BANK OF ENGLAND

Appendix to Staff Working Paper No. 845
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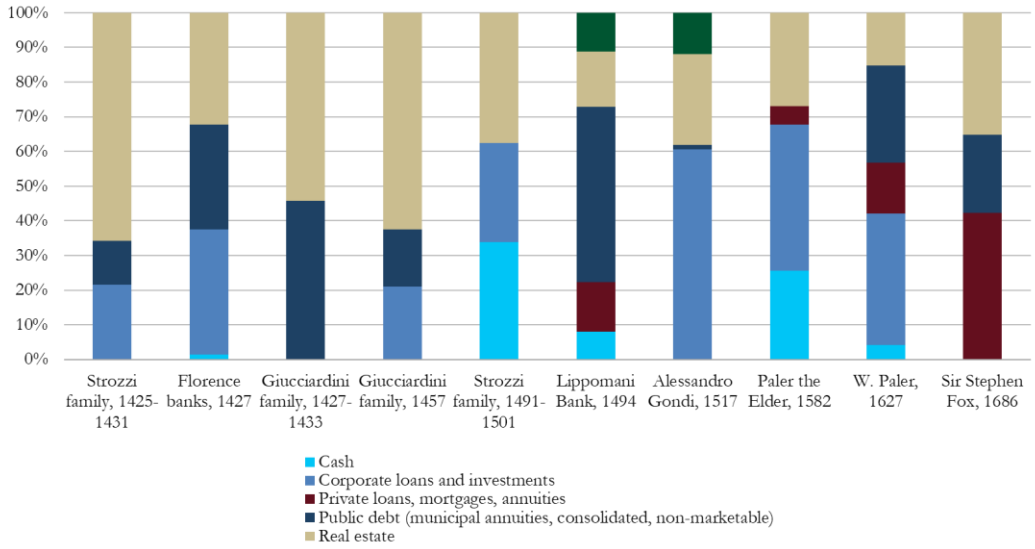
ONLINE APPENDIX TO "Eight centuries of global real interest rates, R-G, and the 'suprasecular' decline, 1311-2018.

January 2020

I. Profit rates – anecdotal evidence

Measuring returns on a fixed income asset – *Erbleihen* and *Pfandbriefe* tied to real estate – my series on "Private R" obviously omits a key component of actual "private R": business investment returns, that is equity returns in the modern context. Given that business loans and investments are to be found in almost every will or tax register from the 14th century, some discussion is required regarding its role, particularly since the equity risk premium has been rather high in recent years. Can corporate returns over time be the "balancing item" that leads to a more even – perhaps even a positive – slope of overall real wealth returns? Even a relatively small upward slope – if coupled with significant increases in the volume of outstanding corporate investments – could obviously lead to meaningful revisions for the overall series. Let us ignore for a moment the argument that such rates should not diverge over the long term unless there are significant market imperfections or barriers to entry for investors to take advantage of these hypothetically more attractive returns.



Appendix figure A.1: Selected merchant and investor asset compositions, 1425-1686.[1]

[1] Sources: Florence/Giucciardini/Strozzi/Lippomani/Gondi (Goldthwaite 1968, 177); Paler: Hildebrandt (ed., 1996, 198-200, 220f., 381, 395; 2004, 78-80); Fox: Clay (1978, 191).

More important here is the historical-empirical situation. Corporate profits are perhaps the most understudied of all the relevant individual series. We know that the most advanced and internationalized corporations (besides religious orders such as the Templars) are to be found among the banking houses of the Italian North, with their pan-European (and pan-Asian) personal networks, and their role in the administration of Papal income – perhaps the most significant single financial agent until the 16th century.

