Monetary Capacity

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Abstract

The monetization of an economy and its fiscal capacity move together in the long run. We provide historical evidence in support of this proposition, and propose a model that explains it. The model shows that while monetization and fiscal capacity are substitutes in the short run, they are complements in the long run. This is because highly monetized societies generate stronger incentives for governments to invest in fiscal capacity, but in turn high fiscal capacity makes it easier for governments to commit to monetary stability, thus leading to higher monetisation. We provide case-study evidence in support of our mechanism, focusing on early successes such as seventeenth-century Netherlands, eighteenth and nineteenth century Britain, and failures, such as Ming China. We conclude by discussing implications for macroeconomics and development.

JEL Codes: E50, E60, H21, N10, O11

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1 Introduction

Efficient states require high levels of fiscal capacity, but taxes can only be efficiently farmed in an economy that is sufficiently monetized. In this paper we investigate the joint relationship between monetary and fiscal capacity. We present, for the first time, systematic comparative evidence which demonstrates the joint long run relationship between monetary and fiscal capacity.

To put the relationship between monetary capacity and state capacity in historical context, we construct two figures. Figure 1 shows the historical relationship between per capita real tax revenue and per capita real money stock. On the horizontal axis, we calculate per capita real money stock by dividing per capita tax revenue in grams of silver by consumer price index in grams of silver. On the vertical axis, we calculate the per capita real tax revenue by dividing per capita tax revenue in grams of silver by consumer price index in grams of silver. Figure 2 differs from figure 1 by also taking the changes in per capita real income into account. In particular, we divide the values on both axis in Figure 1 by per capita real income. Whatever the exact methodology, the long-run relationship is clearly positive: both Figure 1 and Figure 2 show a positive correlation between state capacity and monetary capacity.[1]

The effect of monetary capacity on fiscal capacity matters because we know that high levels of fiscal capacity lead to economic growth. Two mechanisms have been proposed in the literature. First, a government with high fiscal capacity is more capable of providing public goods, solve externalities, and generate positive spillovers. In the early modern period, the most prominent example was national defense, which promoted internal market integration and lower economic risk (O'Brien 2013, Malinowski 2017), as well as colonization, which reaped economic returns for the home economies (Palma 2016a). Second, fiscal capacity promotes growth by financing complementary legal capacity which in turn provides for property rights protection (Besley and Persson 2011).

In this paper we take the relatioship between fiscal capacity and economic growth for granted,

[1]The money stock data is based on Palma (2018) for England, De Vries and Vander Woude (1997) and Weber (2000) for Dutch Republic, Gelabert (1995) and Tortella and Ruiz (2013) for Spain, Pamuk (2000) for the Ottomans, Glassman and Redish (1985), Riley and McCuster (1983) and Saint-Marc (1983) for France, Wojtowicz et al. (2005) for Poland-Lithuania, Blanchard (1989) and Kahan and Hellie (1985) for Russia. Consumer price index index is the daily cost of respectability based on Ozmucur and Pamuk (2002) for the Ottomans, Mironov (2010) for Russia, and Allen (2001) for all other states. Tax revenue data is based on Karaman et al. (2017).

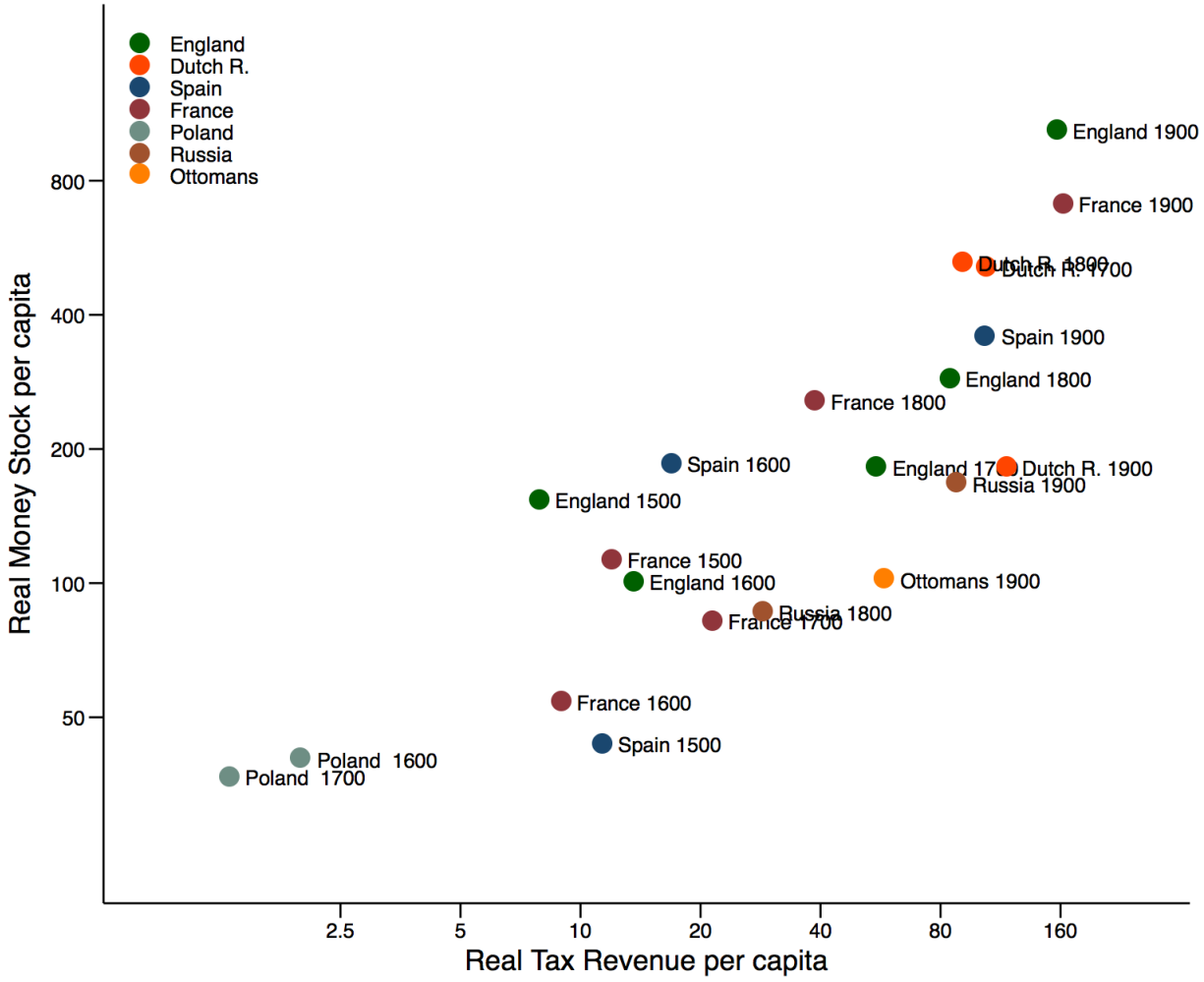

Figure 1: Real tax revenues and money stock per capita. Sources: see text

and investigate the relation between monetary capacity and fiscal capacity. By monetary capacity, we mean the government's capacity to issue sufficient liquidity for the markets to work propertly (or to allow the private sector do to so), and for the collection of taxes to be efficient.

Elsewhere, it has been shown that highly monetized societies are able to sustain higher equilibrium income growth rates.[2] But at the same time, highly liquid societies are also easier to tax, which leads to higher levels of fiscal capacity,[3] and thus to higher growth through a second

[2]Palma (2016b) provided historical evidence in support of this proposition, focusing on the role of higher levels of liquidity leading to lower transaction costs, and more specialized and urban economies.

