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Julien Pinter

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Monetarist arithmetic at COVID-19 time: a take on how not to misapply the quantity theory of money

Julien Pinter* [1]

[1] *NIPE - University of Minho*

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Abstract

The COVID-19 crisis has revived an old heated debate on whether significant increases in the money supply - such as the ones seen after the pandemic outbreak - ultimately lead to higher inflation. Some observers have alluded to the quantity theory of money for that purpose, though in our view, this has sometimes been in a misleading way. Against this background, this paper seeks to clarify several aspects of the quantity theory of money and the so-called "monetarist" approach to it, which are useful to apply it fairly in the current world. First, we review and discuss the meaning of the velocity term in the quantity equation. We argue that it has no relevance as a behavioural concept: there is no such thing as a "desired velocity". Rather, income velocity should be seen as a variable deriving from a larger system of parameters and variables related to money demand, as the monetarist approach clearly puts it, with no intrinsic relevance. Secondly, we clarify the practical relevance that the quantity theory approach can bear in the twenty-first century. We argue that although the quantity theory is unsuitable to explain conventional monetary policies, the mechanism on which it builds bears relevance in analysing some recent unconventional monetary policies. Thirdly, we review the channels and assumptions underlying the asserted quantity theory link between money growth and inflation. In light of our analysis, we conclude that the high money growth rates seen since the pandemic outbreak are not likely to translate into higher inflation rates.

Keywords : quantity theory of money; quantity equation; inflation; money growth; velocity of money

JEL Classification : B00, E41, E50, E58

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1 Introduction

"There are actually two big fallacies (...) One of them is what I think of as the doctrine of immaculate inflation: the notion that an increase in the money supply somehow translates directly into inflation without causing economic overheating along the way" (Krugman 2021)

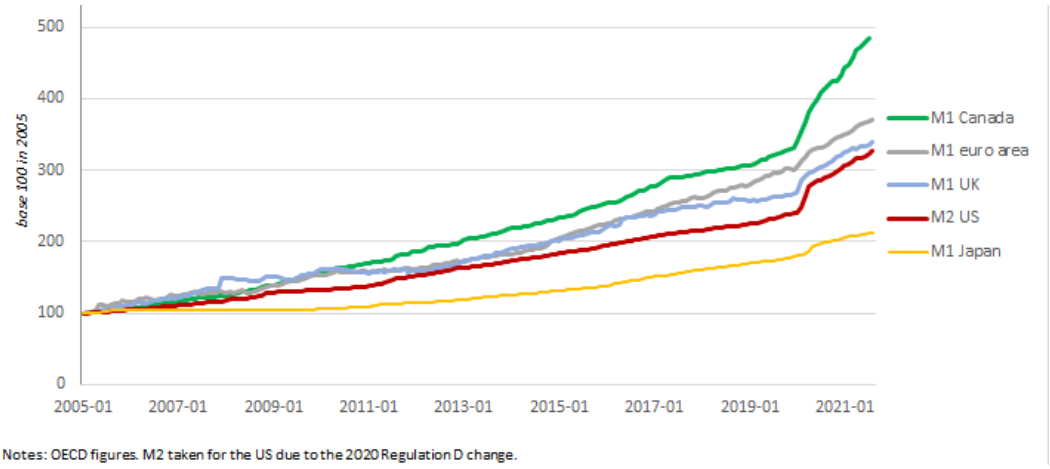
"The correlation between monetary growth and inflation has an historic pedigree as long as your arm" (Goodhart 2020)

Central banks around the world have resorted to unconventional monetary policies on an unprecedented scale to deal with the economic risks associated with the COVID-19 pandemic crisis. The European Central Bank, for example, announced in March 2020 a programme of up to 750 billion euros of asset purchases, later more than doubled to 1850 billion euros (approximately 10% of the GDP of the euro area in 2019). The Federal Reserve almost doubled the size of its balance sheet between March 2020 and July 2021, bringing it to a new post-World War II record. Similar trends have been observed in emerging economies (Hofman & Kamber 2020). In contrast to the previous wave of unconventional monetary policies following the 2008 crisis, the policies implemented after the COVID-19 outbreak have often been accompanied by significant increases in monetary aggregates (Figure 1). This has ignited a debate on whether such high money growth would ultimately lead to high inflation, as illustrated by the two above quotes. Some economists, such as Goodhart & Pradhan (2020), have, for example, argued that the fact that the COVID-19-related policy measures "will directly raise the broader measures of money" would in itself contribute to pose inflation risks. In the public debate, many have used elements related to the quantity theory of money to posit or discuss a link between money growth and inflation (Bloomberg (2020), Financial Times (2020), The Economist (2020), Wolf (2020), Bloomberg (2021)). Elements of the quantity theory of money have also been used in recent years by some recognised academics in opinion columns (Blanchard & Pisani-Ferry (2019), De Grauwe & Diessner (2020)). It can also be common among some observers to reject the quantity theory of money approach based on the fact that increases in central bank money have not led to high inflation in the recent past.