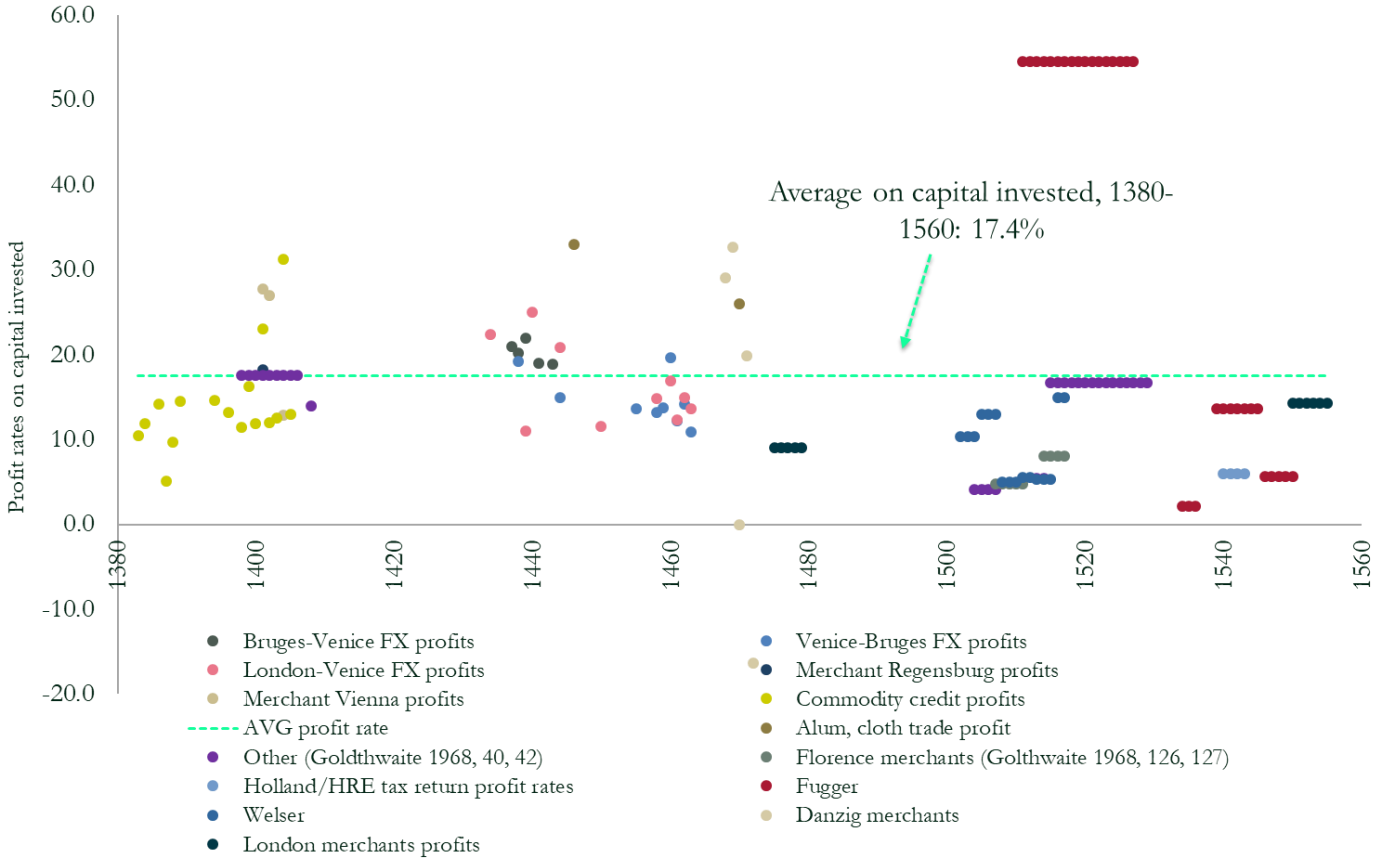
While I have not undertaken a more systematic compilation of corporate profit trends here, one should note that there is sufficient evidence of equally elevated profit margins for early modern times, even if we discount some of the more lofty outliers, such as the Hochstetter's alleged 500-600% margins in the 1510s (Ehrenberg 1922, 213): Rothmann (1998, 537f.) records average margins of 20.6% for German merchants at the fairs in Regensburg and Vienna in the early 1400s; averaging Samsonowicz' (1969, 64-70) profit rates for Danzig merchants in the late 15th century yields levels of 13% p.a. gross, with ranges from -16% to 32%; De Roover (1963, 117-120) compiled profit rates in FX money markets in Venice, Bruges, and London between 1438-1465, averaging 15.1%, a figure close to the 14.1% average Venetian trade credit rates in 1383-1405 (Mueller 1997, 635). Ehrenberg (1922, 388ff.) reports average profit rates for successful German merchant houses in the late 15th – mid-16th centuries of 18-24% p.a.; in their prime, the Fuggers during the years 1511-1527 commanded no less than 54.5% (ibid., 196). In early modern tax collections in the Holy Roman Empire, an annual gross profit rate of 4% for corporates was generally assumed (Isenmann 1980/2, 166). In the Dutch tax assessments during the 16th century, a 6% gross profit rate was assumed (Tracy 1985, 83). Grassby (1969, 724ff.) reports typical nominal rates of gross profit of 8-10% in 15th century London among grocers and merchants; the same source (ibid., 725) reports subsequent rates of profit for the Indian voyages in the 17th century that are highly volatile, but typically range between 22.3-46.9% during 1613-1617, with a decline to 9-13% between 1617-1628.

Comparing these – certainly still anecdotal – levels with modern corporate returns – even if we allow for early modern peculiarities regarding tax regimes, depreciation, and regulation – reveals clearly that over the very long term, business returns (real and nominal) cannot have shown a rising trend, and could thus not have produced a general upward slope for "nonhuman wealth" returns. Hudson (1986) and Harley (2010) find nominal returns on British business capital ranging between 9-20% between the late 18th century and the 1850s in leading, capital-intensive industries.[2] For the 20th century, Fama and French (1999, 1995) report nominal internal rates of return on capital for U.S. nonfinancial publicly-listed firms during 1950-1995 of 12.1%, and during 1973-1996 of 14%, before interest and depreciation; these are

[2] Allen's (2009, 421) higher values only refer to the fixed capital return. As he notes, Hudson (1986) and Harley (2010) refer to returns on total business capital, around half of which is comprised of trade credit. The lower reported values by the latter two are the relevant ones here, since they represent the broader definition in line with what Fama and French (1999) or Jorda et al. (2017) measure.

plausible levels compared with mean nominal USD-denominated equity returns since 1870 of 10.54% p.a. (post-1950: 13.2% p.a.) reported in Jorda et al. (2017, A66, table A.9).

Since the spread between our early modern sample and such modern levels is not ex ante enormous, however, we can enter into a hypothetical thought experiment: to consider an extreme scenario, suppose that in the year 1500, roughly at the peak of public real rates, business investment just comprised 5% of "global nonhuman wealth"; suppose further that today the business investment share has risen to 50%;[3]



Appendix figure A.2: Selected merchant and bank gross profit rates on capital invested, 1380-1560.[4]

[3] Certainly an elevated estimate, given that housing wealth still outstrips equity wealth for Jorda et al.'s (2017, A63) global sample.

[4] Sources for London merchants: Grassby (1969, 724f.); Danzig merchants: (Samsonowicz 1969, 64-68); Venice: Mueller (1997, 331f.; 339 [Saranza bank]); Florence/Other: Goldthwaite (1968, 40, 42, 126f.); FX profits Bruges/London/Venice: De Roover (1963, 117-120); Welser/Fugger/Augsburg: Mayr (1931, 38) and Ehrenberg (1922, 119, 132, 145, 157, 195); Fryde (1972, 354); Holland tax on profits: Tracy (1985, 83); HRE tax: Isenmann (1980/2, 166); Regensburg/Vienna merchants: Rothmann (1998, 537f.). Weinsberg: Fuhrmann (2010, 44).