[3]It was recognized by both early modern commentators and modern historians that "when money supplies

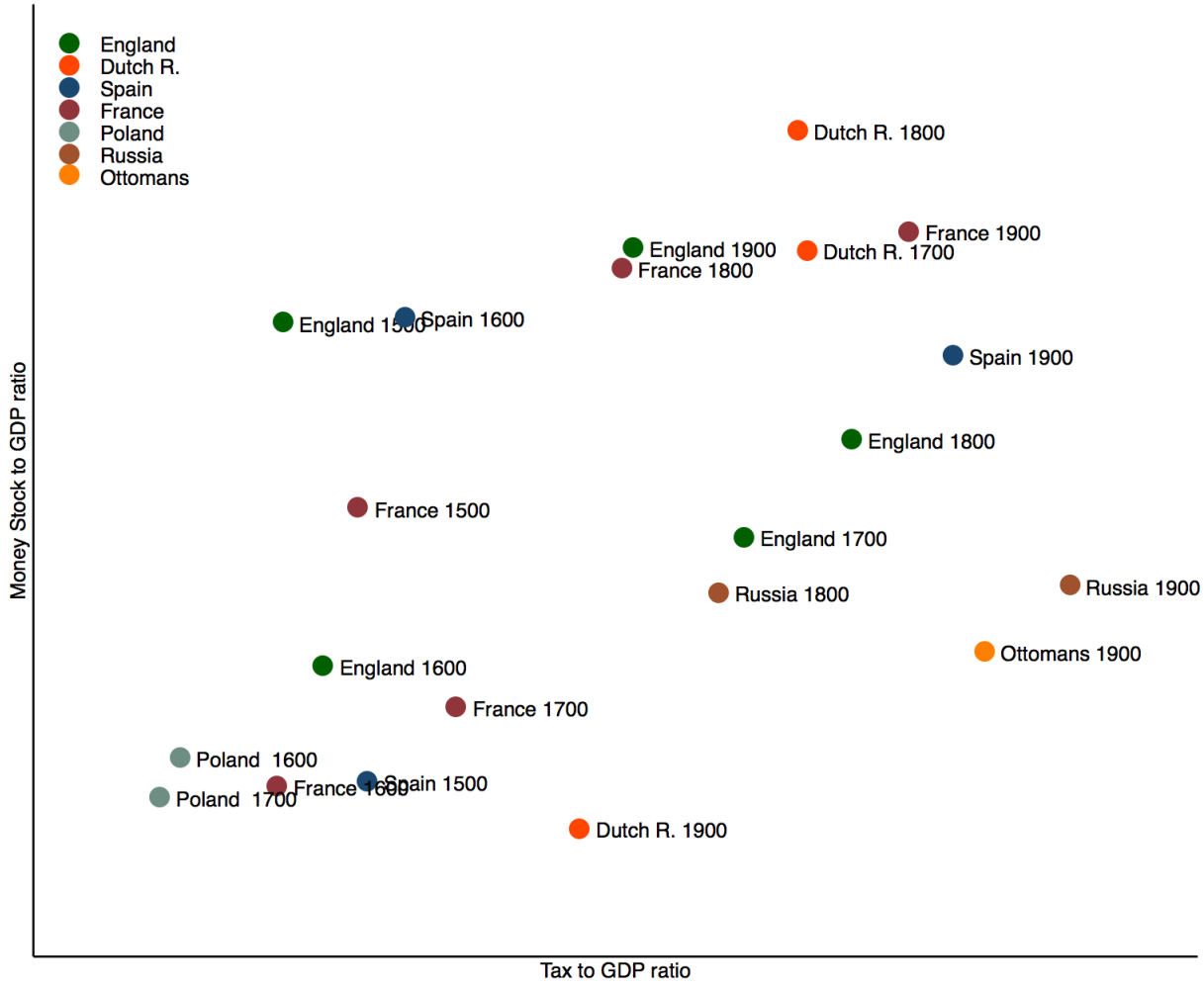

Figure 2: Tax to GDP ratio vs. Money to GDP ratio. Sources: see text

channel. In turn, higher fiscal capacity makes it easier for government to commit to a stable monetary unit, leading to growing public acceptance of forms of money which circulate above intrinsic value[4], and hence, making it possible to achieve higher levels of monetization.

To illustrate this mechanism, we construct a model where monetization is a function of expected inflation, and the government can invest in future fiscal capacity. Higher initial monetisation makes it easier to tax the economy, thus strengthening the incentive to invest in future

were very low, tax collection was extremely difficult (Desan 2014, p. 256; see also p. 312)

[4]Examples include both money circulating by tale (rather than weight) and paper money

fiscal capacity. But greater future fiscal capacity makes it less likely that, in case of future fiscal shocks, the government will have to use inflation to generate revenues. This acts as an implicit commitment device, which induces agents to demand more money and thus increases monetisation. We show that, while taxes and monetary expansion are substitutes in the short-run, they are complement in the long-run. Then, over the long-run, one should expect monetary and fiscal capacity to move together.

We provide empirical evidence that this has been so historically, focusing on early successes such as seventeenth-century Netherlands, eighteenth and nineteenth century Britain, and failures, such as Ming China. We conclude with implications for our understanding of the role of central banks today.

2 Model

Consider an economy inhabited by a multitude of agents, which lasts for two periods. All private agents have the same exogenously given income, which is equal to y in both periods. Preferences are linear in consumption, as well as in a public good provided by the government. While consumption receives weight one in preferences, the public good receives weight $\alpha > 1$. In each period $s \in \{1, 2\}$, up to an amount $\gamma_s m_s y$ of the public good can be provided, where m_s is an endogenous variable to be described below, and γ_s is a random variable which takes value $\overline{\gamma} > 0$ with probability π, and value zero with probability $1 - \pi$. The public good can be interpreted as expenditure in defence, and the case $\gamma_s = \overline{\gamma}$ as one in which, in period s, the country must fight an external war.

Income can be seen as the sum of the value added generated in a multitude of transactions taking place in each period. A share $m_s \in [0, 1]$ of these transactions is conducted using money, as opposed to barter. In period 1, this share is exogenously given. The share for period 2 is determined by agents at the end of period 1.

We have assumed that the maximum expenditure in the public good, $\gamma_s m_s y$, is proportional to the degree of monetisation of the economy (m_s), and to the economy's size (y). As clarified below, this assumption simplifies the model by ensuring that expenditures are proportional to

revenues.[5]

In each period, the government can generate an inflation tax $i_s \in [0,1]$, inflicting a loss $i_s m_s y$ on private agents, and giving the government revenues $\delta i_s m_s y$. For example, if money is paper money, the government could print new money. Of, if money is metallic, the government could impose a debasement of the existing currency, either by forcing agents to bring their coins to the mint for re-minting, or by providing incentives to do so.[6]

We assume $1/\alpha < \delta < 1$. The second inequality means that the inflation tax inflicts a higher cost on private agents than it generates revenues for the government. As clarified below, this will imply that the inflation tax is more inefficient than general taxation. One justification for this might be that an inflation tax reduces the reputation of the government as a monetary authority, thus compromising its future ability to generate revenues.[7] The first inequality ensures that, despite its inefficiency, money-printing is desirable as a last-resort source of public revenues in case of war.

Agents choose m_2 based on their expectation on the inflation tax that the government will impose in period 2, i_2^e. We capture this in reduced form,[8] by assuming

$$m_2 = m\left(i_2^e, \mu\right),$$

where $m(0,\mu) > 0$, $m(1,\mu) = 0$, and the function m is decreasing and concave in i_2^e: it is

[5] While this assumption simplifies the model, it is not strictly required to generate our results.

[6] For example, the government could allow for the production of currency units (e.g. francs, ducats, etc) with a lower metal content. Agents would then bring their currency units to the mint, to obtain a higher number of units. In the process, the government could reduce the metal content of the currency units more than initially declared, thus keeping part of the metal for itself.

[7] Without these dynamic considerations, it is not obvious why an inflation tax should be more inefficient than general taxation. Suppose for example that $y_t P_t = v_t M_t$ holds, where M_t is money supply and v_t is the velocity of money. Suppose $y_t = v_t = 1$ for all t. Suppose that the government increases the money supply from $M_1 = 100$ to $M_2 = 120$, in the process appropriating 10 units of the newly minted currency. The wealth of agents decreases from $M_1/P_1 = 100/100 = 1$ to $M_2/P_2 = 110/120 = 0.9167$, while the government gains $10/P_2 = 0.8333$. Clearly, in this case, the inflation tax inflicts the same cost on private agents than it generates revenues for the government. One could alternatively justify the assumption by arguing that re-minting is costly, but administering a general taxation system is costly, too.

