; see also donatives, legions, auxiliaries, Praetorians, urban cohorts Arnouville-lès-Gonesses hoard, 231, 132n, 186n aroura, 53n Arrius Menander, 33 Arsinoe, 52; record-office, 61 Arsinoite nome, 48n, 49, 50, 51, 52, 54, 56, 57, 58n, 62, 252, 253n Artemis, 8 Arverni, 108n as, 178n, 236 Asia, temple offerings, 9n, 106; bread prices, 26; garrison, 34, 106n; taxation, 47n, 59n; customs dues, 52n, 61-2, 254; Asian treasury at Rome, 177n; currency, 28, 177n; coin hoards, 74; Sulla's war-indemnity, 254 Asiana, 50n asporos, 253 Asturia, 103 Athens, 14n; gold coinage, 155n Aubenton hoard, 96, 121 Augustus, 77; takes assets from temples in Rome, Italy, Egypt and Greece, 9, 9n; seizes Egyptian wealth, 6; sales of bona damnatorum, 6; sells off State land, 22; censuses, 59n, 61n; large scale spending, 4, 18; congiaria and donatives, 39, 40, 79, 249; army praemia, 35; gifts, 42n; refuses aurum coronarium, 7; lending, 22-3; temple-offerings, 4; legacies, 4, 11, 40; short of funds, 5n, 11; melts down his silver statues, 10; publishes accounts of Empire, 19n; mints in Rome, Spain and Lugdunum, 99, 100; obverse and reverse die counts, 155n; cistophoroi, 155n, 170; aureus weight, 216; denarius weight, 219-20; 'restored' aurei under Vespasian and Trajan, 117n; 'restored' denarii and sestertii under Nerva, 196; Suetonius and coin type, 98 aureus, at first 40 to pound, 213; weight

285 reductions, 100-2, 215-19; see gold coin, Nero, Titus, Domitian, Trajan, Commodus, Didius Julianus, Pescennius Niger, Caracalla, Severus Alexander, Antioch aurum coronarium, 43, 87; from Italy, 7; from Gaul and Spain, 7; Arabia, 7n; regular payment, 7 Austria, 88 Autun hoard, 43 auxiliary troops, pay and numbers, 34, 36, 40 average, median and mean, 219n Avezé hoard, 208 Babylon, ancient, payments in kind, 20; silver payments, 20; tetradrachms of Alexander, Baden Baden hoard, 224, 194n balance of payments with Far East, 103-4, 206n; Pliny's figures high, 111-12; in Renaissance, 103n Baltic, 93n banks, small size, 3; local banking monopoly, 219n; see also temples, money-changing Barger Compascuum hoard, 178 barley payments, 49, 56, 57, 58n barter, 20, 33, 108; probably widespread, 20; in ancient Babylon, 20; in India 20n; Dark Age, concealed, 20n; Egypt, 32; see also payment in kind, tax in grain Barway hoard, 75, 194n Bath, coin finds, 232, 132n Bazaurt hoard, 112 bebregmenē, 253 Beck Row hoard, 94, 200n, 201n, 220, 221n, 240, 247 Bela Reka hoard, 165 Belene hoard, 190 Belgica, 76n, 121n Belgium, gold hoard, 59, 68, 131n, 159, 160n, 161n, 168n, 206n, 215n, 216, 218n; contents, 181n, 182; weight loss, 181-3; regressions, 181 Benha hoard, 188 Benkovac hoard, 8 Beograd hoard, 29 Bezanovo hoard, 141 Bithynia, 24n black market in coin, 219n Bletchley hoard, 168, 185n, 240 BMCRE, 134n, 135n, 147n, 153, 173n, 189n, 213n, 220n, 222n Boeckh pound, 213, 214, 215, 221n Boljetin hoard, 98 bona damnatorum, 6n, 10n, 11n, 22, 25n; Hadrian and, 43n Bononia, 9n; fire at, 18

booty, 13, 94, 99



286

INDEX

border tribes, 44; see tribes property, 10, 108n; deficit, 11; refunds Börgend hoard, 220 tribute, 4n, 44n; halves praemium, 36; Borlesti hoard, 184 seeks gold, 103; statues destroyed, 10n; bronze coin melted down, 98; hoard, borrowers, 24n, 23-5; see credit, lending Boscoreale hoard, 233, 69n, 120, 121n 200n; denarius weight, 221n Callaecia, 103 Boston hoard, 111 Canterbury mint, 260, 261 Boudicca revolt, 221n Braccianese, via, hoard, see Rome 3 capita, 58n Capitol, Rome, 8, 10n, 12, 18; cost, 42; Braga hoard, 40, 119, 131n, 181n, 206n bread, see prices African, 9n Bredgar hoard, 4 Cappadocia, garrison, 106n; revenues, 11, 46 Brescello hoard, 145n Caracalla, army pay increase, 15, 33, 35, 104; Briatico hoard, 9 increases civilian handouts, 15, 90, 250; brigandage, 78 donatives, 36n, 81n; congiaria, 79, 81, 90, Brigetio hoard, 56, 206n, 208n 249; building, 16; doubles 5% taxes, 16; new taxes, 16; extends citizenship, 16; Briglands hoard, 175 Bristol hoard, 198, 69n, 127n, 128n, 153n, increases subsidies, 45, 93n; crown 194n, 196n money, 16; minting under Severus, 135-8; as Emperor, 138-40; limited accession Bristol mint, 260, 261 Britain hoard, 217 minting, 138; brings in radiate, 97, 138-9; Britain, 22, 88, 89, 106, 121n; revenues, 46; almost half silver-output in face value, coin hoards, 68n, 74, 75, 76; its denarius 139; circulation effects, 138; reduces silver hoards as working sample, 201-5; little content and gold weight, 101, 117n, 138, gold, 76; bronze coin curtailed, 108; 217, 218; weight of aureus, denarius and survival of denarii of Republic and radiate, 216, 218, 222; silver fineness, 222, Antony, 196; counterfeiting, 198; see also 224, 228n; coins per type, 139-40; Britannia, Trajan, Hadrian male/female ratios, 139, 141; little minting Britannia asses, found in Britain, 178n in Egypt, 30; Dio and plated gold, 97, 98 bronze coin, 233, 236; regional patterns, 108, Carnuntum, 72; hoard, 147 121, 174, 174n; very uneven, 132-3; Carter formula, 144n, 149-50 wastage, 129; production peaks different Carthage, tax-privileges, 4n from precious metal, 129-30; Renaissance Cassius Longinus, C., 9, 257; his widow, Junia parallels, 131; stray finds, 131; amount, Tertia, 7 169; reduction in zinc content, 236-7; Castagnaro hoard, 67, 194n Castle Bromwich hoard, 157, 194n rationale, 236-7 Brussels, 153n Castro do Avarelhos 1 hoard, 80 Brutus, M. Junius, 257 Castro do Avarelhos 2 hoard, 81 Buchen hoard, 26 Castronovo hoard, 31 Budge Row hoard, 234, 201n Causevo hoard, 221 budget, Imperial, 33-46; amount, 45-6; censor, 61n provincial revenues, 46, 53, 253-5; before Cephallenia hoard, 166 and after Pompey, 253; new coin too Cervena hoard, 108 Ceylon, 3 little to cover expenditure, 112 buildings, 16; cost, 41-2, 45; size, 41; luxury Chadwell St Mary hoard, 207 Chalcedon, 63n materials, 42; reconstructions, 41; see also change, long-term: local shrinkage in bullion outflow, 103-4, 111-12, 206n; see also cultivated area, 58; lower tax-rates, 56-8, subsidies 63; see budget, fineness, debasement, weight standards Byzantium, 61 Chatti, 87n cadmea, 236 Cherbourg hoard, 3 chersos, 253 Caerleon I hoard, 14 Caerleon 2 hoard, 156 Chester, stray finds, 106n Caesarea hoard, 27 Chester mint, 260, 261 Caesarea, Tiberian minting, 25n Chichester hoard, 131 Cailly hoard, 50 childlessness, aristocratic, 7 Caligula, 39, 67; condemnations, 6, 17, 108n; China, and embassies, 44, 93n; and Roman seizures of property, 6n, 7, 108n; sells trade, 103n