Against this background, this paper seeks to clarify some key aspects of the modern quantity theory of money approach[1] (QTM henceforth) which are sometimes used too loosely (voluntarily

[1]In this paper, in line with Bordo (1989) or McCallum & Nelson (2010), we consider the "modern" quantity theory of money approach to be the "monetarist" one, discussed e.g., in Friedman (1970) or Friedman (1956). See Tavlas (1998) for a discussion on "monetarism" and the quantity theory of money.

Figure 1: Increase in monetary aggregates after the COVID-19 pandemic outbreak in a sample of advanced economies (base 100 in 2005)



or not), we believe. We review what we consider to be key QTM concepts behind the potential link between money growth and inflation, which can be subjected to misinterpretations. We also review some key aspects of the causal impact of unconventional monetary policies on monetary aggregates. In doing so, we aim at assessing the key elements necessary to answer the following question: what would the large increases in monetary aggregates witnessed since the start of the pandemic imply for inflation, from the QTM perspective?

We introduce the modern quantity theory of money approach by first discussing the quantity equation, reviewing its historical evolution and the meaning of its key term, "velocity". We argue that the velocity term in the quantity equation should not be seen as a behavioural concept: there is no such thing as a *"desired speed of circulation of money"* in the current world. Instead, we argue that velocity should simply be seen as a variable summarising a system of parameters and variables related to money demand, as put clearly in the monetarist approach in particular, and thus with no relevance in itself. Consequently, the link between the money supply and the price level in the QTM approach has to be seen indirectly through a system of money demand and money supply equations. The prediction that a given exogenous increase in the money supply would lead to a proportional increase in the price level is thus inherently dependent on underlying assumptions on the long-run behaviour of parameters related to money demand (among others). We then discuss the relevance of the QTM approach for the current world. We argue that the standard QTM narrative, considering a hypothetical exogenous increase in the money supply, is of little relevance for explaining conventional monetary policies. It can, however, bear relevance to analyse the impact of unconventional monetary policies consisting of large-scale asset purchases.

More generally, we argue that the modern QTM approach can bear relevance when money balances would exceed the amount of money that would be demanded if every other variable relevant for money demand would be at its long-run equilibrium value. We conclude by discussing the potential implications of the increase in the money supply *per se* seen after the COVID-19 outbreak. The view defended in this paper is that there are two main necessary conditions for the large increase in the money supply *per se* to lead to high inflation. The first is that the money supply remains at relatively high levels, i.e., that the recorded increase be not temporary. The second is that central banks do not act sufficiently to increase interest rates in response to inflationary pressures. This could be the case, for example, if fiscal solvency or financial stability considerations were to significantly affect monetary policy decisions.

Although in the past, many articles have examined the quantity theory of money, research contributions on this aspect in the twenty-first century have been rare, following the abandonment of monetary targets by most central banks. The recent studies of Teles et al. (2016) and Benati et al. (2021) both show that the relationship between money growth and inflation is still alive, though the formers find that the relationship has weakened since the 2000s. Other authors, such as Stella et al. (2021), argue that the correlation between money growth and inflation depicted in the past century and popularised by among others Lucas (1996), is "naive" and not stable in the current world. Their econometric study, aimed at reproducing the results of McCandless & Weber (1995), shows that the relationships previously depicted by these authors are very fragile and often non-existent in the twenty-first century. In no case do the authors find any evidence of a proportional relationship between inflation and the growth rate of any monetary aggregate in the long run in OECD countries. Reinforcing these results to some extent, by empirically testing a simple version of the QTM (in their baseline estimates) on a panel of 46 countries, Gertler & Hofmann (2016) find that the link between money growth and inflation has weakened over time. McCallum & Nelson (2010) provide a very rich and exhaustive review of the QTM. They explain to what extent the quantity theory and monetary aggregates can be ignored in current economic models.