[8] The function m could be micro-founded using a monetary model such as in Ch. 24 of Ljungqvist and Sargent (2004). Note that in those models the government can freely chose the money supply. Instead, we would have to assume that the money supply is ultimately constrained by the amount of metal in circulation. By increasing such amount, the inflow of metal from the colonies would presumably lead to higher monetisation, as we assume below.

$dm/di_2^e < 0$, $d^2m/d\left(i_2^e\right)^2 < 0$. In words, the negative effect of an increase in expected inflation on monetisation is smaller at low levels of expected inflation.[9] The parameter $\mu \geq 0$ is a shifter capturing all exogenous factors that facilitate the monetisation of the economy. A rise in μ could capture, for example, a rise in the amount of available metal. It is $\partial m/\partial \mu > 0$, $\partial^2 m/\partial i_2^e \partial \mu \leq 0$ and $\partial^2 m/\partial \mu \partial i_2^e \leq 0$.[10]

The government can also impose a tax t_s on the value added generated in transactions. We want to capture the idea that transactions denominated in money are easier to tax. We obtain this by assuming that only transactions denominated in money can possibly be taxed. Alternatively, one could assume that all transactions can be taxed, but transactions not denominated in money require greater fiscal capacity to tax.[11] In each period, the tax cannot exceed the state's current fiscal capacity, τ_s. Fiscal capacity in period 1 is exogenously given, while fiscal capacity in period 2 is determined by the government in period 1. To increase fiscal capacity to $\tau_2 > \tau_1$ costs $\phi F\left(\tau_2 - \tau_1\right)$, where F is an increasing and convex function, with $F'\left(0\right) = 0$, $F'\left(1 - \tau_1\right) = \infty$. To obtain a unique solution (see below), we further assume $F'''\left(0\right) > 0$. The parameter $\phi > 0$ is a cost shifter that captures all exogenous factors that make investment in fiscal capacity less attractive.

Indirect utility in period s is equal to

$$v_s = \alpha g_s + \left[1 - \left(i_s + t_s\right) m_s\right] y.$$

In each period, the government maximises expected inter-temporal utility subject to a balanced budget constraint and to the other constraints described above. The discount rate is equal to one.

The timing of the game is as follows:

- Period 1:

[9] This assumption helps ensuring the uniqueness of the equilibrium, but would ultimately have to be justified by a micro-founded model.

[10] So, an increase in μ rotates the function m upwards, increasing the intercept on the y axis but leaving the intercept on the x axis unchanged.

[11] The simplest way to model this would be assuming that the cost of investment in fiscal capacity F (see below) is increasing in m_t. Note that one potential issue with the current formulation is that with transactions denominated in money being easier to tax, m_2 will also be a decreasing function of t_2^e in a micro-founded model.

1.1 The government sets t_1 and i_1.

1.2 The government sets τ_2.

1.3 Private agents set m_2. The public good is produced, payoffs realise.

- Period 2: The government sets t_2 and i_2. The public good is produced, payoffs realise.

We solve for the equilibrium using backward induction.

Period 2. Assume $\min[\delta + \tau_2, 1] > \overline{\gamma} > \tau_2$.[12] This means that, even in the "war scenario", the government is able to provide the efficient amount of the public good, however it must resort to money printing to some extent. This assumption generates a "static substitutability" between taxes and monetary expansion, as in standard fiscal theories of the price level. However, we show below that, dynamically, taxes and monetary expansion (more precisely, the degree of monetisation) are complements, because a higher degree of monetisation makes it more attractive to invest in fiscal capacity.

Because taxes and monetary expansion are substitutes, investment in fiscal capacity acts as an implicit commitment device: the greater fiscal capacity, the lesser the need to resort to money printing in case of war.

The government's problem is

$$\begin{aligned} \max_{i_2,t_2} \quad & \alpha g_2 + [1 - (i_2 + t_2) m_2] y \quad \text{s.t.} \\ & (\delta i_2 + t_2) m_2 y = g_2 \\ & t_2 \leq \tau_2 \\ & g_2 \leq \gamma_2 m_2 y \end{aligned}$$

If $\gamma_2 = 0$, there is no need to spend on public goods. The government will then set $t_2 = i_2 = 0$. If $\gamma_2 = \overline{\gamma}$, the government wants to raise $\overline{\gamma} m_2 y$ in revenues. Given that money-printing is a less efficient source of revenues than taxes, the government first sets taxes to the highest possible

[12] Although τ_2 is endogenous, it is always possible to choose $\overline{\gamma}$ so that it falls in the required range. Alternatively, as evident from the first order condition below, one can always choose τ_1 (which is exogenous) and ϕ so that the equilibrium τ_2 is just below $\overline{\gamma}$, thus making the assumption true.

level, $t_2 = \tau_2$, and finance the rest of the cost of providing public goods through money printing,

$$i_2 = \frac{\overline{\gamma} - \tau_2}{\delta}.$$

Period 1. In period 1.3, forward looking agents set

$$m_2 = m\left(\pi \frac{\overline{\gamma} - \tau_2}{\delta}, \mu\right).$$

Note that a higher fiscal capacity in period 2 encourages private agents to hold more money in that period: this is the commitment mechanism described above.

Consider investment in fiscal capacity in period 1.2. Suppose for simplicity that $\gamma_1 = 0$, so that revenues in period 1 are allocated entirely to investment in fiscal capacity. Also for simplicity, suppose that fiscal capacity in period 1 is large to enough to pay for the optimal investment in fiscal capacity in period 2. Clearly, the government will then chose a level of tax that is just enough to pay for investment in fiscal capacity $t_1 = F(\tau_2 - \tau_1) / (m_1 y)$

After some manipulations (reported in the Appendix), the government's problem can be written as

$$\max_{\tau_2} \quad y - \phi F(\tau_2 - \tau_1) + y + \pi \frac{(\delta\alpha - 1)\overline{\gamma} + (1 - \delta)\tau_2}{\delta} m\left(\pi \frac{\overline{\gamma} - \tau_2}{\delta}, \mu\right).$$

The solution to this problem satisfies the first order condition

$$\overbrace{\pi \frac{1 - \delta}{\delta} m\left(\pi \frac{\overline{\gamma} - \tau_2}{\delta}, \mu\right)}^{\text{I}} + \overbrace{\pi \frac{(\delta\alpha - 1)\overline{\gamma} + (1 - \delta)\tau_2}{\delta^2}\left(-\frac{\partial m}{\partial i_2^e}\right)}^{\text{II}} = \phi F'(\tau_2 - \tau_1), \tag{1}$$

which has a unique solution.[13]

[13]This follows from three facts. First, the left-hand side of to (1) is concave and either increasing, or increasing then decreasing, or decreasing in τ_2. To see that, note that, by the assumption that m is decreasing and concave, the first term is increasing and concave in τ_2. As for the second term, the ratio $[(\delta\alpha - 1)\overline{\gamma} + (1 - \delta)\tau_2] / \delta$ is linearly increasing in τ, while $-\partial m / \partial i_2^e$ is increasing in i_2^e and thus in decreasing in τ_2. Second, the right-hand side is increasing and convex in τ_2 (recall we have assumed $F''' > 0$). And third, for $\tau_2 = \tau_1$, the left-hand side

Our main result is contained in the following Proposition:

Proposition 1. *A fall in ϕ and a rise in μ both lead to a greater fiscal capacity and a higher monetisation of the economy in period 2 (higher τ_2^* and m_2).*

Proof. In the Appendix. □

The parameters ϕ and μ only affect the fiscal and monetary side of the economy respectively, and yet their changes lead to changes in both fiscal capacity and monetisation. This is because fiscal capacity and monetisation are complements: higher expected monetisation strengthens the incentives to invest in fiscal capacity. In turn, higher expected fiscal capacity, by strengthening the government commitment not to use the inflation tax, encourages monetisation. This implies that a monetary expansion (for example, due to an increase in the amount of available metal, i.e. an increase in μ) is, dynamically, complementary to higher taxes.