INDEX 287

chōmatikon, 48n Chronicle of 354, 79, 248-50 chrysargyron, 62n Cicero, 53, 58 Cinto Caomaggiore hoard, 88 circulation, see coin circulation circulation speed, 18on, 191-2, 212n; see also timelag, coin circulation Cirencester, stray finds, 106n cistophoroi, 150-1, 155n, 170 civil war, tax impact, 56 Claudius I, 39n, 77; gives immunity, 4n; and delatores, 6n; building, 11; condemnations, 11; gold crowns, 7, 43n, 108n; tax-concessions, 61; as censor, 61; congiaria, 79, 87, 249; donative, 87; statues, 10; and arena, 6n, 248n; coinage, 100, 150; denarius weight, 221; 'restored' aurei under Trajan, 117n; sestertius-weight, 186n, 236; imitation bronze circulates, 198n; impromptu silver-mining, 103n; minting in Egypt, 211; tetradrachm seriously debased, 100 Claudius II, 115 Cleopatra VII, deposits money, 8; robs temples, 9 client kingdoms, 44 Clodius Albinus, 17; hoard, 93n, 176n; coins per type, 135n Clunia hoard, 22 Cogeces hoard, 91 Cohen catalogue, 147n; and RIC1, 123n, 135n, 152, 158n, 173n coinage, in short supply, 21, 23, 25, 32, 108; often ignored by authors, 97; viewed in moral terms, 98; manipulation by State, 5; and propaganda, 97-8, 105, 127, 136, 138, 177, 199n, 212; struck for new Emperors, 98, 127, 134, 138, 142, 238-40; for private individuals, 98; target for destruction, 98; worn, 98; motifs, 97, 98, coinage anomalies, 102; market indifference, 102, 195n, 198n coin catalogues, 173n; concordances 173n; see also BMCRE, Cohen, RIC coin circulation, 52, 106-8; slow, 28n, 31, 82n, 85n, 86, 90; in Egypt, 28n; civilian and military sites similar, 106; effect of mint location on coin distribution, 108, 121-2, 174; impact of ending of army-supply, 108; circulation termini, 117n; regional discrepancies, 120-2, 132-3, 173-4, 201n;

and army pay, 121; see velocity of

coin, counterfeit widespread, 20, 22, 108, 198

coin denominations, see aureus, denarius, sestertius, radiate, as, semis, quadrans,

circulation, mobility

tetradrachm, didrachm, drachma, cistophoroi, Lycian drachma, argenteus, solidus, stater, darics, cyzicenes coin dies, 144-67; see also die productivity; sample studied, 151; size, 151; die counts for silver types, 152, 154; estimated silver die total, 153-4, 165; die counts for gold types, 158; estimated gold die totals, 159; fixed totals per type, 109, 159-62; high output and low output types, 158-9; die use uneven, 110, 162, 166; obverse and reverse die totals, 110, 129n, 154-5; reverse dies defined striking capacity, 155, 162; a little silver struck from gold dies, 110, 151, 160; die populations otherwise distinct, 166; gold dies few and of high quality, 166; negative binomial 'k' for Hadrianic gold, 158n; for Hadrianic silver, 152; for Crepusius denarii, 150, 150n; migrant dies, 175n; finds in Gaul and St Albans, 175n; medieval dies ('piles' and 'trussels'), 260, 261; republican, 154-5; Greek, 155n coin, Egyptian, see Egypt, tetradrachms coin frequency patterns, 144, 145 coin hoards, 67-94; samples studied, 67n, 68n; as evidence, 29, 108-9; historical implications, 83-4; as basis for extrapolation, 153n; theories of origin, 77; need to reinterpret, 77, 78; and trade, 93n; and insecurity, 77; dates, 180n; chronology, 72, 79; close to accession dates, 86-7, 89; internal chronology, 93n; some later than end-date, 93, 185; 'short-run' hoards, 102; Republican, 77, 78n; burial and retrieval, 82-3; amounts, 79, 81; composition, 68n; internal similarities, 83, 113-16; lack of premium coin, 83; single denomination, 68, 82; size clusters, 68, 76; smaller hoards, 67n, 68n, 256; circulation hoards, 67, 83; savings hoards, 67, 83, 198; geography, 72-6; plentiful in frontier provinces, 78, 85; British denarius sample, 200-5, 68n; Eastern, 67n, 74, 88n; Egypt, 30n; outside the Empire, 44n, 67n, 68, 92-4; compared with Empire hoards, 92-3; and congiaria, 78-82, 84-90; correlations, 80, 81n; as payments, 81-2; and army sites, 83-4; and continuous occupation, 83n; underweight denarius hoards, 245-7; vestigial bronze component, 68-9n; vestigial Eastern component, 82n, 175n; weighted towards later coin because of wastage, 115; compensation formula, 115n; hoards and stray finds, 115, 118-20; underlying patterns similar, 118; bronze, 67n, 82n



288 INDEX

coin output, see mint output coin ownership, mixed denominations, 69-70 coin, payment in new, 8; from temple treasure, 9 coin populations, reconstructing, 144-71; extrapolation techniques, 144-50; die count available normally very incomplete, 144; reconstruction requires two parameters, 144; see die productivity, coin dies, negative binomial distribution coin, shortage of bronze, 22; dwarf, 22; diverse weight, 3, 102n coin, stray finds, 71-2; 106n, 115, 117-20 coin transmission, 20n, 106-8; and government spending, 106; coin minted for use in another currency zone, 174-5n coin types, matrix, 147, 147n; as markers in mint output, 97n, 140; productivity, 134-7, 139-40; possible rotation, 178; content, 97-8, 177-8, 178n coin volume, see volume coin wear, 20, 180-92, 204, 210; linear rates, 181; see weight loss Colchester, hoard, 228, 135, 138, 194n; stray finds, 106n collybus, 70n Cologne hoard, 235, 153n Colosseum, 12, 42 columns, 42n Commagene, rich want Roman rule, 6n; tribute refund, 18, 255; becomes tributary again, 12; gifts to, 44; revenue, 255 Commodus, see also Crispina; coming of age, 89; new taxes, 14; spending, 14; expropriations, 14-15; plunders temples, 9n; executions, 15; and delatores, 15; subsidies, 15, 44; overspending, 15; powerful Prefects, 105n; and Colossus, 10n; statues destroyed, 10n; congiaria, 79, 89-90, 248, 250; and coin hoards, 89-90, 94; minting ratio under Marcus, 141; accession minting, 238, 239; reduced minting at Rome and lower standards, 97, 101, 102, 105n, 123, 189, 227; his denarii already lighter under Marcus, 241; denarius weight, 222; fineness, 224; annual variation, 126; lighter aureus, 218; male/female ratio, 126, 126n; sestertius, reduced weight and zinc-content, 236-7; intensive minting in Egypt, 30-1, 106n; tetradrachm lighter and more debased, 233; metal shortage, 104 computer, programs, 258-9; 123n, 144n, 145, 145n, 147, 148, 149n, 150, 152, 159, 167n, 171n, 260; databases, 67n, 109, 145; modelling, 144n, 149; see also MLP condemnation of wealthy, 5, 5n, 11, 15, 24; in Alexandria, 6n; trials, 25; Emperor's

congiaria, 18, 23, 39-41; chronology, 79, 82; at accession, 86-7; recipients privileged, 40; numbers, 249; amounts, 248; cost, 248-50; and donatives, 40, 78n, 86; and coin hoards, 78-82, 84-90 Connecticut, 146 Constantine, 172n Constantinople, and Egyptian wheat, 58 Contres en Vairais hoard, 6 copper, 236, 241; see also mines Coptos, 52 Corban hoard, 149 Corbridge hoard, 36, 127n, 131n, 159, 160n, 168n; weight loss, 181-3, 192; weights, 182, 206n Corné hoard, 52 corn-dole, 3; recipients, 40; see also plebs frumentaria Cos, 4n, 61; temple banking, 8 Cosa hoard, 236, 180n, 219n costs, building, 41-2; African, 41n; Imperial budget, 45-6; subsistence, 46n; see also prices counterfeiting, 20, 22, 108, 198; plated coin, countermarks on coin, 98n Covasint hoard, 125 Coventina coin find, 237, 132n Coyanca hoard, 30 Crassus, M.Licinius, 9 credit, private, 3-4; crisis under Tiberius, 11, 23-5, 32 Crepusius denarius issue, 82 BC, 144; numbered dies, 149; used to test extrapolation formulae, 149-50; negative binomial estimates relatively efficient, 150; decline in die productivity, 162n; uneven productivity, 166n; coin samples, 170; see coin populations, negative binomial Crispina, 126n, 140; Dis Genitalibus die study, 151n crown gold, see aurum coronarium crown land, see land Cubii, 44 Cuicul, 37 Cumae hoard, 16 cumulated hoard-analyses, 70-1, 208-9 Cunetio hoard, 238, 145n customs dues, 14, 51-2, 58, 61-2, 254; see tolls Cyprus, see Larnaka cyzicenes, 70n Dacia, 13, 44, 88, 94n Dalmatia, gold-mines, 99, 100n, 103

damnatio memoriae, 10n, 98, 221n; see also

statues

involvement, 5; as beneficiary, 5n;