II. Growth and demographics – a closer look at general trends

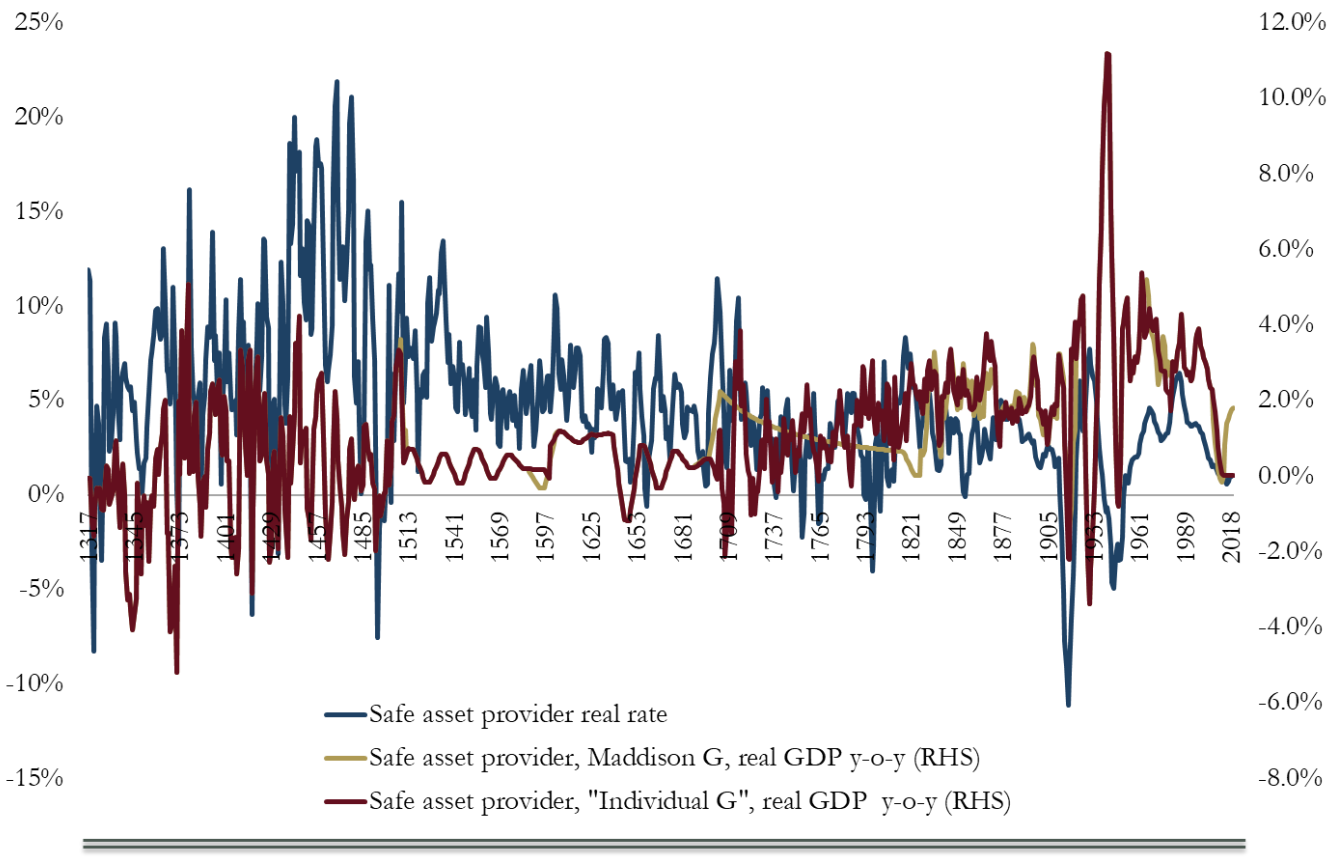
Numerous authors have explained the trend fall in real interest rates since the 1980s with reference to demographic or growth factors. As Baker, DeLong, and Krugman (2005, 315) sought to demonstrate, "over the long run, rates of return on assets are correlated and causally connected with rates of economic growth…only in stock market bubbles can capital gains diverge widely from economic growth, and then only for a little while". Gordon (2016) – who takes a historical perspective extending back to the 19th century – is most commonly associated with the thesis that secular productivity trends explain recent real rate developments. Similarly, even though Rachel and Smith (2017) are generally dismissive of a major role for growth factors, they attribute a quarter of the fall in real rates since the 1980s to weaker global growth prospects (ibid., 14).

Studies including Hansen (1938) and Gagnon, Johanssen, and Lopez-Salido (2016), have suggested a meaningful role for population growth factors in the determination of real interest rates, as slower population growth reduces the marginal product of capital and labor (assuming both are complements), thus reducing capital returns, and real rates.

Against the background of these arguments, I proceed in this section by investigating the (very) long-term correlation between growth and real rates, and between demographic change and real rates, respectively. I test correlations for both pairs on the single-issuer, "safe asset provider" basis, and for the global sample of advanced economies, employing various lags and moving averages. In all but three possible combinations, I find a negative correlation between real rates and either demographic change or real GDP growth over the very long term.

Surely there are more sophisticated ways to statistically test underlying correlations, but the general observation here is that a high-level parallel evolution of growth rates and real rates is not readily detectable. Trend breaks in growth rates do not overlap well with those in interest rates, and this is equally true for country-level observations.[5] The general trend of relatively muted real GDP growth rates until the mid-18th century, followed by a subsequent acceleration is well documented – even though most (very) long-term studies continue to be either restricted to individual countries, or omit high frequency year-on-year data (Clark 2008; Maddison 2010; Malanima 2011; Alvarez-Nogal and Escosura 2012; Broadberry et al. 2015).