More in detail, investment in fiscal capacity is attractive for two reasons. First, to tax the economy is, by assumption, a more efficient way to generate revenues than the inflation tax: faced with the possibility of a costly future war, the government may then want to invest in fiscal capacity in the present. This effect is captured by term I in condition (1). Second, the government realises that, by setting up greater fiscal capacity, it also implicitly commits not to generate too much inflation in case of a war. This encourages private agents to conduct more transactions in money, which in turn makes any existing fiscal capacity more effective (given that it is easier to tax money transactions than barter transactions). This second effect is captured by term II in condition (1). A fall in ϕ is an exogenous shock that makes it more attractive to invest in fiscal capacity. As the government invests more, its implicit commitment not to resort to the inflation tax also increases, encouraging greater monetisation. In turn, greater monetisation further encourages investment in fiscal capacity. The result of this positive feedback loop must be an increase in both τ_2^* and m_2. The effect of an increase in μ is similar. This is a shock that, for any level of commitment, increases the amount of transactions that agents conduct using money. As a result, monetisation increases. In turn, higher monetisation increases the taxable

is positive (recall we have assumed $\delta\alpha < 1$) while the right-hand side is zero, while for $\theta_2 = 1$ the left-hand side is finite while the right-hand side is infinite.

base available to the government, making investment in fiscal capacity more attractive. But this leads to greater commitment not to print money, unleashing a positive feedback loop similar to the one described above. The result must again be a rise in both τ_2^* and m_2.

3 Case studies

3.1 China: from precocious industrializer to sleeping dragon

> "Uncoined and largely obtained from foreign sources, silver resisted all efforts to subordinate it to imperial will. The rise of the silver economy during the late imperial era dealt a devastating blow to the state's sovereign authority over the livelihood of its subjects." (von Glahn 1996)

Early Chinese empires had problem of chronic shortage of currency. This is a problem China shared with other world regions, but which unlike the latter it managed to largely solve in medieval times during the Song (960-1279) and Yuan (1271-1368) dynasties. The Song period, in particular, witnessed not just intensive growth and technical change (Jones 1988) but also remarkable monetary developments.

First, during the Northern Song, monetization went along with increasing state revenues. The state's total revenues grew steadily during 997-1086, as the share of taxes paid in money (rather than kind) also steadily increased (von Glahn 2016, p. 231-2). There is ample evidence that "monetization of state revenue required an ample supply of coin" (von Glahn 2016, p. 233), and the Song were capable of repeatedly increasing the money supply; consequently, government revenues grew steadily as well (von Glahn 2016, p. 234-235).

In 1024, the state took over the issuing of paper bills of credit in Sichuan, and created the world's first paper money, inconvertible after 1160. Initially, public confidence was cautious and the notes circulated at moderate to high levels of discount, but after an experiment in 1166-7 which suggested the government was committed, they circulated until 1190 at close to face value (von Glahn 1996, pp. 49, 53 and 57). From 1215 almost all land sales contracts became denominated in paper money (von Glahn 2016, p. 265), and together with this paper

monetization of the economy came rises in tax receipts for the state, and a shift from in-kind payments to money taxes. At the same time, taxes paid in kind fell, not just in relative but also absolute terms, "from 25-30 million shi per year in the eleventh century to 6 million shi per year in the late twelfth century" (von Glahn 2017, p. 259).

Despite these shifts, "the state's share of total output remained roughly constant from 1077 to the end of the Southern Song" (von Glahn 2017, p. 265; see also p. 259, fnt. 8). This is, in our view, how the Chinese experience most differs from the subsequent European experience, especially during the ninetieenth century, which we discuss in the next subsections. The failure of the Song state was due to its choice of keeping taxes constant despite considerable levels of income and population growth. This is a mistake that China would repeat again during the Ming, as we discuss below, and yet again centuries later, during the eighteenth century Qing.[14]

The failure of state capacity to rise eventually implied that policy changed once the empire faced serious military threats. While the Song had previously lost much of North China to the Jin, and had conceded this loss by 1141, their fiscal infrastructre had remained solid, since the Southern Song remained in control of the richer and most populated parts of the empire (von Glahn 2016, p. 256-7). But Song-Jin war and civil war in Sichuan during 1205-8 "utterly bankrupted the central government, forcing it to resort to ruinous fiscal and monetary policies" (von Glahn 2016, p. 255). While the government's money supply had been for decades prudently managed, during the Song-Jin war of 1206-8 the central government financed deficits using printed money. The total volume of notes in circulation hence increased from 10 millions of guan during 1168-83 to 365.9 millions 1231-40; notes duly gained a discount (up to 75

Paper money nevertheless survived and florished into the Yuan era, but this dynasty was unable to establish a fiscally stable state (von Glahn 2016, p. 284). Once the first Ming emperor took over the state, anti-market reforms were undertaken, aiming to restore "the autarkic village economy of the idealized past" (von Glahn 2016, p. 285-6). There was then a partial return to in-kind payments, along with a nationalization of land. As far as tax policy was concerned, the Ming would repeat the mistakes of the Yuan. Surveys carried during 1387-93 defined fixed

[14]This is, in our view, how the Chinese experience most differs from the subsequent European experience, especially during the ninetieenth century, which we discuss in the next subsections

tax quotas which did not change after 1393. This meant that the state was unable to build a proper fiscal infrastructure, as was forever stuck at a low level of fiscal income. When a new type of inconvertible currency was introduced, it suffered depreciation and discount rates which had reached a discount of almost 80

China's usage of paper money had amazed the few Europeans who travelled to China during the Middle Ages, most notably Marco Polo. But by the time the first Portuguese arrived by sea in the early sixteenth century, paper money no longer circulated. China would not again use paper money until a brief experiment more than three centuries later, in 1853, when the government tried to re-introduce incovertible paper note – which were unaceptable to the public and immediately generated inflation (von Glahn 2016, pp. 382). They were soon abandoned, and even "by the end of the Qing dynasty China still depended heavily on silver coin as its principal currency" (von Glahn 2016, pp. 383).

Ming-Qing China was a remarkable example of the disastrous consequences of Buchanan's "starve the beast" principle, if taken to the limit. During the early modern period, as population increased by a factor of at least three, taxation revenues actually declined (table 1). The failure to adequately tax commerce and agriculture has been pointed out as a "permanent flaw" of early modern and nineteenth century China (Spence 2013, p. 5) What was causing this process of "inverse state formation" just as the opposite was happening in Europe? Ideological and institutional constraints surely contributed (Brandt et al 2014). But we emphasize that the lack of monetization also prevented appropriate levels of taxation of the economy, since it is much harder to tax a less monetized economy.[15]

From the demonitization of paper onwards, the Chinese state had minimal involvement in the provision of money (only copper coins were provided). This contrasted with the case of Europe, where states ran mints – competing mints during the middle ages which were later centralized during the early modern period – which provided money circulating by tale and in standardized form. Consequently, China was stuck with low monetary as well as fiscal capacity. In China, the state was not involved with the exception of some imperial provision of copper coin – burdensome to transport, only used for small exchange, and usually circulating at value close to that of its

[15]See Ma (2014) for an overview of the Chinese monetary system from 1800 to 2000.

melted weight.[16] As for silver or gold, the state was not involved altogether. As time went on, the Chinese economy remained under-monetized and agents anticipated that the implementation of a fiat money system was not credible. The economy was trapped in an inefficient equilibrium, and no obvious coordination mechanism to get out of this was available. Economic growth required an adequate amount of liquidity under credible policies such that money could circulate by tale, not weight. Instead, well into the nineteenth century, the Chinese were forced to trade using silver bars, foreign currency, costly credit mechanisms, or even exchange and store value using bronze, which circulated at approximately weight value, leading to high transaction costs. As a consequence of these developments, the Chinese state was unable to modernize in the early modern period (Brandt et al 2014), while the European economies were increasing state capacities (Table 1). Through the lens of our model, what happened to cause the monetary system to collapse was that China did not have enough fiscal capacity to cope with the fiscal shocks it faced.