accusations encouraged, 5; in provinces, 6



INDEX 289

Danube provinces, 74, 75, 76, 77, 87, 92-3, 94; 99, 175; coin finds, 196, 197 Darfield hoard, 202 darics, 70n DDR, 72 debasement, 28, 29n, 223-45; price impact, Renaissance, 29n; Byzantine, 99; Claudius, 100; Nero, 100; Trajan-Elagabalus, 101; and government spending, 103; and metal-supplies, 103; causes, 104; followed by increased minting, 104; causes currency crisis, 98-9; see also fineness debt, reform, 21, 21n; called in, 24; see also borrowers, credit Decebalus, 44 decennalia, 88, 90 delatores, 15; punished, 6 Delhi, Sultan, 42 Delphi, 9n Delta, 52n denarius, weight, 213, 219-23, 225; fineness, 204, 223-32; Severan, and market, 219n depopulation, rural, 58-9, 104n desiccation of land, 58n Diarbekir hoard, 240, 127n, 131n, 159, 161n, 173, 206n dichoenicion, 48 Didius Julianus, 68n; reduces aureus weight, 218n, 239 didrachm, 231 dies, see coin dies die productivity, 163-7; ancient and modern, 155n, 162; comparative figures, 163-4; Greek, 163; medieval, 163, 164n, 260-1; minting experiments, 163-4; estimates, 163n; limited range of possibilities, 163-5; order of magnitude, 164-5; productivity lower for marginal issues, 165n; set production-targets and restricted productivity, 166, 109, 162; die use uneven, 110, 162, 166 die studies, silver, 151-5, 167n; gold, 129n, 155–60 Dimbau hoard, 132 Dio Cassius, and army pay, 33-5; and senatorial pay, 37-8; and coinage, 97, 98; and gold, 219n; Vespasian's taxes, 12; Caracalla's taxes, 16 Dio Chrysostom, and land, 54 Diocletian, 50; Price Edict, 25n, 200n; indictions, 61; taxation of Egypt, 63n, underweight argentei, 213n discharge-bonuses, see army Dolaucothi, gold mine, 76n Dolna Orehovica hoard, 191 Dolni hoard, 93 Dombresson hoard, 62

Domitian, finances, 12n; buildings, 12; their cost, 40-1; raises army pay, 12, 46; date, 87n; military cutback, 12; pays for land, 44; cancels tax-arrears, 62; congiaria, 79, 87, 249; rapacity, 12, 5n; statues destroyed, 10n; as writer on coinage, 100n; minting variants under Vespasian, 239-41; improves coinage, 12, 97, 100, 151; denarius improvement brief, 230; heavy denarii and aurei, 83n, 216, 217, 218; silver content of denarii, 199, 224; denarius weight, 221; little bronze in 82-5, 131; coin dies, 167n; 'restored' Julio-Claudian bronze, 195; and Julio-Claudian denarii, 195, 198; his aurei shortlived, 118n; much of his coin liquidated, 20, 100, 102; Egyptian minting, 211n donatives, 18, 36n, 39, 78; at accession, 86-7, 89; rates, 257; Republic and Late Empire, 257; recipients, 40; and congiaria, 40, 78n, 86; and coin hoards, 78, 82, 84-5, 86-90; cost, 78n, 86; in inscriptions, 79n donkeys, see prices Dormagen hoard, 69 drachma, silver, Egyptian, 50n, 90, 231; copper, Egyptian, 50n Draganci hoard, 99 Draghiceni hoard, 153 Drobeta hoard, 32 Drzewicz Nowy hoard, 241, 93n, 131n, 245-6 dupondius, 233; weight, 101, 189-90; wear rate, 189-90 Dura, 70n; hoard, 209 Dutch 25-cent piece, 192 dwarves, Palace, 10n

Eastern Empire, coin hoards, 67n, 74, 75, 76, 88n; local minting, 106; mints grow in number, 170n; coin amount, 169-70; Severan denarius mints, 135; denarii used in East, 169-70; some Eastern coin denominations struck in Rome, 174-5n; see also Alexandria, Antioch, Asia, Caesarea, Egypt Eastern trade, 52, 103-4, 111-12, 206n Ebusus, 22n Edwinstowe hoard, 162, 194n Egypt, 9, 88; prices, 26-32; revenues, 46, 53, 254; taxation, 5, 47-59, 61; Egyptian treasury at Rome, 177n; tax-cycles, 61-2, 63n; wheat production, 58; payment in kind, 21; treasure from, 9, 21, 99; currency, 28, 90; tetradrachm, weight and fineness, 232-5; didrachm, drachma, 50n, 90, 231; denarii, 90-1; aurei, 91; bronze, 28n; currency conversion, 48, 50n; mint output, 30-32; amount, 169n; coin

290 INDEX

hoards, 67n, 74, 75, 128n; bunched by date, 90; Milne hoards 2, 3, and 6, 30n; 3 and 6, 113, 169n; 6, 31n; 7, 211n; 17, 30n; mint output spasmodic, 127, 211; large-scale reminting under Nero, 31, 198n, 211; further recycling by Severan period, 211–12; see also Alexandria, tetradrachm

Egypt, Ottoman, 50n, 52n, 58n; Napoleonic, 55n, 58n

Egypt 1 hoard, 107, 245, 247 Egypt 2 hoard, 203

El Madamud hoard, 233n

Elagabalus, handouts increased, 16, 90, 250; statues melted down, 10; intensive silver minting, 16, 104; weight of denarius and radiate, 222, 222n; fineness, 224; silver weight reduced, 101; tax-remission, 62n; male/female ratio in denarii, 141; see Antioch

Elephantine, 52 Eleutheropolis hoard, 120, 194n Elveden hoard, 242, 115, 126 Emerita, mint, 99 Emirovo hoard, 214 Emona, 72; hoard, 28

Emperors, wealth, 39; staff, 39; Christian, 9; give slaves, corn, land, elephants, ivory, rhinoceros horn, tortoise shell, 42–3n, 44, 44n; reciprocal giving, 42–3, 44; cost of gifts, 45; spending unrestricted, 43; and coin motifs, 97–8, 177–8; and minting, 100n; visits, 14; estates, 22

Emperors, see also Augustus, Tiberius,
Claudius, Nero, Galba, Otho, Vitellius,
Vespasian, Titus, Domitian, Nerva,
Trajan, Hadrian, Antoninus Pius, Marcus
Aurelius, Lucius Verus, Commodus,
Pertinax, Didius Julianus, Pescennius
Niger, Clodius Albinus, Septimius
Severus, Caracalla, Geta, Macrinus,
Elagabalus, Severus Alexander, Gordian
III, Postumus, Diocletian, Constantine,
Magnettius Julian Anthemius Justinian

Magnentius, Julian, Anthemius, Justinian Empresses, minting, 137, 139, 140, 141, 126, 126n; long production-runs, 140; see Messalina, Sabina, Faustina I, Faustina II, Crispina, Julia Domna, Julia Mammaea, Julia Maesa; see also Marciana, Matidia, Plautilla

Empress dowagers, denarius volume, 140-1; see also Empresses

English coin hoards, Civil War, 84 Enosesti hoard, 204

Ensiedel hoard, 222

Ephesus, temple banking, 8; bread-prices, 26, 32

epibolē, 48

epinemesis, 48
episkepsis, 54
equites see Knights
Eriswell hoard, 243, 199n, 200n, 221n
Erla hoard, 68, 127n, 159, 194n, 206n
Este 1 hoard, 5
Este 2 hoard, 63
Exeter mint, 260, 261
extortion by governors, 6, 59n; as source of wealth, 6

Falkirk hoard, 244, 153n
Faustina I, denarii, 137, 140; die study, 16on
Faustina II, 88; denarii, 140
figures in authors, some suspect, 16–19
finances of Empire, 1–19, 33–63; successive
phases, 11; some figures proverbial,
16–19; see budget, tax, Emperors
fineness, silver bullion, 223n; denarius coin,

fineness, silver bullion, 223n; denarius coin, 223-31, 238-45; tetradrachms, 232-4; fineness and quantity inversely related, 238-40; fineness and weight inversely related, 242-3; dual minting standards, 243-4; quality control at Rome mint, 223, 230-1; worse at Alexandria, 233; see also debasement, weight accuracy

fiscus, 25n, 43

fiscus Alexandrinus, 177n fiscus Asiaticus, 177n fiscus frumentarius, 177n fiscus libertatis et peculiorum, 39 Flaminda hoard, 113 flooded land, and tax, 53-4, 252-3; contradictions, 253; see also irrigation Florence, coin circulating, 169n; grosso, 222n florins, English, 153n foundations, for tax-payment, 22 franc, French, 192 freedmen, imperial, 38, 39 French mints, 131n frequency table, 18on, 219-20n Frincesti hoard, 210 Frondenberg hoard, 154 Fucine Lake, 11