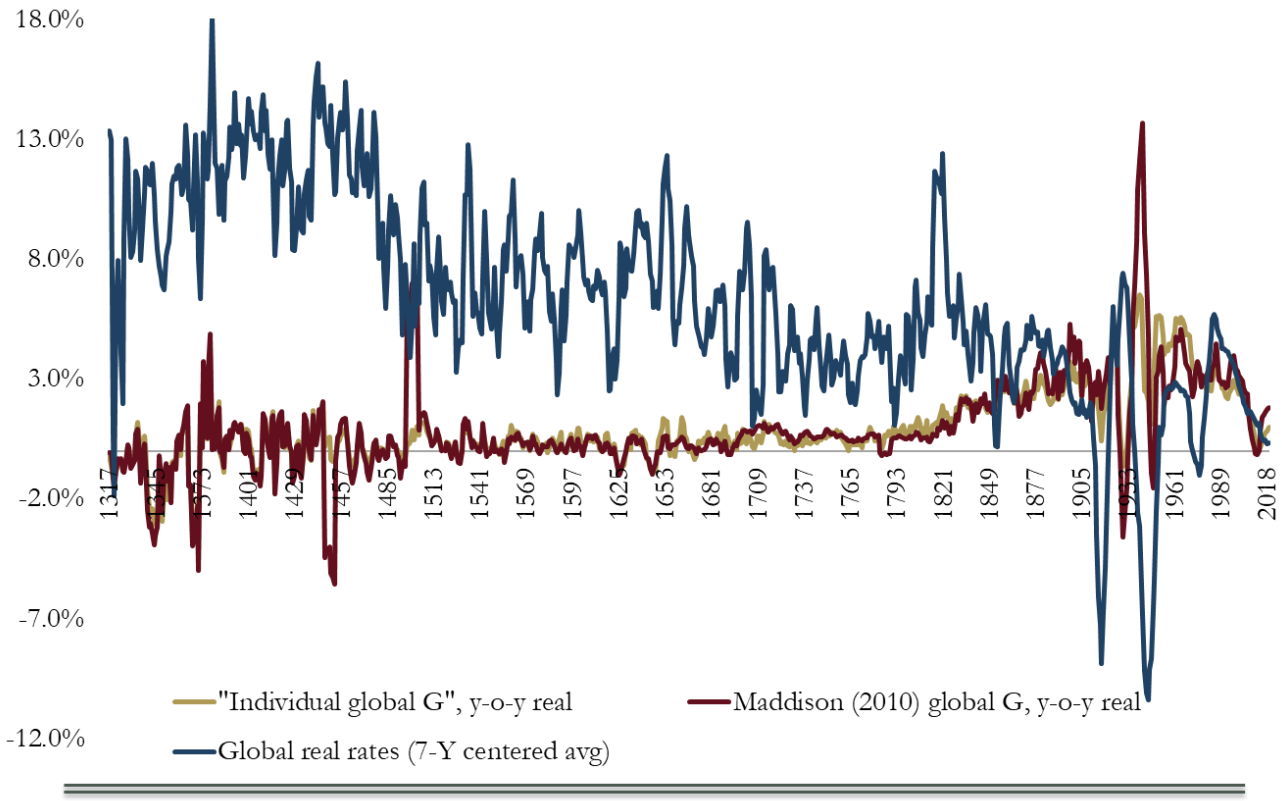
[5] In reduced form the problem is already apparent when one compares Homer and Sylla's "best credit" rates (1991, 554) by half-century with underlying growth rates. Spain, for instance, is considered the "best credit" issuer in the 15th century – at a time when the economy records among the lowest per capita GDP in Western Europe and is stagnant trend-wise (Broadberry and Fouquet 2015, 230).



Note: 7-year centered averages displayed. Sources: real rates as per appendix table A.1; real GDP growth data: Maddison (2010) interpolated basis; 'Individual G' uses Malanima (2011, 205-17, 'column 6') for Northern Italy 1314-1509; Alvarez-Nogal and Escosura (2013, 33, estimate 1), adjusted by population estimates in Allen (2000, 9) for Spain 1510-1599; van Zanden and van Leeuwen (2012, appendix table 2, decadal interpolated) for Holland 1600-1702; Broadberry et al. (2015) via Thomas and Dimsdale (2017) for the U.K.. 1703-1918; NBER macrohistory database, BEA/FRED for U.S. for 1919-2018; Bundesbank (2017) for Germany for 1962-1980.

Appendix figure A.3: Real rates versus real GDP growth, "safe asset provider" basis.

Broadberry and Fouquet (2015) have offered a recent long-term aggregate growth overview more nuanced than previous studies, in which they reject the simplistic narrative of a "stagnant millennium" prior to the take-off associated with the Industrial Revolution. I use the same overlapping country-sets for the single-issuer and advanced economies correlations, already introduced in the real rate data selections. Appendix figures A.3-A.6 display long-run trends on the simple seven-year centered average basis. On this basis (Appendix figure A.3), the all-time correlation between seven-year centered average real rates, and seven-year centered average year-on-year real GDP growth is de facto non-existent (between -0.058 and -0.064), testing Maddison's (2010) real GDP data against some of the more recent country level series.



Note: 7-year centered averages displayed. Sources: real rates as per appendix tables A.2-A.3; real GDP growth data: Maddison (2010) interpolated basis; 'Individual global G' GDP-weighs Alvarez-Nogal and Escosura (2013, 33, estimate 1), adjusted by population estimates in Allen (2000, 9) for Spain; Pfister (2008, table 6) interpolated for Germany; van Zanden and van Leeuwen (2012, appendix table 2, decadal interpolated) for Holland; Malanima (2011, 205-17, 'column 6') for Northern Italy; Broadberry et al. (2015) via Thomas and Dimsdale (2017) for the U.K.. Outside of periods covered by these country-level series, Maddison (2010) is still used for 'Individual G' (including France, Germany pre-1500 etc.).