	China	Ottoman empire	Russia	Poland-Lithuania	Austria	Prussia	France	Venice	Spain	England	Dutch Republic	Portugal
1500-1549	-	-	-	0.8	-	-	2.6	10.4	3.0	1.5	-	-
1550-1599	-	1.7	-	0.4	-	-	3.2	9.5	4.0	2.7	-	-
1600-49	-	1.4	-	0.5	-	-	3.0	7.5	7.2	2.6	12.0	7.1
1650-99	-	1.7	-	1.3	2.6	2.0	8.0	10.6	7.7	4.2	13.6	5.6
1700-49	2.3	2.6	4.4	0.6	6.3	6.6	6.7	12.7	4.6	8.9	24.1	8.0
1750-99	1.3	2.0	7.6	1.7	11.3	14.1	11.4	13.2	10.0	12.6	22.8	10.6
1800-49	1.2	5.0	6.2	-	10.2	-	14.3	-	8.6	13.5	-	9.1

Table 1: Comparative levels of fiscal capacity. Source: For Portugal, Palma and Reis (2016); for China, Brandt et al (2013); for the others, Karaman and Pamuk (2010), which rely on a variety of sources.

[16]This too contrasts strongly with the European case, where copper coins circulated by tale at a value well above their intrinsic worth, i.e. they were close to fiat.

3.2 England

It is worth noting the traditional view of the industrial revolution as a phenomenon alien to the state can now be rest aside. In addition to authorizing entry, parliamentary acts set regulations for tolls, taxation, and the takings of land; in the words of Bogart (2013), "Britain's history shows that many transport improvements were difficult to implement because they required financial innovation and involved taxation and vexing property rights issues." This process was much more efficient in Britain than in France, where the state was unable to set aside local progress-blocking privileges (Rosenthal 1990). The strenght of Britain's military (especially the navy, whose work was of course made easier by Britain's geographic position) led to the creation of a stable, low risk, low ambiguity, integrated internal market (O'Brien 2014). All in all, it is safe to say that high state capacity was an important, if not the most important, factor explaning Britain's rise.

But why did British fiscal capacity rise in a comparative sense, as shown in Table 1? Recent work on the origins of state capacity enphasizes the role of warfare in leading to higher levels of taxation:

> "The British government very quickly ceased issuing "unfunded" debt, turning to straight issues of "funded" debt after the trauma of the South Sea Bubble in 1720. Special taxes were committed by Parliament to the service and redemption of each new issue. As Parliament was a permanent legislative body with exclusive taxing authority, it could make a commitment to the creditors of the state that was both credible and perpetual ... But the pressure of debt service occurring after each war must have been a more powerful force impelling government to develop a larger tax base and to extract taxes more efficiently. The two processes obviously reinforced each other over the eighteenth century, but the direction of causation appears to be from war finance to increased debt to higher debt service/total revenue ratios to higher taxes" (Neal 2000, p. 126-127, see also O'Brien 1988 and Besley and Persson 2011).

Our explanation is complementary to this, enphasizing that even if other right conditions were present, it would have been difficult for the tax rises to be implemented without solving

a monetization bottleneck in the economy, since having a monetized economy is a necessary condition for the government to be able to appropriately collect taxes. This can be most clearly seen by considering the narrative evidence corresponding to England as a case study.

In contrast with the case of China, England discovered more gradually the route towards a stable monetary system (Sargent and Velde 2002, Neal 2000). Following the discovery of vast amounts of precious metals in America by the Spanish after the 1550s, England's money supply had been steadily rising. In the first century this was, however, closely accompanied by population growth (Figure 1). But from the 1630s onwards, real per capita money supply rose persistently, in a process which started sooner than the rise in per capita incomes (Figure 2).

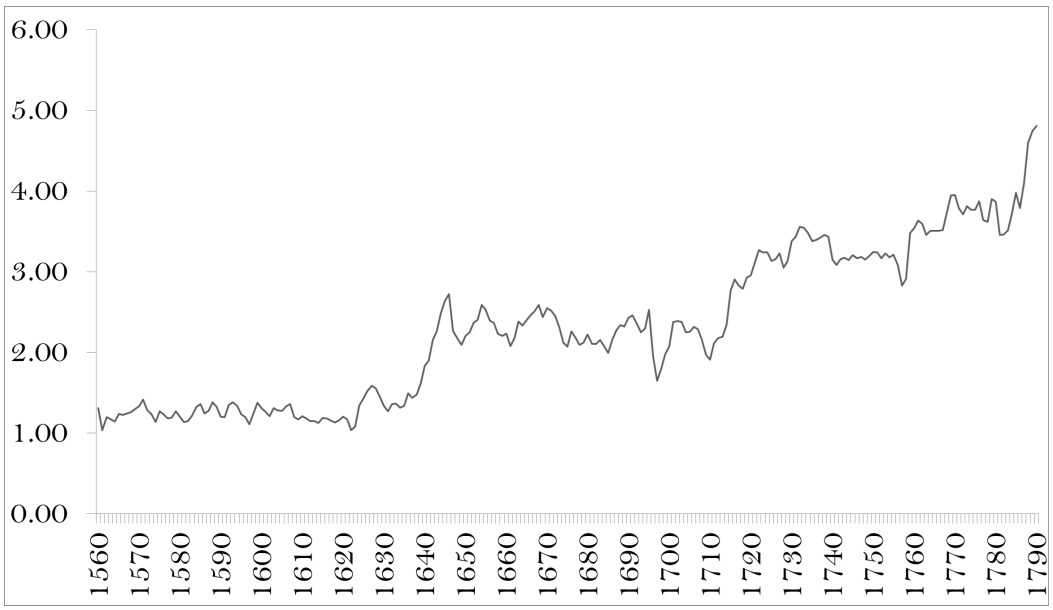

Figure 3: English per capita money supply, 1560-1790, constant £ of 1700. Source: (Palma 2017)

What explains the timing of the rise in per capita money supply, documented in Figure 1? A theory known as the monetary approach to the balance of payments (McCloskey and Zecher 1976) argues that each country's reception of precious metals was driven by the productivity of their external sector driving trade surpluses or deficits (this is related, but goes beyond, David Hume's well-known price-species flow argument). Without denying some truth to this mechanism, the fact of the matter is that geopolitical changes which changed endowment avaliabilities often mattered more. We illustrate with two examples.

Figure 4: English/GB GDP per capita. Sources: Broadberry et al (2015)

First, production of precious metals in America rose steadily from the 1530s onwards (Figure 5). This rise went over and above both the price and population growth levels for England, as with other European countries. But what is noticable is that, despite a great emphasis of previous work on "the great inflation" of the sixteenth century, in fact England had declining or flat per capita supply of money for a century after this episode began.

The historical consensus is that "[b]y 1630 the general state of the silver in circulation had... grossly deteriorated to an unacceptable level" (Connors and Glyn 2016). Then in November 5th, 1630, England signed with Spain the Treaty of Madrid (1630), where it renounced supporting the rebels of the Spanish Netherlands and the Protestants in Germany. This was followed by the Cottington treaty (2 January 1631), a secret agreement arranging for the partition of the Dutch Republic between Spain and England in return for the restoration of the Palatinate. Immediately, £80,000 worth of Spanish silver were brought over to England. More importantly, from then onwards Spanish silver on its way to pay troops in the Low Countries would be transported via England, and 2/3 of this silver would stay as payment. This is what led to the clearly visible jump in English mint output (Figure 6) and per capita money supply (Figure 1) at this time.