Gaius Caesar, see Caligula
Galba, 68n; coin, 98; intensive minting, 100,
201n; bronze, 151n; die study, 169
Gallia Narbonensis, 76n, 83n, 121n, 254
garden land, 4n, 50
Gare hoard, 245, 132n
Garesnica hoard, 114
Garonne hoard, 246, 129, 131, 132n, 151n,
180n, 236–7; weight loss, 186–91; unusual
composition, 189n
garrisons, provincial, 13, 34, 106; see army
Gaul, 9, 22, 90n; revenues, 46, 254; gold from
conquest, 9, 21, 99; early wealth, 100n,



INDEX 291

Gaul (cont.) 108n; army recruitment, 83; bronze coin curtailed, 108; see also Gallia Narbonensis, Tres Galliae Genas hoard, 189, 93n, 176n Germany, 44, 71, 72, 88, 121n Geta, coin dating, 133; coins per type, 137; coin melted down, 98 gifts, Imperial, 4, 11, 42-3; to Parthian king, 18, 44; to individuals, 18; to Emperor, 43 gift-exchange, 42, 87, 93; in medieval India, 42 Gigen hoard, 104 Girla Mare hoard, 164 gold crowns, 7, 43n, 108n; see aurum coronarium gold mines, seized, 11; Spain, 99, 100n; Dalmatia, 99, 100n, 103; Britain, 76n; see also mines gold, price, 28n; price fall, 21; payment in, 28; gold:silver ratio, 167, 217, 218, 218n; gold coin predominant in face value, 29, 70-2, 99n, 111n, 164; estimated amount, 168-70; increased importance in c4, 9n; late finds, 9n; cross-frontier payments in Late Empire, 93n; regional distribution in coin hoards, 75, 173-4; decrease, 104, 248n; metallic purity, 215n; at a premium, 218, 218n; see also aureus Golden House, 18 Goljama hoard, 124 Gordian III, silver fineness, 224n Gotland, 94n, 246n Gradesnica hoard, 102 Gradistea hoard, 134, 196n grain-dole, see corn-dole, plebs frumentaria granaries, 62 grass, 54 Greece, 4n, 5n, 6n, 9, 42n, 87 Gresham's Law, 221n; and coin hoards, 102, 195n; see coinage anomalies Grocka hoard, 148 Gt Melton hoard, 185 Guelma hoard, 247, 132n, 186n Gyulfehervar hoard, 171

Hadrian, 77; spending, 13; increased, 45; building, 13; handouts, 13; congiaria, 79, 87–8, 250; donative for Aelius, 88; and provinces, 13; abandons conquests, 44; subsidies, 13, 44, 45; foreign gifts, 44; tax-concessions, 13, 56–7, 56n, 61; cancellations, 59–61; gives immunity, 4n; building boom, 13; travels, 13–14; statues, 13n, 14n; coin propaganda, 98; Adventus, Exercitus and Restitutor types, 98, 178n; fluctuations in mint output, 130, 141; weight reductions, 101; silver fineness, 224, 227; estimated coin production, gold

and silver, 111, 164-5; estimated die production, 111, 153-4, 159; die targets, 159-60, 162; die counts for gold types, 158; high output and low output types, 158-9; annual average, 162; die linking, 89n; negative binomial 'k' for Hadrianic gold, 158n; for Hadrianic silver, 152; withdrawal of Republican denarii in Britain, 196, 198; economics, 200n; decline of Hadrianic denarii in Britain, 202-5; sestertius, lower weight and zinc content, 187, 236-7; minting in Egypt, 31, Hammurabi, Code, 20 Handley hoard, 186 handouts, 13, 14, 15, 16, 18, 43; periodicity, 40, 86; amount, 40–1; cost, 45; see also congiaria, donatives hardness, Roman coin, 163n, 180; modern coin, 180 Hasanfaka hoard, 179 Heddernheim hoard, 123 Hemse hoard, 248, 163n Heptanomia, 51 Heracleopolite nome, 52, 61n Herculaneum, weights, 214 Hermopolis, 52 Hermopolite nome, 49, 50, 55, 251 Herod Agrippa, 254 Herod the Great, as Roman benefactor, 5n; and taxation, 6n Heroninos estate, 16n, 28n, 55n Hiera Nesos, 49, 252, 253 hoarding, 194n Holler hoard, 76 homologos, 253 Howe hoard, 64, 200n, 247 Hoxne hoard, 83n hubbing, 162n, 166-7 Hull mint, 260, 261 Hyginus, 47, 55 hypologos, 253

Iberi, 44
Ibn Battuta, 42
ignorance, ancient, 19
Ilium, 61
India, use of barter, 20n; Roman coin finds, 103n, 206n; gifts, medieval, 42; tax in Mughal India, 255–6
indictions, 15-year, 59; 5-year, 63n
inflation, 25–9; little western evidence, 25; slow, 25n, 29, 32; long-term, 28; c3, 28n; in East and West, 29; army pay comparison, 29
Ingrandes hoard, 86
inheritance, by provincials, 7n

Iazyges, 94n



INDEX

292 inscriptions, tax-, 21, 59n, 60, 62; price-, 26; destruction, 98 interest rates, 176; drop, 21 Ireland, hoard, 92n, 94n irrigation, 47, 52, 54; see also flooded land Italica hoard, 42 Italy hoard, 101 Italy, 6, 7, 8n, 9, 12, 13, 14, 20n, 21, 24, 25, 25n, 26. 44, 60, 87, 88, 100, 106; coin hoards, 74, 75, 76, 77; monetisation, 77; Republican coin common, 99; insecurity, 78; settlement of tribesmen, 94n; restricted coin supply before 64, 108, 121-2, 174, 201n; local coin supply, 172 iugerum, 53n Jerusalem, Temple, 9 Jews, seek Roman rule, 6n; revolt, 56n; deposit money, 8 Judaea, 6 Julia Domna, denarii, 133n; coins per type, 137; minting under Caracalla, 139; weight of radiate, 222n Julian, and tax cancellation, 59; and tax grievances, 63n Julio-Claudian Emperors, hated, 199n; aurei liquidated under Nero, Vespasian and Trajan, 117n; most denarii liquidated by 90s, 195-6; 'restored' bronze under Titus and Domitian, 195; 'restored' denarii and sestertii of Augustus under Nerva, 196 Julius Caesar, robs temples, 9; plunders treasury, 9n; expropriates, 99n; financial legislation, 21, 23; revenue from Gaul, 254; and tax-cycle, 59n; donatives, 257; as benefactor, 8n; mints gold, 99; aureus weight, 216; 'restored' aurei under Trajan, 117n Jungfleisch hoard, 233n Junuzlar hoard, 100 Justinian, 58n; and coinage, 99 kankut, 255 Karanis, 49, 54; gold hoard, 34, 176n Karnak hoard, 61, 206n Kempten Lindenberg hoard, 223

Kempton, R.A., 145, 146n, 258 Kervian en Cameret hoard, 211 Kirchmatting hoard, 230 Kirkby Thore hoard, 167 Kleinredrichingen hoard, 138 knights, deaths in Civil Wars, 6n; under Claudius, 11n

La Haye Malherbe hoard, 37 La Mafumet hoard, 249, 187-8n La Magura hoard, 250, 93n, 127n, 128n, 131n, 153n, 221, 222, 225, 240, 241;

weight loss, 183-6 La Oboroceni hoard, 251, 153n La Puriceni hoard, 252, 93n, 153n, 240, 245-7 La Salasuri hoard, 129, 153n, 176n, 193n, Lambaesis, 34n land grants, to poor, 18; to veterans, 36-7 land, private, tax low, 48; land tax, see tax, prices land, public: 22n; public/private ratio, 48, 49, 50; taxed heavily, 47-8; crown land, 56-7, 255; sold, 48; difficult to lease, 48 land, sales, 24; reluctance to sell, 24; limited market, 24-5; senatorial, 21; leases, 55 land investment, 24; large-scale, 25; senatorial, land types, 49; basilikos, 49, 252; cleruchic, catoecic, 49; idiotikē, 252; ousiac, 48n, 49, 55, 251-2, 255; prosodikos, 49, 55, 252, 253; hieratic, 49, 50; garden (paradeisos), 50 Langres hoard, 12 Lanuvium, 8 Laodicea mint, 215n Larnaka hoard, 172, 194n Laurium, 103n Lavenham hoard, 103 Lawrence Weston hoard, 128, 153n Lay hoard, 212 Le Cannet hoard, 60, 131n, 206n legacies, under Republic, 6-7; to Emperor, 6-7, 15, 43; to Augustus, 7; to private individuals, 7n, 23n legates, provincial and legionary, 38 legions, 106n; pay and numbers, 34; legacies to, 40; legionaries as miners, 103n; Alban, 257; Pannonian, 257 lending, 4; secured on land, 32; to provincials, 4n; mercantile, 4n; Imperial, 4n, 22-3, 24; among aristocracy, 4n, 24; legal ban, 23; Caesar's law, 23; see also borrowers, credit Lentilly hoard, 11 Le Buis hoard, 45 liards, 22 Liberalitas coin legend, 78-9, 88 Liberchies hoard, 39, 127n, 131n, 151n, 159, 160n; die pairs, 155n; 161n, 168n, 173, 180n; weight loss, 181-3, 192; weights, 182, 206n Licinus, Iulius, 39 life-expectancy, in army, 35 life-tables, 35 Limoges hoard, 2 Lipnik hoard, 115 liquidity, shortage, Roman world, 21, 23, 25, 32, 108; in east and west, 29; 52; see also