In comparison to the above studies, the contribution that this article intends to have is to shed light on the QTM and on its relevance in today's central banking world, in a manner accessible to a wide audience. The underpinnings of the link between money growth and inflation are often not made explicit, sometimes considered as occult, or at other times considered to be self-evident[2] so that no discussion seems necessary: this paper intends to provide clarification on this aspect. For

[2]One may interpret Tirole (2020, 5:30) e.g., as such: "in theory that (debt monetisation) is inflationary because there is more money chasing the same goods, and therefore there should be inflation".

this purpose, the approach we will adopt is to present the core intuitions behind the theories we will mention, rather than to thoroughly and mathematically depict their underlying mechanisms, for example as done in the works of Friedman (1956) and others.[3]

The remainder of the paper is structured as follows. Section 1 introduces the QTM approach by briefly reviewing the historical evolution of the quantity equation. Section 2 discusses the meaning of the velocity term, and depicts the assumptions necessary to assume a constant velocity in the modern QTM approach. Section 3 discusses the relevance of the QTM in the current world, and in particular in the COVID-19 context. The last section is a conclusion.

[3]For this purpose, several simplifications will be made. We will focus mostly on individuals, and not refer to companies when discussing the QTM and the demand for money (see Friedman (1956) for such discussions). Also, we will mostly abstract from expectations to focus the discussion solely on the underlying *primary* mechanism of the QTM. Implicitly, we, therefore, consider that a necessary condition for expectations based on the QTM to be a relevant feature is that the QTM be relevant so that an analysis of the primary mechanisms of the QTM is first needed before incorporating expectations. Incorporating expectations would not change the key messages of the paper, but would severely complicate their exposition. Debates on how excess use of production capacities leads to inflation in a globalised world are also ignored, so we focus on the key concepts related to the QTM.

2 A short historical review

2.1 The quantity equation: from the transaction form to the income form

It is convenient to analyse the quantity *theory* of money approach by first introducing the following identity, the transaction version of the equation of exchange (also sometimes called the quantity *equation* of money):

$$MV = PT \tag{1}$$

where M is a measure of the nominal quantity of money[4] in the economy, V is a measure of the "transaction velocity" of money, i.e., it corresponds to the average number of times a unit of money is used (i.e., "changes hands") over a certain period to make the period's transactions in the economy, PT is the total value of all the transactions made during this period, with P a price index representing a weighted average of the prices of all transactions that occurred during the period, and which have a total physical volume of T.[5] Irving Fisher is perhaps the best-known economist for having early examined and popularised this above equation (Fisher 1911),[6] although the relationship depicted by the quantity identity flourished well before, as detailed by Bordo

[4]For the rest of the paper, one can think of M as a narrow money measure, without loss of generality. The most important feature here is that the money considered as M is used to make the economy's transactions. Because we will later focus explicitly on goods and services transactions, the bank reserves part of the monetary base could not be used as a measure of M in what follows (because it cannot be used to make the economy's goods and services transactions). Fisher (1911) defines money as "what is generally acceptable in exchange for goods" (Chapter 2) and uses this definition of money in his "narrow" version of the equation of exchange (p.25). In his "extended version" of the equation of exchange ($MV + M'V' = PT$, Chapter 3), he considers currency on the left-hand side of the equation of exchange, which he defines as "any type of property right which, whether generally acceptable or not, does actually, for its chief purpose and use, serve as a means of exchange". This leads him to include bank deposits (M') in the equation of exchange, which were used at the time as means of exchange through checks, and which Fisher considered as not "generally acceptable" to the extent that the use of checks requires the consent of the payee. An alternative conception is that M could be thought of as every very liquid instrument, i.e., every instrument which could be turned quickly into a means of exchange generally accepted for goods and services transactions (what would make broad money or Divisia indexes relevant as a measure of M).

[5]In Fisher (1911), T denotes the "volume of trade" (p111) and is thought as an index of quantities (i.e. units of goods). P is an *ad hoc* index of prices (Chapter 2 and 9). We can take the following illustrative example: for n transactions made during the period, the first one done at the price P_1 with quantities Q_1, the second at the price P_2 for quantities Q_2, (...), the total value of all transactions during the period is $\sum_{i=1}^{n} P_i Q_i$. By taking $P = \frac{\sum_{i=1}^{n} P_i Q_i}{\sum_{i=1}^{n} Q_i}$, P is a weighted average of the prices associated with the transactions of the period (the weight for transaction i being $\frac{Q_i}{\sum_{i=1}^{n} Q_i}$). As mentioned in Fisher (1911) (Chapters 9 and 10), there are an indefinite number of ways of conceiving index numbers for P and T.