In accordance with the mechanism we propose in this paper, English fiscal capacity also rose significantly due to these arrivals of silver, during the 1630s. The timing is not confounded by

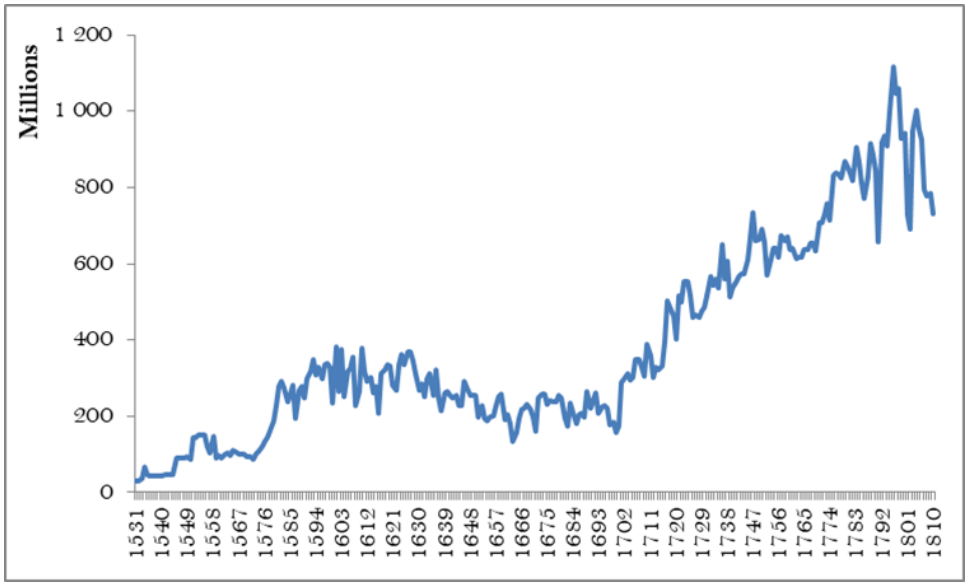

Figure 5: American production of precious metals. Source: Palma (2017)

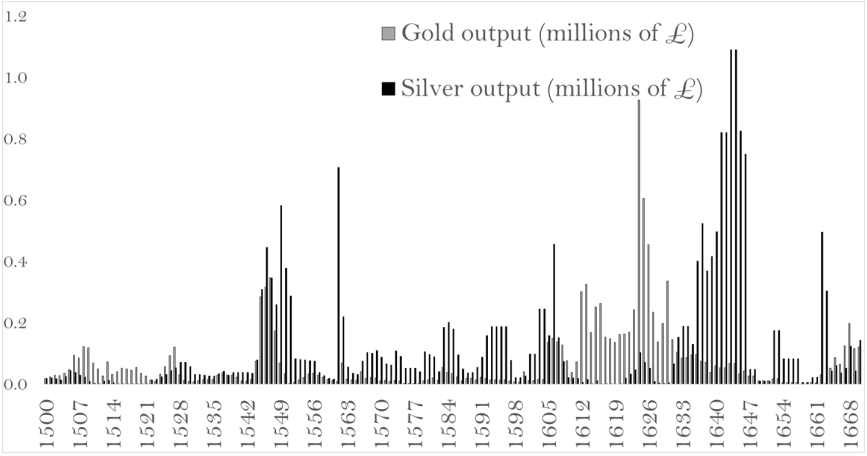

Figure 6: English mint output, 1500-1670. Sources: Palma (2017), based on Challis (1992)

the civil war, which only started in 1642. Figure 7 shows this clearly. For Spain, one could argue that the timing of the signing of the Madrid and Cottington treaties were endogenous. But for England, they were a matter of geopolitical luck, deriving from Spain's situation and England's geographic position. Hence, we enphasize that the monetization of the economy was a precondition for the construction of the fiscal-military state, and in fact it predated it. It may well have been a necessary condition.

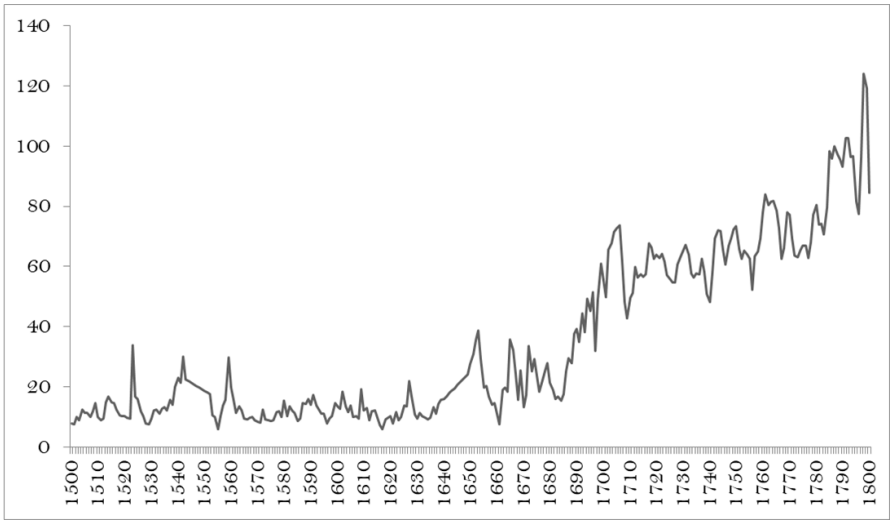

Figure 7: English government real per capita revenues, 1500-1800. Sources: Karaman, Pamuk, and Yildirim-Karaman (2017). The unit is per capita tax revenue in grams of silver divided by a daily cost of the Allen (2001) respectability basket; hence the unit corresponds to "days of Allen's basket"

Another instance is that of the Methuen treaty, signed in 1703 with Portugal. It was a military and commercial treaty which proposed preferential custom treatment for Portuguese wines (in an attempt to diversify away from French wines), in exchange for English manufactures. The differential values was to be paid in gold, and the timing of this treaty was determined by Portugal's finding of large quantities of gold in Brazil in the early 1690s. As a consequence, two-thirds of Brazilian gold ended up in England: "Almost all our gold, it is said, comes from Portugal" [Smith 2003 (1776)]. The resulting monetary injection to the English economy was significant: about £40 million for the 1700-1770 period alone (Palma 2014). Accordingly, Conduitt, the sucessor to Newton as master of the mint, claimed in 1730 that "nine parts of ten, or more, of all payments in England are now made in gold" (Challis 1992, p. 431). The outcome of this for English mint output can be seen in Figure 5 and, in per capita money supply we can clearly see another upwards level effect at this time (Figure 1). And once again, English fiscal capacity rose following this episode, following the rise in monetary capacity, as we show in Figure 7. Of course, the effects of the Glorious Revolution must have mattered as well; our explanation does not pretend to substitute but to complement this; without adequate liquidity it would have been difficult for the state to collect taxes.

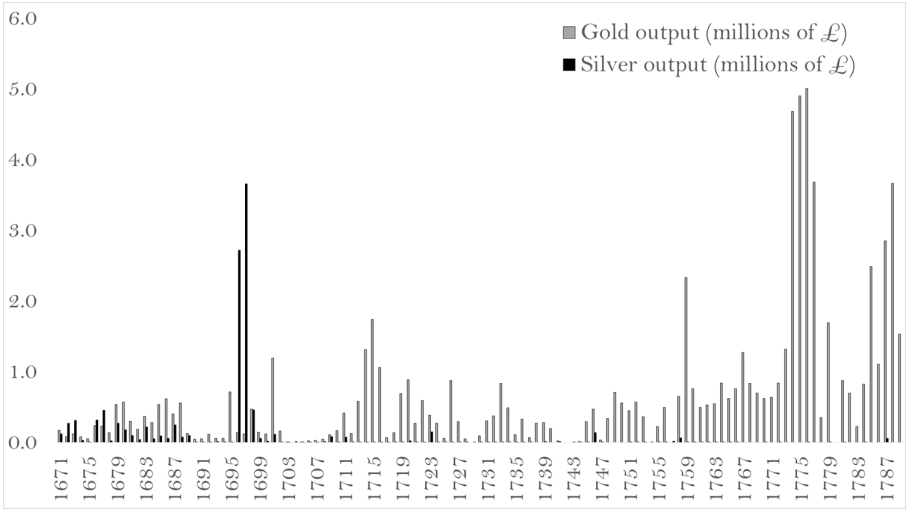

Figure 8: English mint output, 11671-1789. Sources: Palma (2017), based on Challis (1992)

Finally, we focus here on one episode at the end of the eighteenth century, when war led to an extraordinary expansion of fiat together with the suspension of convertibility; this episode can be contrasted with the apparently similar measures of the Yuan and Ming of medieval and early modern China, but nonetheless led to completely different results.