volume of coin, coin circulation



INDEX 293

Little Brickhill hoard, 176, 181n, 194n, 196n, 240; weight loss, 184-6 Little Poland, 67n, 93, 94 Livia, 11 Llanarmon hoard, 218 Lohe hoard, Swedish, 113n Lombardy, 204n London, stray finds, 106n London mint, 260, 261 Londonthorpe hoard, 127, 127n, 128n, 193, 194n, 240, 245, 247; weight loss, 183-6 Long Cross pence, 260, 261 Longuenesse hoard, 71 Louis VIII, 261 Lovec hoard, 105 Lucius Verus, marriage, 89; minting, 105, 109, 141, 182, 184; ratio to coin of Marcus, 109, 141, 241; reminting, 205 Lugdunensis, 76n, 121n Lugdunum, sales, 10, 108n; fire, 18; mint, 23n, 99, 121; location reflected in coin patterns, 108, 121, 174; transferred to Rome, 99, 100; battle in 197, 93n; casualties, 70n Lusitania, 103 lustrum, 61-2; and Augustan censuses, 61; in Egypt, 62 Lycian drachms, emerge in the West, 82n, 175n Lydney hoard, 159 Lyon, 70n; hoard, 46

Macedonia, revenue, 255 Macrinus, 38, 68n; commissions statues, 10n; limits statue size, 10; buys peace, 45 Maecenas speech in Dio, 22, 107n Mafumet, see La Mafumet Magnentius, 215n Magura, see La Magura Maillé hoard, 83 Malalas, and coinage, 99 malleatores, 109n Mallerstang hoard, 121 manipulation of coin in circulation, see underweight hoards manipulation of weight and fineness of the denarius, 225, 227-8; doubling of coins struck per pound of silver, 228

Mans hoard, 89 manumission payments, 39n Marciana, 175 Marcomanni, 77

Marcus Aurelius, see also Lucius Verus, Commodus, Faustina II; as author, 17; marriage, 88; sells property, 10, 14; wars, 14, 44, 77; plague, 14, 94n, 104, 104n; recruiting crisis, 94; land grants, 44; money gifts, 44; tax cancellations, 14, 59n, 60; handouts, 14, 81n, 88-9, 92, 248, 250; parallel hoard series, 89; and coin hoards, 81, 81n, 88-9, 90, 92, 94; minting and praemia, 78n, 89n, 126n, 141; bronze coin under Pius unevenly distributed, 132-3; denarius production under Pius out of phase with Emperor coin, 131n, 141; contrasting production-norms, 109; denarii more debased than his colleagues', 240-1; silver fineness reduced, 101, 224, 227; sestertius, reduced weight and zinc-content, 189, 236-7; propaganda reminting, 105, 206; including denarii of Antony, 197, 205; fixed minting ratios, 140-1; male/female ratio, 141; minting in Egypt, 30-1; tetradrachm weight and

fineness reduced, 233
Matidia, 175
Mattiaci, 103n
Mauretania, revenues, 46
mean average, 219n
meat payments, 58n
mechanised scanning, 165
median average, 219n
melting down of coin, see restored coin,
Caligula, Geta, minting, reminting

Membury hoard, 253, 220, 225, 251 Memphis, 62 Menden hoard, 180 Mendesian nome, 48n, 49, 50, 52; population

collapse, 104n
Menelaite nome, tax-privileges, 4n
mercenaries, payments to, 93n, 94

Mespelaer hoard, 49
Messalina, and coin, 98n
metal shortage, 104; in later periods, 104n

metal-supply, 12n; see mines, gold mines Metkovce hoard, 150 Mezdra hoard, 163

mezzadria (share-cropping), 55 Milan mint, 131n, 169n Minerva, 9n

mines, 223n; wasting asset, 103n; copper, 103n, 105n; plague impact, 104n; see also gold mines

mint, central: at Rome, Emerita and Lugdunum under Augustus, 99; at Lugdunum, 23n, 121; location reflected in coin circulation, 108, 121, 174; transferred to Rome in 64, 99, 100, 121, 174; operating costs, 200n; organisation, 109, 142-3; slave and freedman personnel, 109n; production parallel, not serial, 142; five officinae for smelting under Trajan, 109n; twelve officinae under Claudius II, 115; officina theories, 142-3; minting for different individuals, 109, 142, 239-42;

Lysias, 70n

294 INDEX

resulting production variants, 109, 142, 239-42; anticipating policy as Emperor, 241; fixed ratios between amounts struck, 109, 142, 162, 166; see also coin dies mint output, 125; stable over medium to long term, 110; short term variation and bullion supply, 110-1; annual variation, 126, 141; intensive accession minting, 127, 134, 138, 142, 238-40; gold, silver and bronze correlate in 148-52, 126, 141; bronze more often out of phase, 130, 141; rough coin totals, 168, 169; gold profile, 120; silver profile, 122-4; strong correlation with negative binomial 'k', 123, 147n; gold and silver compared, 123-4; minting and prices, 29-32; in Egypt, 29-32; at Rome, 32; correlations in Renaissance period, 31; minting and praemia, 78n, 89n, 126n, 141; and military expeditions, 107; silver fineness and quantity inversely related, 238-40; fineness and weight inversely related, 242-3; coins per type, 134-6, 137, 140; Severan type production relatively stable, 135; Eastern denarius mints, 135, 136-7; proportion of female coin, 126, 126n, 137, 139, 140, 141

minting, rationale, 106–7; and State payments, 107; and Imperial budget, 46; and donatives, 85n; reminting for profit, 102, 104, 177, 195–200, 204–5, 212; requiring recall of coin, 105; propaganda reminting, 105, 206, 212; manipulation under Commodus, but low output, 105–6; choices within older gold coin, 208; more denarii under Severi, 104; local minting mainly in the East, 106–7; Maecenas and, 107n

mints, Greek, see Athens, Amphictionic,
Babylon; Roman, see Rome, Ticinum,
Lugdunum, Arles, Emerita, Siscia,
Alexandria, Antioch, Laodicea, Caesarea;
medieval, see Bristol, Canterbury,
Chester, Exeter, Hull, London,
Newcastle, Shrewsbury, York;
Renaissance, see French mints, Milan,
Venice

Miskocz hoard, 81 missilia, 40 Mithridates, 9 MLP, 145, 145n, 258 Mnester, 98n mobility and immobil 172-9: explicit re

mobility and immobility of coin, 121, 122, 172–9; explicit regionality under Late Empire, 172; implicit under Principate, 172; divergences between gold hoards, 173; correlations, 174; Marciana and Matidia denarii rare in West, 175; Sabina

denarii over-represented in Black Sea, 175; Marcus sestertii under Pius scarce in Britain, 175; 'divus Marcus' denarii rare in the North-West, 175; regional clustering in Britain and on Danube, 175; cellular patterns, 176; coin sent out new, 176; recycling of coin, 176, 178; rationale, 177-8 Mocsolad hoard, 135, 194n modii, 58n Moesia, 44, 94n Moldavia, Roumanian, 67n, 92-3, 94 monetary anomalies, 29 monetary awareness, 28, 29 monetary deprivation, north of Alps, 22, 108, I 74n monetary unification of Empire, more nominal than real, 179 monetisation, 3, 20, 115n; rural, 108n; varied, 194; see liquidity, coin circulation, volume of coin money changing, 70n, 78n, 98n, 169, 219n; see coin, minting, mint output money, State need for, 3 money, utilised, 20 Mons Claudianus, 42n Mons Porphyrites, 42n Mont, Mosel hoard, 119 Monteleone hoard, 17 mortality, army, 35, 78; see also plague Mrcevac hoard, 142 Much Hadham hoard, 254, 90n Mughal India, taxation, 255-6 muqtah, 256 Muswell Hill hoard, 199 Müller formula, 144n Mylasa, 219n

Naboo, 49 nabud, 255 naubion (dike-tax), 48 Naville pound, 213, 214-15 negative binomial distribution, 144n; numerous applications, 145, 150; effective with incomplete coin data, 144-50; alternatives ineffective, 148n; distribution applicable to types and dies, 147; demonstrated with biological data, 145-6; with coin types, 147; with die frequencies, 150; method A based on fitting frequencies, 145n; method B derives 'k' from known matrix total, 146-8; practical procedures, 258; method A applied to Reka Devnia, 147, 148n; computer programs for method B, 258-9; strong inverse correlation between 'k' and denarius output index, 123, 147n, 148; method B correlation closer, 148n;