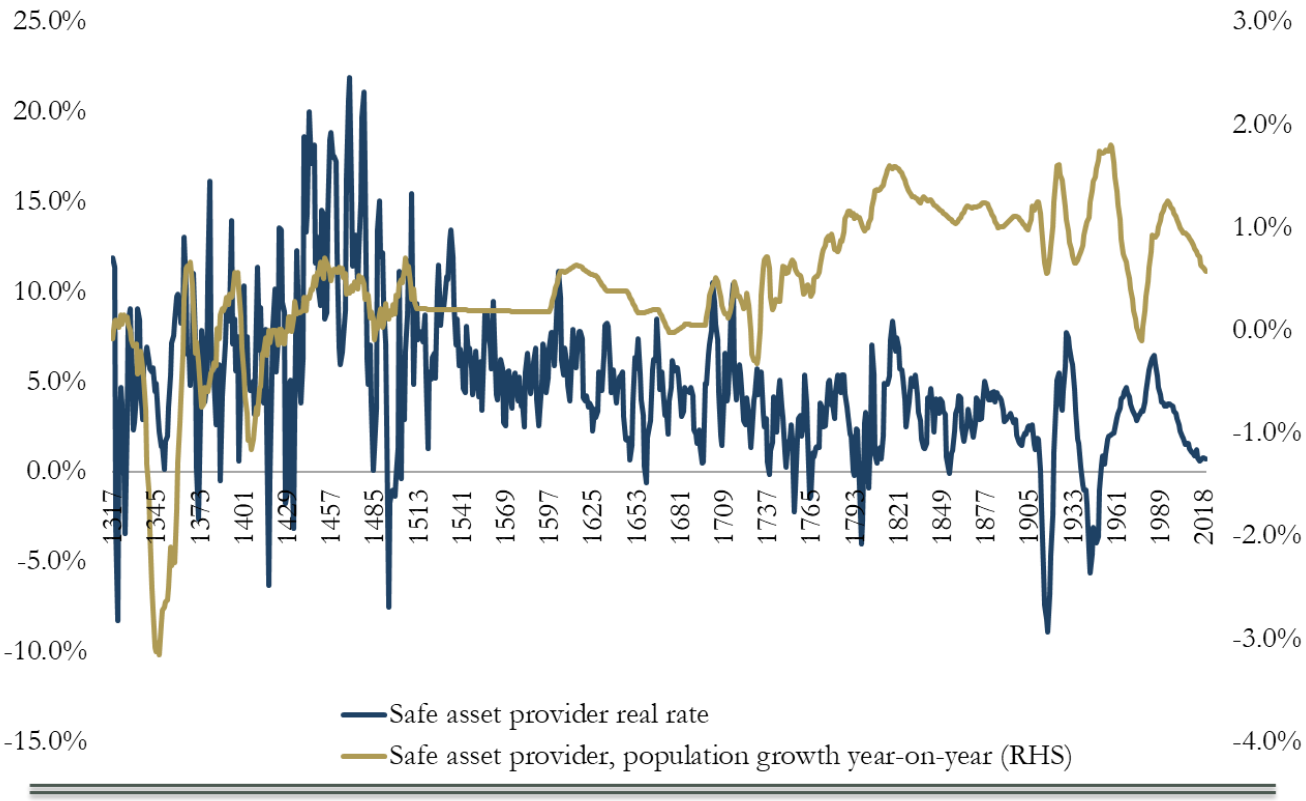
Appendix figure A.4: Real rates versus real GDP growth, global basis, 1317-2018.

On the full global basis (Appendix figure A.4), the correlation is more clearly negative (-0.37), exhibiting a more pronounced rise of real GDP particularly from the 18th century, against an accelerating real rate trend decline. The same negative correlation is obtained by using 3- or 13-year centred averages, or if either series is lagged 2 or 4 years. I also test against alternative "global" series composed on non-Maddison data ("Individual G"), obtaining a similar negative correlation (-0.45).

This may at first be a surprising result. Even when we allow for merely an indirect channel from real GDP growth to interest rate developments, in particular via capital accumulation, we should probably expect a bigger effect. There may be several reasons why the general growth series present in the literature do not suit our purposes here – issues which may also point towards problematic assumptions present in such early modern growth accounting.

Turning to demographic drivers, we see a similarly inconsistent pattern: some demographic shocks, such as the Black Death 1348-1349 are visible in a sharp drop in real rates – but on a general level

population growth accelerations are at times associated with interest rate increases (the 20th century interwar- and post-war episode), at times with static or slightly falling levels (the second half of the 18th century); simply correlating real rates with year-on-year global or "safe asset provider" real rates yields negative values, which remains true if various lags are applied (Appendix figures A.5 and A.6).