Figure 6 illustrates the massive response of Britain's monetary authority to the threat of revolutionary and (later) Napoleonic France. As the figure makes clear, the government showed only moderate responses to most pre-1789 conflicts, but by contrast the response to 1789-1792 was massive, and in fact after 1797, convertibility was completely suspended – and would remain so until 1819-21 – hence making the notes pure fiat. Yet, and quite unlike the response of the Chinese public under apparently "similar" circumstances, the public accepted the notes, despite the whispering of French alarmists, who claim these would be worthless once the French landed.[17] This comparative experience suggests that the emergence of an efficient monetary system was conditional on agents' internalization of the states' capacities and institutional background (Bordo and White 1990).[18] Of course, the full political and intellectual acceptance of fiat would have to wait for the twentieth century, as the inauguration of the gold standard in

[17]The notes typically circulated at little discount, even under the circumstance of imminent invasion. At a late stage they briefly peaked ay 50 %, a comparatively low figure.

[18]The success of Britain's unorthodox monetary policy convinced the public that fiat was viable, and the additional liquidity support continued growth (O'Brien and Palma 2016b).

1819-1821 and the nature of the ninteenth century debates of the currency versus the banking school make clear.[19]

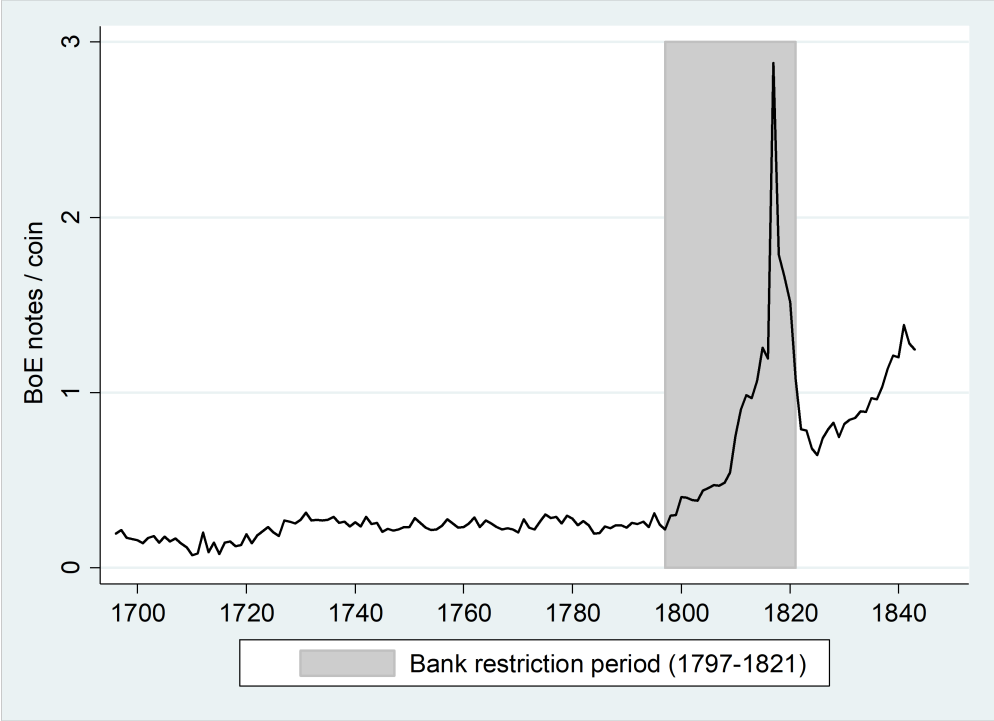

Figure 9: Ratio of Bank of England notes in circulation to English coin supply. Source:O'Brien and Palma (2016)

As this figure shows, even in England until the late eighteenth century most of the money supply increase was due to increases in coin. Hence, the increase in money supply was necessarily limited as it was dependent on precious metals.[20] Britain was able to achive the observed growth rates during the ninetieenth century due to its transition to a temporarily fiat system, followed by a system largely based on convertible paper money, but which was (at least until 1844) capable of providing adequate amounts of liquidity and facilitate tax gathering (the classical Gold Standard).

[19]The lead in providing liquidity to the economy pursued by the Bank was widely considered an enviable success in policy circles and was eventually followed by the rest of the Europe

[20]As late as 1790 the monetary base was composed of £44 million of commodity-based coin but only £12 million in notes (£8 million Bank of England notes and £4 million for all other; see Capie 2004). Broader forms of money were complements, not substitutes, to coin (Palma 2016) and hence their growth too dependend indirectly on the supply of metals

3.3 The intra-European experience

Despite being "the first modern economy" (de Vries and van der Woude 1997), the politically fragmented character of the Dutch political structure meant that no proper national debt backed by a taxing authority emerged in the early modern period:

> "In short, the Netherlands, due to the fragmented character of its political structure, never issued during this period a truly national debt backed by a national taxing authority. This was despite the constant pressures placed upon Dutch financial resources by the repeated assaults of the French or the English. Consequently, the Netherlands missed out on the financial revolution that arose later in England What Dutch citizens and bankers lacked was a liquid, transparent, secondary market for the securities issued by their various public authorities. Their financial system failed to match the effectiveness of their monetary system" (Neal 2000, p. 123)

Despite the emphasis by economic historians such as Neal on the Netherland's failure to develop centralization to the same degree as was to be the case in England, the fact of the matter is that the Dutch economy performed very well during the early modern period (Figure 9). The Dutch had a well-monetized economy, especially from the sixteenth century onwards (Lucassen 2014), which in turn allowed the state to easily collect taxes. Due to high levels of monetary and fiscal capacity, the Netherlands were able to achieve high levels of income and growth.

As for France, while John Law's Banque Royale was clearly modelled after the Bank of England, one key difference was that its issue of banknotes was not limited by any reserve requirement, but rather by the King's Council (Neal 2000). This made it more difficult for dynamically consistent (i.e. credibly committed) policies to be implemented, and Law's scheme duly collapsed. A paper money system fiat-money system was again implemented France during the revolutionary period. Initially backed by land as a collateral, the "assignats" were eventually overissued, and once the guillotine-enforced Terror ended, hyperinflation followed (Sargent and Velde 1995). Following this episode, France was forced to return to commodity money (Bordo and White 1990). But subsequently, France too would follow the English example and set up modern monetary institutions which interacted positively with its new state which, due to the

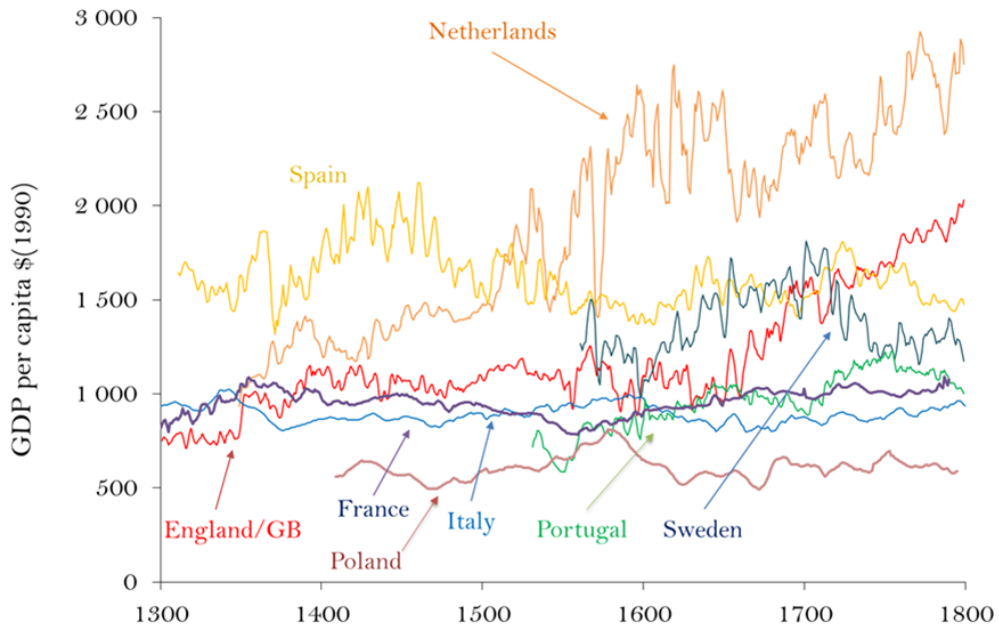

Figure 10: GDP per capita in several European countries. Sources: For France, Ridolfi (2016); for England/GB, Broadberry et al (2015); for Holland, van Zanden and van Leuween (2012); for Germany, Pfister (2011); for France in 1850, lvarez-Nogal and Prados de la Escosura (2013, p. 23); for North and Central Italy, Malanima (2011); for Spain, lvarez-Nogal and Prados de la Escosura (2013); for Sweden, Schn and Krantz (2012).