INDEX 295

Oboroceni, see La Oboroceni

negative binomial distributions (cont.) Trajanic type frequencies fitted by method A, 148n; Crepusius frequencies fitted by methods A and B, 150n; value of 'k' for Crepusius denarii, 150, 150n; for Hadrianic gold, 158n; for Hadrianic silver, 152 Nemenikuce hoard, 139 Nemi, 8 Nero, 39n, 77; refuses costly statues, 10n; supports aerarium, 12, 43; gives tax freedom, 4n; cancels taxes, 12, 60; tax-reforms, 60, 62-3; commission of consulars, 61; immense gifts, 15n, 18, 43; spending, 12, 221n; executions, 6; seizes estates, 6n, 12n; private fortunes, 6n, 7; temple treasure, 9; taxes tenants, 8; minting at Rome, 97, 98; in Egypt, 31, 198n, 211; liquidates earlier coin, 99; reduces coin standards, 100, 102, 199, 216n, 217–18, 221n, 223–4, 227, 228–30; modern theories, 221n; large scale reminting of aurei and Egyptian tetradrachms, 104, 105, 124, 208n, 221n, 233; minting objectives, 198; reminting profitable, 198n; concentrated in AD 64/6, 198n; lower aureus weight, 217-8; lower denarius weight, 221; fineness reduced, 100, 223-4; sestertius, weight and zinc-content reduced, 186, 236-7; previous coin disappears, 100; hunt for precious metal, 103; Dalmatian gold-strike, 103; regional distribution of bronze coin, 108, 121, 174; post-64 aurei and denarii slow to disappear, 201, 206, 208, 209 Nerva, 68n; sells property, 10; land grants, 18, 37n; veteran colony, 37; congiarium, 87, 249; intensive minting, 100, 129n; turns statues into coin, 10; refuses new statues, 10n; heavy aurei, 83n; denarius weight, 222; strikes 'restored' denarii and sestertii of Augustus, 196 neutron activation analysis, 224n Neviodunum, 72 Newcastle mint, 260, 261 Nietulisko Male 1 hoard, 255, 153n Nietulisko Male 2 hoard, 256, 153n Nijlen hoard, 18 Nile flood, 47 Nis/Naissus hoard, 145n nome: see Arsinoite, Heptanomia, Heracleopolite, Hermopolite, Mendesian, Menelaite, Oxyrhynchite Noricum, 76n Normanby hoard, 257, 115 Nubia, 103 numbers, proverbial, 6n; 16-19

Octavian, 8, 9; see Augustus offerings, votive, 9; by Augustus and Pompey, qn officinae, modern theories, 142-3; see mint, central officinatores, 109n olives, 50-1 Orkney hoard, 94n Ormskirk hoard, 110 Orosius, 55 orpiment, and gold, 103 Osijek hoard, 140, 153n, 194n Osterode hoard, 192 Ostia, 11 Otho, 68n; intensive minting, 100, 201n Ottomans, 50n, 52n, 58n over-taxation, 47, 63 Oxyrhynchite nome, 49, 50, 52, 55, 57, 251 Oxyrhynchus, 52, 56; registration of property, 61,62 palaces, size, 42; staff-costs, 38-9, 45 Palestine, 88; revenue, 254 Pallantium, 4n Pallas, M.Antonius, 17, 39 Pannonia, 44, 90n, 94n; revenues, 46 Paris 1 hoard, 51 Paris 2 hoard, 57, 206n, 208n Parthia, 9n; gift, 18; indemnity, 18 Patras hoard, 7 payment in kind, in Roman Egypt, 21; banking, 21n; Phrygia, 21; Spain, 21; Sicily, 21n; Arab Syria, 21; Tunisia, 21n; France, 22; in wheat, 20, 21; as tax for other crops, 21n; army, 40, 29; see also barter peculium, 39 Pelusium, 253n Perennis, Tigidius, and coin, 98n Pergamum, money changing, 70n, 169 Perscheid hoard, 53 Pertinax, 15n, 68n; borrows, 3n; sells Imperial property, 10, 15; subsidies, 44; retrieves gold, 44; land law, 54; congiarium and donative, 87n, 249 Pescennius Niger, 15; reduces aureus weight, 218n, 239 Petronius, 17 Phernouphitou, 49, 50 Philadelphia, 54 Philae, temple treasure, 9n Philo, 59 Philostratus, 254 Phrygia, 21 physician, Imperial, 4n plague, 14, 94n, 104, 104n plated coin, 198n



296 INDEX

Plautianus, Fulvius, 10 Plautilla, Fulvia, denarii, 133n; coins per type, 137 plebs, 78; composition, 40; frumentaria, membership purchased, 40; received congiaria, 88n, 90; numbers, 88n, 249 Pliny the elder, and coinage, 97n, 217-18; and gold-supply, 103; and Eastern trade, 103-4, 111-12; and temple treasure, 9n; and payment in kind, 21n Pliny the younger, as borrower, 24n; as landowner, 24n, 55n; as legatee, 7n; on handouts, 40; on delatores, 6 Plutarch, and Capitol, 42; and tax-gatherers, 59n; and Asia's debt, 254 Poetovio, 72 poison, cost, 18 Polyclitus, 39 Pompeii, 20n; coin finds, 67n, 69-70, 71, 83, 121, 196, 201, 201n, 215n, 217n; stone weights, 214, 214n Pompeii 1812 hoard, 258 Pompeii 1957 hoard, 259 Pompey, 9n, 46, 253 Popica hoard, 116 Popovo hoard, 106 population, 46n; Egypt, 51; losses, 104n; mortality, army, 35, 78; see plague Postumus, 132n pound, Roman, 181n, 213-15; and calibration of coin, 213; Boeckh, 213, 214, 215, 221n; Naville, 213, 214-15; weights at Naples, praemia (discharge-bonuses), see army Praetorians, 37; handouts, 14, 18, 36n, 40, 88, 90, 257; free rations, 29 Prelazko hoard, 173 Pré Haut hoard, 78 price control, 26n prices, see also costs; early Empire, 25n; Diocletianic, 25n; land, 21; grain, 25n; tombs, 25n; wine, 26; bread, 26, 26n; wheat, 26, 56n; donkeys, 29-31; donkey-hire, 25-6; and coin output, 29-32; seasonality, 29; and debasement, Renaissance 29n; Byzantine, 98; sudden change, 32 privileged, recipients, 40, 88n; taxpayers, 52; provinces and cities, 4, 12; the unprivileged, 40n; procurators, ad bona cogenda, ad bona damnatorum, ad bona Plautiani, 6; kalendarii Vegetiani, 15n; cost, 37, 38, 45 propaganda, 10; use of coin, 97-8, 105, 127, 136, 138, 177, 199n, 212 property market, glut, 24 proscriptions, 6n, 17 prosdiagraphomenon, 48, 70n

prosecutions, 6, 9n proximi, 38 Ptolemies, 21n; Philadelphus, 254; Auletes, 53, 254; coin melted down, 211n, 233 public borrowing, 8; lack of, 3-4 public spending, 4, 33-46; deficits, 5; financial recovery, 5 Puriceni, see La Puriceni purity of coin, gold, 215n; silver, bronze, see fineness, debasement, zinc Puteoli, 4n, 20n Puy-Dieu hoard, 260, 132n, 181n; weight loss, 186-7, 189-90 quadrans, 236 quinarii, 216n, 250 radiate, 97, 101, 109, 115, 138-9, 140, 142,; weight, 222, 223n; fineness, 222, 228; denominational value, 222n Raetia, 76n, 121n ransom, 93 Razvigorovo hoard, 126 recall of coinage, see also wastage, minting, restored coin; 105, 105n; rationale, 197-200; Julio-Claudian coin reminted between 64 and 107, 117n; more silver in older coin, 199-200; Trajanic, uneven effects, 105n; silver, Julio-Claudian reminted first, 106; Republican denarii, 106, 196; late Flavian gold, 106; Egypt, 211-12 Reghin hoard, 155 regional effects, see mint, central; mobility Reims 1 hoard, 44 Reims 2 hoard, 225 Reka Devnia hoard, 261, 109, 126, 123n, 131, 131n, 133-43, 147, 151n, 153n, 176n; its strengths, 133-4, 134n, 145, 147n; similarities to western hoards, 133n, 135, 138; and via Braccianese (Rome 3), 113; and Elveden, 115 reminting, see minting; recall Republic, legacies, 6-7; coin hoards, 77, 78; die totals, 113n; coinage, 99; mostly liquidated, 104, 196; re-emergence on frontiers, 196; silver content of denarii, 199n, 200n; weight reduction, 219n res privata, 6, 15 restored coin, 101, 104-5, 117n, 151, 195, 196, 233; rationale, 195n Rheingonheim hoard, 92, 201n Rhodes, 9, 61 Ribchester, stray finds, 106n RIC catalogue, 134n, 147n, 153, 173n; RIC 12, 198n, 208n, 216n rich and poor, 6n; 4on; 59 Richborough, stray finds, 106n