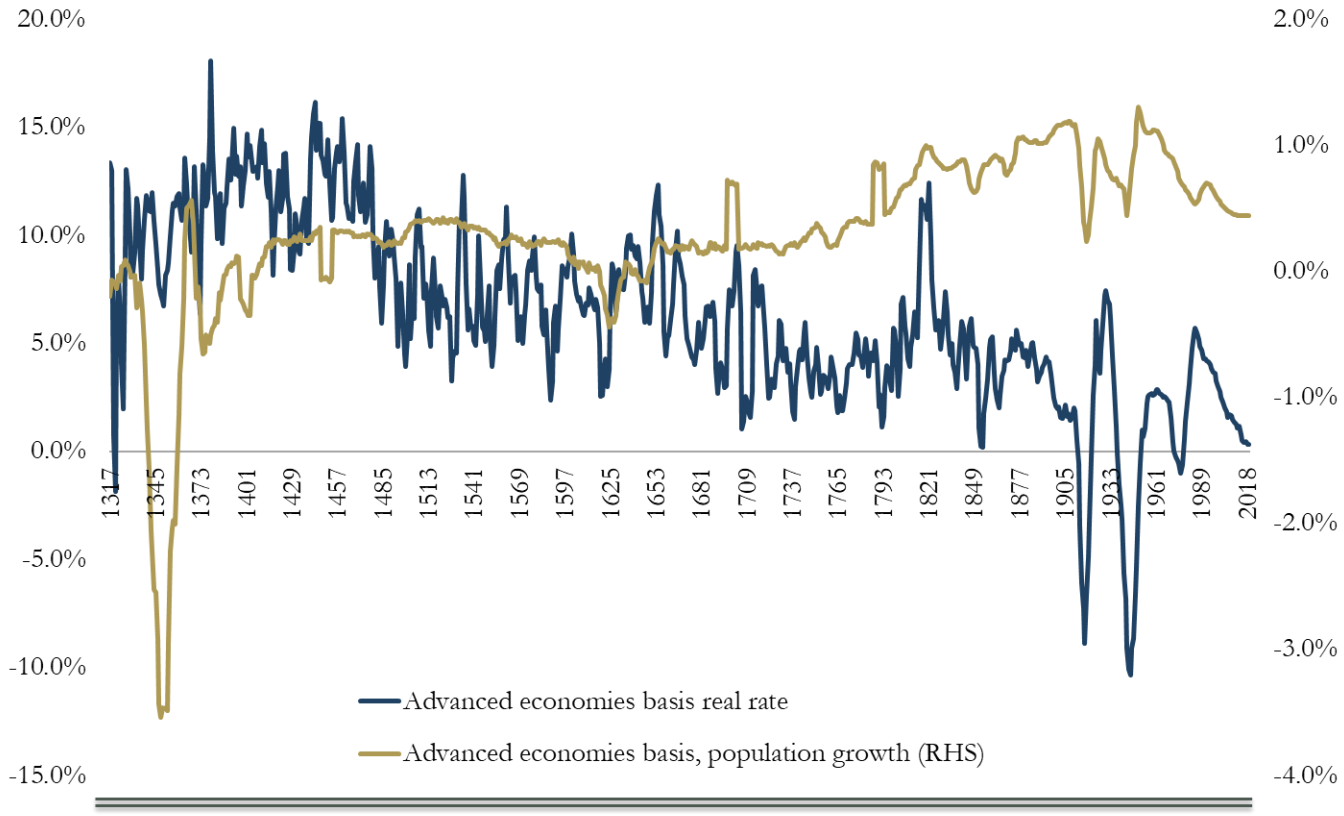


Note: 7-year centered averages displayed. Sources: real rates as per appendix table A.1; population growth prior to 1820: Northern Italy: Malanima (2011, 205-217, implied pop. – index change column 6 less index change column 3); Spain: Allen (2000, 9); Holland: interpolated figures in Paping (2014); U.K.: Broadberry et al. (2015) via Thomas and Dimsdale (2017); Germany: Pfister (2008, 4); U.S. 1919-1930 NBER microhistory database, 2008-2018 FRED; all other population growth: Maddison (2010).

Appendix figure A.5: Real rates versus population growth, "safe asset provider" basis.

Might life expectancy (or a combination of population and life expectancy levels) be a better measure to consider? I have not systematically undertaken a direct comparison. But I note that data for instance for England (Wrigley and Schofield 1981 via Voigtlaender and Voth 2013, 779) does not suggest a close match: life expectancy on their basis shows a downward trend over 1550-1750 – when we should expect dis-savings –, and jumps in the 1560s and the 1740s, which has left no traces in the English real

rate series. Overall, one should likely be hesitant to attribute at least a dominant role to demographic factors in (very) long run real rate dynamics.



Note: 7-year centered averages displayed. Sources: real rates as per appendix table A.2-3; population growth prior to 1820: Northern Italy: Malanima (2011, 205-217, implied pop. – index change column 6 less index change column 3); Spain: Allen (2000, 9); Holland: interpolated figures in Paping (2014); France: Allen (2000, 9); U.K.: Broadberry et al. (2015) via Thomas and Dimsdale (2017); Germany: Pfister (2008, 4); U.S. 1900-1930 NBER microhistory database; all other population growth 1820-(incl. Japan): Maddison (2010).

Appendix figure A.6: Real rates versus population growth, global basis.

Global population (Appendix figure A.6), after recording an average growth rate of .13% between 1000-1500, generally accelerated its expansion, with average growth rates of .27% between 1500-1600, with a fall back to .09% for the crisis-ridden 17th century (Parker 1997), followed by a renewed increase to .61% per annum for 1700-1820, .63% for 1820-1900, and finally 2.9% per annum for 1900-2000. The negative relationship is also confirmed on the city-level by the two classic long-term population surveys of de Vries (1984) and Bairoch et al. (1988): the only cases of population stagnation or decline are the Italian city-states between the early 14th and 16th century: Bairoch et al. (ibid., 43,49) put the decline for Venice in this timeframe at 9.1%, for both Florence and Genoa it is 42%. In contrast, Spain and Castile

showed strong population growth in the 16th century (Ruiz Almansa 1948), as did the population of Holland, which grew by more than 30% over the 17th century (Lourens and Lucassen 1997).

III. Financial repression, and a GDP-weighted global usury ceiling

Finally, financial repression und usury factors are a key potential influence. With the former's prevalence even apparent during the mid-20th century (Reinhart and Sbrancia 2015), it is only too straightforward to attribute a decisive role to it during times when institutional mechanisms were supposedly fragile, while references to usury and evidence of personal retribution against creditors abound. Temin and Voth (2005) have argued that even for 18th century Britain, merchant banks restricted credit supply in the face of interest rate restrictions. Allen (2009) finds sharply rising real profit rates in the U.K. between 1800-1860 and acknowledges that "even deducing a few percentage points for depreciation, the return to capital in the 19th century exceeded interest rates by a wide margin" – his explanation being that "interest rates…were too heavily regulated to be a reliable indicator of the demand for capital" (ibid., 421).