Revolution, was now able to collect efficient amounts of taxes.

In Europe, the road to dynamically consistent monetary policies with regards to fiat was slow but steady, but as the eighteenth century advanced and drew to a close Britain's example clearly showed it was possible, and others soon followed (Roberds and Velde 2014). From that period onward, for most European polities warfare did not mean either dramatic debasements or the uncontrolled expansion of paper notes for fiscal reasons.

4 Conclusions

> [E]ndless books have been written about the dangers of government printing too much money. But for centuries the opposite problem was just as common: governments often couldn't mint enough coins... to meet their subjects' needs (Pomeranz and Topik 2005, p.14)

In this paper we have argued that monetary and fiscal capacity are jointly determined. This fact has implications for both macroeconomics and development.[21] In macroeconomics, the fiscal theory of the price level consensus is that, as long as there is fiscal dominance, prices are determined by fiscal policy. Taxes and monetary increases are hence seen as substitutes. We have argued that historically, monetization has been a precondition for the building of fiscal capacity, and that in turn, countries with high fiscal capacity are capable of building more efficient monetary systems. Our model fleshes out how this joint causality takes place. Our research questions the view, popularized by the fiscal theory of the price level, that monety and taxes are substitutes. Instead, in our model, they are indeed substitutes in the short run, but become complements in the long run.

The literature on long-run growth has been converging to an increased emphasis on the importance of high state capacity both as an force which historically prompted some Western countries ahead and as a blocking factor preventing development in poor countries today. The state of the art has hence moved away from the previous enphasis on the predatory state; that is, the idea that historically the main blocking factor was the incentive effects caused by expropriation of property by states which were too strong or absolutist (as previously enphasized by deLong and Sheifler 1993, Acemoglu et al 2005). Historically, only states that were able to gradually centralize the administration and implement a system of broad taxation were able to provide a sufficient amount of public goods and to overcome externalities, allowing their economies to survive interstate competition under an investment-friendly environment of decreased uncertainty and ambiguity (Epstein 2000, Mokyr and Voth 2009).[22]

In this paper, we concentrate on one neglected aspect of the cost which was imposed on societies where the state was "too weak": the inadequate provision of a liquid means of exchange which could support ease in the collection of taxes, low transaction costs, and extended levels of specialization and market participation.[23] We discuss the relationship between the comparative emergence of a modern system of state finance and the public provision of money which was able

[21] It was previously known that more advanced economies tend to have more advanced monetary and financial systems, but the direction of causality has been a matter of debate (Levine 2005)

[22] For a sample of the literature which considers the links between state-building and economic growth, see Besley and Persson (2011), Brewer (1988), Dincecco (2009), O'Brien (2011), and Rosenthal (1990).

[23] This section is based in part in the ideas developed in a previous policy paper (Palma 2014)

to support continued economic growth. We start with the remarkable case of China, which after an early experiment with paper money, failed to develop a commitment mechanism to keep the supply of fiat limited, and as a result made the supply of liquidity altogether impossible. The interaction of monetary and political institutions in China did not allow for the development of a system comparable to that which Europe was able develop gradually, and would in due time support the transition to modern economic growth. We then discuss the intra-European experience, which suggests that the emergence of an efficient monetary system was conditional on the right institutional background.

The advancement of Europe's economy during the early modern period happened at the time when China was regressing to a basic uncoined, silver-based system, and simultaneously, the government's share of the economy was steadily shrinking to a negligible size just as in Europe the opposite was taking place. While per capita income under Song and Yuan China was higher than in contemporaneous Europe (Broadberry et al 2014), and China had fiat money – a remarkable innovation for its time, which should rank alongside other "great inventions" of China such as the printing press, paper making, the compass, and gunpowder – the Chinese state was unable to modernize and achieve high levels of state capacity in the absence of a monetized economy.

The comparative historical experience of Europe vis-a-vis China suggests that continued growth requires a mechanism capable of providing adequate amounts of liquidity while at the same time credibly committing not to over-expand in order to residually balance government deficits. In this paper, we have argued that fiscal capacity contributes one such mechanism, and that higher monetisation, in turn, strengthens the incentive to invest in fiscal capacity. This complementarity implies that monetary and fiscal capacity will move together in the long-run, amplifying the effect of each other.

Europe's success in solving this problem, and within Europe, the early successes of the Netherlands and above all Britain with the Bank of England, were a key part of the success of this part of the world as a necessary precondition to the take-off towards modernity.

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Appendix

Government's period 1 expected payoff. The government's expected payoff can be written as

$$\begin{aligned}
&\left[1-\frac{\phi F\left(\tau_2-\tau_1\right)}{m_1 y}m_1\right]y+\left(1-\pi\right)y+\pi\left\{\alpha\overline{\gamma}m_2+\left[1-\left(\frac{\overline{\gamma}-\tau_2}{\delta}+\tau_2\right)m_2\right]\right\}y= \\
&=y-\phi F\left(\tau_2-\tau_1\right)+y+\pi\frac{\delta\alpha\overline{\gamma}-\overline{\gamma}+\tau_2-\delta\tau_2}{\delta}m_2 \\
&=y-\phi F\left(\tau_2-\tau_1\right)+y+\pi\frac{\left(\delta\alpha-1\right)\overline{\gamma}+\left(1-\delta\right)\tau_2}{\delta}m_2
\end{aligned}$$

Proof to Proposition 1. The FOC can be re-written as

$$\Phi\left(\tau_2,\mu,\phi\right)=\pi\frac{1-\delta}{\delta}m\left(\pi\frac{\overline{\gamma}-\tau_2}{\delta},\mu\right)+\pi\frac{\left(\delta\alpha-1\right)\overline{\gamma}+\left(1-\delta\right)\tau_2}{\delta^2}\left(-\frac{\partial m}{\partial i_2^e}\right)-\phi F'\left(\tau_2-\tau_1\right)=0.$$

By the discussion in footnote 13, the function $\Phi\left(\tau_2,\mu,\phi\right)$ is monotonically decreasing in τ_2, and there exists a unique τ_2^* such that $\Phi\left(\tau_2^*,\mu,\phi\right)=0$. Furthermore, it is

$$\begin{aligned}
\frac{\partial\Phi\left(\tau_2,\mu,\phi\right)}{\partial\mu}&=\tau\frac{1-\delta}{\delta}\frac{\partial m}{\partial\mu}+\pi\frac{\left(\delta\alpha-1\right)\overline{\gamma}+\left(1-\delta\right)\tau_2}{\delta^2}\left(-\frac{\partial^2 m}{\partial i_2^e\partial\mu}\right)>0 \\
\frac{\partial\Phi\left(\tau_2,\mu,\phi\right)}{\partial\phi}&=-F'\left(\tau_2-\tau_1\right)<0.
\end{aligned}$$

Consider an increase in μ. The total differential of $\Phi\left(\tau_2^*,\mu,\phi\right)=0$

$$\frac{\partial\Phi\left(\tau_2^*,\mu,\phi\right)}{\partial\mu}d\mu+\frac{\partial\Phi\left(\tau_2^*,\mu,\phi\right)}{\partial\tau_2^*}d\tau_2^*=0,$$

which immediately implies $d\tau_2^*/d\mu>0$ (and thus $dm_2/d\mu>0$). Similarly, consider an increase in ϕ. The total differential of $\Phi\left(\tau_2^*,\mu,\phi\right)=0$

$$\frac{\partial\Phi\left(\tau_2^*,\mu,\phi\right)}{\partial\phi}d\phi+\frac{\partial\Phi\left(\tau_2^*,\mu,\phi\right)}{\partial\tau_2^*}d\tau_2^*=0,$$

which immediately implies $d\tau_2^*/d\phi<0$ (and thus $dm_2/d\phi<0$). ■