> INDEX 297

Rinteln hoard, 262, 247n Riopar hoard, 151 riots, coinage, 99 Rome: central mint, 29, 99; transfer in 64 from Lugdunum, 99, 100; later mint, 213n; some coin struck for local circulation in the East, 174-5n; sales at, 10; Capitol, 8, 12, 18, 41; temples as banks, 8; tribes, 40; Tiberian fire, 17; Neronian fire, 100; 900th anniversary, 88; c5 gold hoard, 172n Rome, see also buildings, coin, congiaria, handouts, mint output, missilia, plebs, Praetorians, sparsiones, urban cohorts Rome I hoard, 38, 127n, 131n, 159, 160n, 161n, 168n, 173, 206n Rome 2 hoard, 95, 121 Rome 3 via Braccianese hoard, 216, 113, 115n, 194n Rongeres hoard, 152 Roussé hoard, 200 Roxolani, 44 Rudchester hoard, 74 rural France, 22 Rutilius Gallicus, 12n Sabina, minting, 140 sacred land, 8n sacred treasure, 4 sacrilege, 9, 9n Sakha hoard, 48, 89 Salasuri, see La Salasuri sales, by State, 6n; by Emperor, 10, 21, 108n; of bona damnatorum, 6n, 10n, 22; of Imperial land, 22n; of land, houses, slaves, 51; tax, 51, 55; tax halved, 11 Sapte hoard, 263, 201n Sardis earthquake, 18 Sascut hoard, 177 Savaria, 62 scolacium, 21n Scole hoard, 264, 199n, 200n, 221n Scotland, hoards, 92n, 94n seasonality, 29, 30 Seiches sur le Loir hoard, 87 Seidol hoard, 183 self-sufficiency, economic, 3 Selinus, 4n semis, 236n senators, deaths in Civil Wars, 6n; under Claudius, 11; under Commodus, 10n, 15; under Severus, 6; impoverished, 38n, 43n; income support, 38n, 43; spendthrift, 43n; governors, number, 38; cost, 37-8, 45; corrupt, 6n, 59n; legates, 38; adclamationes, 15n Seneca, 17 Septimius Severus, see also Caracalla, Geta,

Julia Domna, Plautilla; and senators, 6, 10n; proscriptions, 6; expropriations, 15, 101n; new fiscal departments, 6; army pay increase, 15, 33, 90, 104; date, 33n; donatives, 81n; congiaria, 79, 90, 249; and coin hoards, 90, 94; army policies, 33n; financial reserves, 15; generosity, 15; gives tax-freedom, 4n; intensive Rome minting, 104, 123; aureus weight, 216n; denarius production, 133-8; 'accession' peak in 197, 134, 142; debasement, 97, 101, 224; weight, 225; Eastern denarius minting, 135, 136-7; minting for different individuals, 109; fixed ratios, 109, 137; coins per type, 134-6; type-production relatively stable, 135, 142; eastern denarius mints, 135, 136-7; proportion of female coin, 137; minting in Egypt slight, sestertius, 69n, 90, 169, 233, 236; weight, 101, 186-9, 221n; zinc content, 100, 101, 236-7; output, 129, 130; circulation patterns, 132-3, 176; wear rate, 186-91; dies, 151n, 169 Severus Alexander, 15; sells property, 10; congiaria, 79, 90, 249, 250; minting, 90n; annual variation, 126, 127; dual aureus weights, 102, 216, 218; denarius weight, 222, 223; fineness, 224, 227; rise in fineness when output declines, 239-40; male/female ratio, denarii, 141 Shap hoard, 65 Shrewsbury mint, 260, 261 shrinkage in cultivated area, 58 Sicily, 53, 58; revenues, 21n, 253, 254-5 Sighisoara hoard, 160 signatores, 109n Silchester hoard, 187, stray finds, 106n Silistra 1 hoard, 136 Silistra 2 hoard, 205 Silly, Orne hoard, 174 Silly en Goufran hoard, 193 silver content, readings by X-ray fluorescence spectrometry, 224n, 233n; by neutron activation, 224n; see fineness, debasement silver, needs, 10n; estimated amount, 169-70; mining, Republican, 103n; possible decline, 104; see also gold, denarius, coin hoards, mint output Sisak hoard, 265, 213n Siscia mint, 213n Sitifis, 37 skewing, 171n Slatino hoard, 117 Slovenia, 72 Snettisham hoard, 266, 83n Socnebtunis, 56 solidi, 58n, 172n, 181n, 204n; weight, 213;



298 INDEX

underweight, 247n; triple solidi, 215n Sotin hoard, 143, 127n, 153n, 194n sous, 22 sovereign, English, 192 Spain, 21, 74, 76n, 85n, 172; gold coin finds, 76n; gold mines, 99, 100n, 103; mints, 99, 220; Renaissance coinage recall, 105n sparsiones, 40 Sparta, ancient, 20n Spearman test, 133n, 174 Spital hoard, 145 sporimos, 252 sportulae, 39 Springhead hoard, 15 St Didier au Mont d'Or, 70n St Georges sur Loire hoard, 10 St Mary Cray hoard, 229 St Pantaléon les Vignes hoard, 19 St Pierre lès Nemours hoard, 20 stadium, 42 Stallius Felix, P., 214n staters, Amphictionic, 155n Statius, 10n, 12 statues, destroyed, 10n, 98; precious metal, 9n; Colossus twice altered, 10n; Imperial melted down, 9n, 10, 10n; prosecution, 9n; bronze, 9n, 10n; Hadrian and, 13 Stein hoard, 267, 201n stipendium, 40n Stockstadt hoard, 73, 127n, 128n, 131n, 153n, 194n Strabo, and mint, 121; and revenue of Egypt, 53, 254 straw payments, 58n stray coin finds, 106n; gold, 115, 117-20; weighted towards earlier coin, 115; compensation techniques, 115-17; and hoards, 115; underlying similarities, 118, 110 subseciva, 12n subsidies, foreign, 43-5, 246n; in gold, 93, 104; cost, 45; and coin hoards, 93 Suetonius, as fiscal source, 5n; and coinage, 98 Sulla, 9, 254 suppostores, 109n surface enrichment of denarii, 224n; see silver content survival rate of coin, 88, 166, 170-1; hidden survivals, 170; the proportion of dies visible, 171; coin sample needed to show a given percentage of dies, 171 Sutton hoard, 90, 220, 221n, 251 Swaby hoard, 122 Sweden, 93n, 94n, 246n Switzerland, 88 Syria, 89; hoard, 206; c8 taxation, 47n Szombathely hoard, 158, 153n, 194n talents, 70n

Tarentum, 36 tax, collection inefficient, 59; postponement, 57; arrears, 59, 60; cancellations, 59, 63; privileged exemptions, 4; anomalies, 4; new immunities, 4; immune cities, 4n; personal immunity, 44; rural bias, 4-5, 51; tax holidays, 54; frauds, 54; tax cycles, 5, 59-63; origin, 59n; 15-year, 59-61; in phase with c4 indiction-cycle, 59; 14-year, 61-2; 5-year, 61-2; 4-year, 62n; regular reviews, 59-61; fixed rate, 53-4; pro rata, 53-4; based on gross yield, 55n; stable on private land, 56; increases, 12, 46; on crown land, 56; Hadrianic reduction, 61; yield maintained, 54; as proportion of crop, 55; taxes in kind, 46; converted to cash, 3; conversion rates, 58n; on flooded and unflooded land, 53-4; in grain, 49, 53, 57; on tree-crops, 53; in money, 51-2, 53, 58n; poll, 4, 5, 14, 51, 53, 61; occupational, 51; tolls, 14; on inheritance, 55; on sales, 11, 51, 55; on manumission, 55; on capital, 8; on house-size, 8; on leased property, 8; on farm land, 8; crown tax, 56; on tenants 8; on freedmen, 8; on gladiators, 14; on slave familia, 8 tax bureaux, provincial, 106n tax collectors, 3; terrorise taxpayers, 59; absorb revenue, 59, 63; tax farming, 63 tax payments, recycled, 106, 178 tax rates, 1/5, 1/7, 1/10, 47; 5%, 16; 2%, 12;  $2\frac{1}{2}\%$ , 12; 1%, 11; yield, 46–7, 48–9, 52n; declining, 47; supplements, 48, 50; vines, 50-1; olives, 50-1; dependent on land-quality, 251-2; on imports, see taxation, 47-63; low, 6; excessive, 47, 63; and irrigation, 47, 52; Ottoman, 50n, 52n, 58n; Mughal, 255-6; in Napoleonic Egypt, 58n Tebtunis, 56 technology, pre-industrial, 3, 162n, 214 Tekija hoard, 97 Tell Kalak hoard, 213, 128n, 131n, 153n, 194n temple, banking, in Rome, Egypt, Ephesus and Cos, 8; treasure, 4; in Rome, Antium, Lanuvium, Nemi, Tibur, Greece, Asia, Egypt, Jerusalem, 8-9; amount, 9; plundered by Sulla, Caesar, Antony, Octavian, Caligula, Nero, Vespasian, Commodus and Christian Emperors, 9, 9n; used for coinage, 9 tenants, taxed, 8; rewarded, 8n; rent reduced, 56 Tenos, 22n Tentyra, 52 Teos, quarry suddenly abandoned, 104n