Certainly, it would be foolish to dismiss repression factors too lightly. The fate of Jacques Coeur, the great French financier who ended in prison on defrauding accusations, or that of the Templars, are two of many high-profile cases. Emperor Ferdinand II, via his financial offices, in 1630 demanded a 50,000 thaler loan from the banker Johann von Bodeck: when the latter resisted, he was threatened with confiscation – and eventually loaned 40,000 thaler secured by claims on future public revenues (Dietz 1921, 262). In 1627, the soldiers of the Duke of Saxony threatened to burn down the properties of two prominent Junkers in Dieburg if the debts of their master were not rolled over (ibid., 1921, 6). In 1554, Henri II of France forced Parisians to subscribe to a 3.1m *livre tournois* rentes sale, defying the Parlement (Munro 2003a, 537). Around the same time, Holland ex-Amsterdam still occasionally resorted to forced subscriptions (Gelderblom and Jonker 2011, 4).

At the same time, I am not aware of any recent study concerned with longer-term real rate dynamics that, for instance, decided to exclude explicitly the period of the 1960s and 1970s in the U.S. in short-term yields on account on the financial repression practices documented for the period by Reinhart and Sbrancia (ibid.). Clearly, a significant complication would be introduced for a multi-century trend study of the present sort if it could be demonstrated that an all-encompassing repression system invalidated any reasonable market pricing of desired returns. However, the steep rates registered in Figures IIII and V above represent a priori evidence that repression cannot have been too effective. Why would a German Emperor or a French King ever have paid interest rates north of 15%, when he could have reached his aims by financial repression? Why would the English King be forced to pawn his jewels to Cologne

creditors in 1431-1434 (Dietz 1921, 209)? For every disgraced Jacques Coeur, we find a Dino Rapondi, a Samuel Bernard, a Stephen Vaughan, or a Stephen Fox, rising to the apex of financial fortunes by their savvy exploitation of strained Crown finances (Richards 1953; Clay 1978; Rowlands 2015). Equally, cases where coercive exploits are rebuffed are plenty: Richard II has to bury plans to raise loans in the 14th century, after merchants "refused to supply the King's wants, unless they received the utmost security, and unless the nobility, clergy, and gentry would furnish him with a considerable sum without interest" (Sinclair 1785, 335). Even at the height of the "Turkish threat", leading German merchant houses reject further credits to Ferdinand I in 1539 "because we are still owed 100,000fl from various imperial offices" (Hildebrandt ed., 1996, 48).

Especially the rise in cross-border lending highly impedes the options by sovereigns to exercise direct pressure. By 1587, two German creditors, Paulus Brockdorff and Moritz Rantzau, are successfully threatening to arrest the English Crown's factor in Antwerp, if their 11,000 GBP (Flemish) loan was not immediately repaid: "in these circumstances, the only course left open to the Crown was to go to the considerable trouble and expense of shipping specie from England to the Low Countries" (Outhwaite 1966, 293f.). It would be entirely wrong to perceive of early modern and late medieval financial relations outside of the major financial centers as a basically arbitrary creditor expropriation. For every documented case of actual repression, it is easy to find numerous cases where the executives were either unwilling or unable to suspend market pricing – and these are the cases used in the aggregations here.

Consider the case of Henri II's "Grand Parti" in 1552, one of the largest individual sovereign loans ever up to that date. Ehrenberg (1928, 303), quoting the chronicler of Lyon (Rubys 1604), documents how contemporary investors hardly needed inducement to willingly lend at 16%:

> "God knows how greed for these excessive gains, disguised by designation as 'free gift' (don gratuit), lured men on. Every one ran to invest his money in 'le grand parti', the very servants brought their savings. Women sold their ornaments, and widows their annuities in order to take shares in 'le Grand Parti'. In short, people ran for it as if to see a fire".

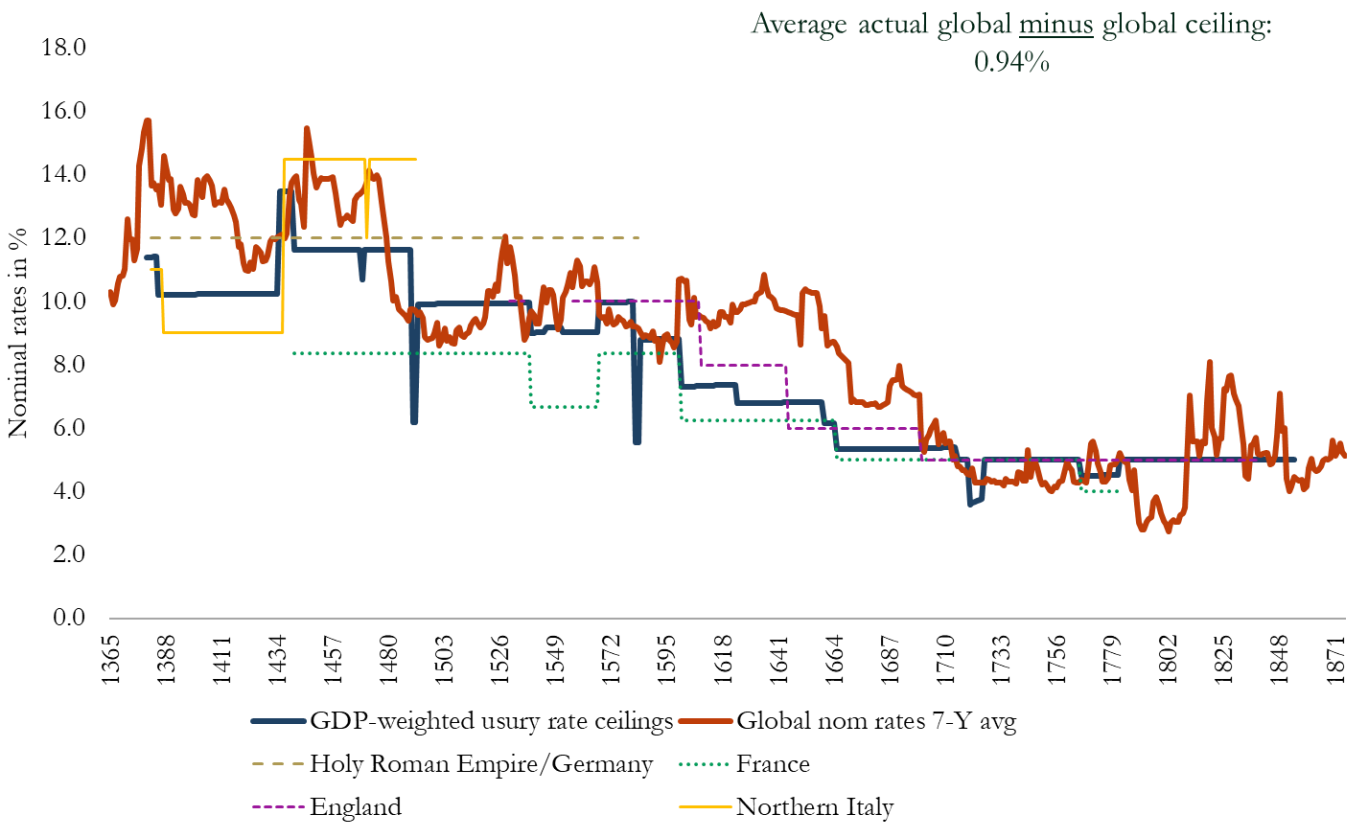
Other examples are not hard to find. As Mueller (1997, 457f.) puts it,