INDEX 299

tetradrachm, hoards in Egypt, 67n, 89-91; weight and fineness, 232-5; target weight, 232-3; fineness unstable, 233 Thamugadi, 37 Theadelphia, 49 Thebaid, 50, 57 Thebes, 52 third-century, shortage of sources, 16, 62n Thorngrafton hoard, 66 Tiberius, 38; restricted spending, 4, 11, 25; and wills, 7; reduces tax, 11; curtails army concession, 11; gifts to senators, 43n; legacies, 40; lending, 23; absentee ruler, 23n; seizes gold mines, 11, 25n; credit crisis, 11, 23-5, 32, 100; and increased mint output, 11, 25, 100, 250-1; strikes gold coin, 23n; aureus weight, 216; denarius weight, 220-1; silver content, 199; obverse and reverse die counts, 155n; coin types, 97n; bronze coin, 25n; provincial silver, 25n; coinage liquidated, 100; tetradrachms melted down, 211n, 212, 233; 'restored' tetradrachms under Nero, 233; 'restored' aurei under Trajan, 117n; anomalous tetradrachm hoard, 233n, 247n Tibodu hoard, 146, 196n Tibur, 8 Ticinum mint, 213n timelag effects, coin circulation, 30-1, 82n, 86, 90, 195n, 205 time reckoning, incorrect, 19 Tisa hoard, 226 Titus, 68n; generosity, 4n; and delatores, 6; intensive minting, 100; higher denarius weight standard, 100, 221; reduced gold, 215n; 'restored' Julio-Claudian bronze, 195; minting variants under Vespasian, 239-41 Tobarra hoard, 47 Tolic hoard, 118 tolls, 14; see customs Tolna Megye hoard, 137, 153n, 194n tombs, see prices Trachian Cilicia, 12 trade, and coin hoards, 93n, 103n; Eastern, 52, 103-4, 111-12, 206n; and coin circulation, 107-8, 178; see archives Trajan, 77; sells property, 10n; and delatores, 6; alimenta, 13; building, 13; shows, 13; congiaria, 79, 87, 249; and donatives, 87; veteran colonies, 37; subsidies, 44; tax-remission, 60; few statues, 10n; minting pattern, 13; fluctuations, 128-30; first aurei heavy, 83n, 218; coinage reforms, 97, 98, 99; Nero's standard

resumed, 100-1, 218; silver content of

denarii, 200, 224, 227, 230; weight, 222;

reminting where profitable, 101, 104-5, 200; 'restored' coin, 104-5, 151, 195n, 196; restored aurei of Julius Caesar, Augustus, Tiberius and Claudius, 117n; from few dies, 101, 151; obverse gold dies, 129n; die study, 160-1; estimated gold die total, 160-1; annual average, 162; increased gold minting, 129, 141; and Dacia, 129n; Republican denarii liquidated, 196, 198; delay in Britain, 196; Trajanic denarius, decline in Britain, 202-5; minting in Egypt, 31, 211 treasure, from Gaul and Egypt, 9, 21, 99; monetary impact, 21; see also temples Tres Galliae, 83n; see Gaul tribes, of Rome, 18, 40; barbarian, 15, 44; Scottish, 45 tribunician years, 87n Troyes hoard, 55, 206n Tunisia, 4n, 21n Turkey 1 hoard, 54 Turkey 2 hoard, 268 underweight hoards, 183, 245-7; coins, Late Empire, 213n, 247n Unterammergau hoard, 169 urban cohorts, 18, 40, 257 Utrecht hoard, 269, 121n, 208n, 215, 217n Valerius Paetus, 98n Vannes hoard, 270, 132n Varus, P. Quinctilius, 59n Vaulx hoard, 182 vegetable seed, 54 Velleius Paterculus, and Tiberius, 43n; and provincial government, 59n velocity of circulation, 180n, 191-2, 212n; see also timelag Venetia-Histria, 76n Venice mint, 167 Verona, 69n; hoard, 72, 194n Verres, C., 59, 70n, 254 Vertus hoard, 58 Verulamium, stray finds, 106n; coin die, 175n Vespasian, 77; seizes private wealth, 6; temple treasure, 9; financial problems, 12; economies, 12; census, 60; tax-increases, 12, 46, 56; repercussions in Egypt and Africa, 12, 56; cancels immunities, 12; subseciva, 12n; congiarium, 79, 249; building, 12; and fisci, 177n; generosity, 12; and coin hoards, 90; intensive minting at Rome, 100, 104; fluctuations, 127-8, 141; aureus die study, 160-1; die total unclear, 161; reminting of gold, 117n; 'restored' aurei of Augustus, 117n; aureus weight, 215n; silver fineness, 224, 227;

segmented output, 239-40; differing



300

INDEX

production norms, 109; his sons' denarii heavier, 239-40; low minting in Egypt, 31, 211 veteran colonies, 36-7 via Braccianese hoard, see Rome 3 Vibius Crispus, Q., 17 vicennalia, 88, 91 Vidin hoard, 196 Vidy hoard, 33, 159, 176n Vienna 1 hoard, 41, 206n Vienna 2 hoard, 161 Vienna 3 hoard, 215 Vienne, 108n Villach hoard, 77, 206n Villani, G, 222n villas, staff, 39n Villeurbanne hoard, 25 vines, taxed, 50-1, 54, 58; old vineland, 50n Vitellius, 17, 68n; coin, 98; intensive minting, 100, 201n Viuz-Faverges hoard, 271, 135, 222, 223, 225, 241, 246n, 245; weight loss, 183-5; little post-Antonine wear, 219n Volubilis hoard, 109 volume of coin in circulation, 105, 111, 168-70; denarii, 193-4; and output-index, 193-4; stability, 194; see liquidity Vyskovce hoard, 272, 127n wages, digging, 25-6; harvesting 25-6 Wallern hoard, 130 wastage of coin, 105, 168, 193, 195; low rates, 32, 164n; wastage of gold, 206-10; natural rate, 115, 205, 210; compensation formula, 115n, 117; results, 118, 119; silver, 210; natural rate for silver, 205; bronze, 129; late Roman, 204n; modern, 204, 204n; wastage and minting at comparable rates, 205-6; artificial effects dominant, 205-6; wastage of Antony's denarii, 205; of Trajanic denarii in Britain, 202-3; Hadrianic, 202-3; continued coin input implied, 205; disappearances between Marcus and the

Severi, 204-5; sharp gold falls in 160s and reminting, 206, 212; low wastage in Egypt, 211, 212; see also minting water regime, see flooded land, irrigation, tax wear, see coin wear, weight loss weight accuracy of coin, 214n, 229-33; variable, 3, 102n, 214n; coefficient of variation, aureus, 216, 214n; denarius, 223, 229-32; tetradrachm, 233n; weight and fineness inversely related, 242-3 weight loss, 20, 180-92, 204, 210; relatively steady, 181n; in Late Empire, 181n; gold coin, 181-3; denarii, 183-6; bronze coin, 186-91; summary, 191; modern comparisons, 192; see coin wear, velocity of circulation weight samples, hoards, 215; museum, 215n weight standards, 100, 101, 186-7, 213-23, 231-3, 236-7; see also pound Welzheim hoard, 79 West Continent, coin hoards, 74, 75, 76 wheat, see prices, tax wheat yields in Egypt, 54-5; Napoleonic, 55n Wigan hoard, 227 Wilten hoard, 201 wine, see prices withdrawal of coin, see minting, recall Woodham Mortimer hoard, 273, 200n, 250-I Wroxeter, stray finds, 106n

xestai, 58n X-ray fluorescence spectrometry, 224n

York hoard, 274, 201n York mint, 260, 261 Yzeure, 22

zabt, 255 Zadar hoard, 197 Zare hoard, 82 Zemun hoard, 23, 118n, 216 zinc, 236-7 Zirkovci hoard, 21, 206n