> "Citizens of Venice, Genoa, and Florence were happy to contribute to the functioning of the state as long as the support took the form of interest-bearing loans and as long as the pressure on liquid capital was relatively moderate…when the burden was judged insupportable, there could be active resistance to the fisc, similar to a tax strike as occurred in Venice in 1442…taxpayers would take pains to come up with what was

> required as long as they got something for their money, some annual return, 'as had been observed of old in the Republic of Venice'".

Recent discussions such as Stasavage (2011, 33-34) agree that the rates on such "forced loans" were in fact close to secondary yields and evidence of credible commitments.

Some regional studies have found a "thoroughgoing compliance" with formal interest rate ceilings, at least in the personal loan market (Ogilvie, Kuepker, and Maegraith 2012, 138). But when formal interest rate ceilings are in fact implemented, they more often retain a merely symbolic quality. Emperor Lewis in 1338 capped interest rates to be charged by Jews at 41.7% for domestic subjects, and at 55.5% for foreigners (Dietz 1910, 197). In Edward II's England of the late 13th century, interest rate ceilings of 45% were enacted (Hansen 1910, 340) – purely circumstantial gestures to please ecclesiastical lobbies, without practical relevance. Both Flanders and the Holy Roman Empire implement interest rate ceilings of 43.3% in the early 14th century (Reg Imperii, VI, 4/2, 393, Henry VII to the Jews of Nuremberg; Haepke 1908, 245) – rates that as far as I can see have not been de facto charged prior to these impositions. The French interest rate legislations in the 16th and 17th centuries explicitly did not apply to royal loans: "the king never intended that these rates of interest should apply to his own financial transactions. Any attempt to do so would make it impossible to obtain the services of financiers and would lead to the abandonment of existing contracts" (Bonney 1981, 19). Finally, Kings themselves showed no hesitation to impose hefty interest rates themselves, when they had the chance to act as creditors: indeed, we have evidence that the Bardi on their part in 1345-1346 were charged by Edward III of England at the rate of 100% for a 18,000 pound debt incurred (Sapori 1926, 83-84).



Appendix figure A.7: A GDP-weighted global usury ceiling, national ceilings, and global nominal rates, 1365-1875.[6]

Appendix chart A.7 displays a GDP-weighted interest rate ceiling covering issuers included in the global headline series between 1365-1875 – but excluding any legislation primarily directed at private or commercial rates – and sets it against actually recorded GDP-weighted nominal rates.[7] We observe that such a weighted ceiling shows a reduction over five centuries of close to 650 basis points, from 11.4% at inception, to the 5% ceiling prevailing in England prior to the 1854 abolition of usury laws: we are here seeing a "legislative trend fall", in other words, of 1.9bps p.a., against a de facto global nominal rate fall of 2.1bps p.a. (both for the period 1365-1875 only). The absolute de facto level exceeds, on average, the

[6] Sources: England: Bond (1840, 226), Richards (1929, 19-20); Usher (1943, 193); Pinto (1857, 217); Neumann (1865, 194). In Germany's case, from 1530 the Reichs-level municipal ceiling specified in the Reichspolizeiordungen are taken.

[7] Among others I exclude therefore the Dutch provisions in 1540/43 instituting a 12% ceiling on commercial loans. Van der Wee (1963, 352, 358) discusses the provisions in the context of broking and commercial business: Munro (2003a, 554) turns this reference into a ceiling on "all debts and commercial bills", which appears less likely. Equally excluded are mandates only targeting Jews, such as the Imperial mandates of February 1614 and August 1625 (Stubenrauch ed. 1858, 313).

weighted usury ceiling by almost a full percentage point: only during confined sub-periods are actual rates trending in a close range below the legal maximum, particularly visible during the 1720s-1770s.

Finally, an important robustness aspect deserving more detailed discussion than given here is the phenomenon that in times of financial market distress, we repeatedly encounter reports that potential creditors, rather than adjusting lending rates to reflect higher default risks from their counterparties, simply refuse to participate in lending per se. Outhwaite (1966, 302f.) describes Thomas Gresham's difficulties to borrow at *any* terms from 1561 onwards: "For that here ys no mony to be hade apon Interest at no prys", even though previous transactions suggest the Crown was flexible to offer unconventionally high rates, for instance via commodity supplements. Outhwaite (ibid.) correctly observes that "we have the interesting situation in which the rate of interest on royal loans fluctuated less than the merchants' willingness to lend at a given rate". Generally, such observations are far too infrequent, however, to validate Temin and Voth's (2005) conjecture from British 18th century observations, that adjustment from the credit supply side dominated under binding interest rate restrictions.