[6]Such a claim is made in Bordo (1989) and Friedman (1970), among others.

(1989).

Money (M) can be used to buy what is commonly thought of as "goods" (intermediate, final or second-hand), services, but also securities and other assets.[7] A transaction can thus involve an exchange of money for a wide range of different items. It is still today very difficult, if not impossible, to have an index capturing all of these transactions in practice; there is no existing statistic recording all transactions occurring in an economy.[8] If we restrict our attention to the final goods and services produced during the considered period, we can substitute T in Equation 1 by Y, the total physical output, to obtain something measurable in the real world from the equation of exchange. Doing so[9] leads us to consider an equation that is more familiar to most economists nowadays, commonly called the "income version" of the quantity equation:

$$MV = PY \tag{2}$$

The replacement of T by Y in the quantity equation is an important step. It is sometimes silent in contributions alluding to the QTM. In Equation 2 the meaning of "velocity" is now totally different. V should now be seen as an *ex-post* measure of the average number of times a unit of money has been used to buy a given amount of final goods and services (for a total value PY), during the period considered.[10] Thus, it becomes conceptually disconnected from the speed at which money circulates to make transactions, the V in Equation 1. Money can circulate at a higher speed to make purely financial transactions, for example, implying a higher V in Equation 1, while individuals still buy the same amount of final goods and services with their money balances, implying that V in Equation 2 did not change. The V in Equation 2 cannot be interpreted anymore as "the average number of times an average unit of money changes hands over a certain period to make the period's transactions", because the focus is now narrowed down to only one specific kind of transaction. Here we have $V = \frac{PY}{M}$. The equation of exchange as presented in Equation 2 is nothing more than a mere identity, allowing us to define the concept of velocity, sometimes in this context called "income velocity" instead of the "transaction velocity"

[7] It is important to precise here that Fisher (1911) refers to all of these as *goods*. This is noted in Chapter 1: "the term "goods" will be used in this book simply as a convenient collective term to include wealth, property, and benefits". His definitions of wealth, property and benefits are detailed in Chapter 9 and basically include all the elements we refer to here.

[8] This is clearly the case for transactions done with banknotes and coins, that are impossible to exhaustively trace out in a world where citizens enjoy a minimum of privacy. See Garvy (1959) for an early and exhaustive analysis on this aspect.

[9] This step of focusing clearly on Y instead of T in the theoretical approach of the quantity equation is sometimes attributed to Pigou (1927).

[10] Note that the meaning of P is now changed accordingly, and becomes the price index implicit in estimating national income at constant prices (Y).

defined above (Friedman (1970), Bordo (1989)).

This income approach emphasises a different conception of the role of money, which is clearly put in the Cambridge cash-balance approach. Taking $k = \frac{1}{V}$, the Cambridge cash-balances approach of the quantity equation is mathematically identical to the version of the equation of exchange represented by Equation 2: $M = kPY$. The essential feature of the Cambridge approach is that it views money as an asset held, a *"temporary abode of purchasing power"* (Bordo 1989). In the Cambridge approach, a fixed k would have conceptual relevance rooted in the assumption that desired money holdings are a fixed proportion of the total income, at the aggregate level. For Friedman (1970), the difference between the transaction version and the income version is of key importance.[11] The income version, with its clear emphasis on money as an asset held, influenced the monetarist approach of the QTM, which we discuss hereafter.

2.2 From the quantity equation to the quantity theory

The transition from the *identity* depicted by Equation 2 to a *theory* concerning money is made when one makes behavioural assumptions about the variables in the quantity equation. A particular assumption is that the velocity V is constant in the long run, say fixed at $\overline{V}$. If one takes the physical output as determined by real factors in the long run, and considers these factors as fixed and not influenced by monetary factors so that $Y = \overline{Y}$, then Equation 3 can be used to illustrate an algebraic prediction of what we will call the "popular version" of the QTM:[12]

$$M\overline{V} = P\overline{Y} \tag{3}$$

With Equation 3 it is straightforward that if an exogenous increase in M arises, this should make P increase proportionally, with no effect on real output. This theoretical relationship defined by a long-run proportional link between money growth and inflation, coupled with the absence of effect of money on any real variable in the long run, is what we call the popular version of the QTM, in line with McCallum & Nelson (2010).[13] This is the version of the QTM to which

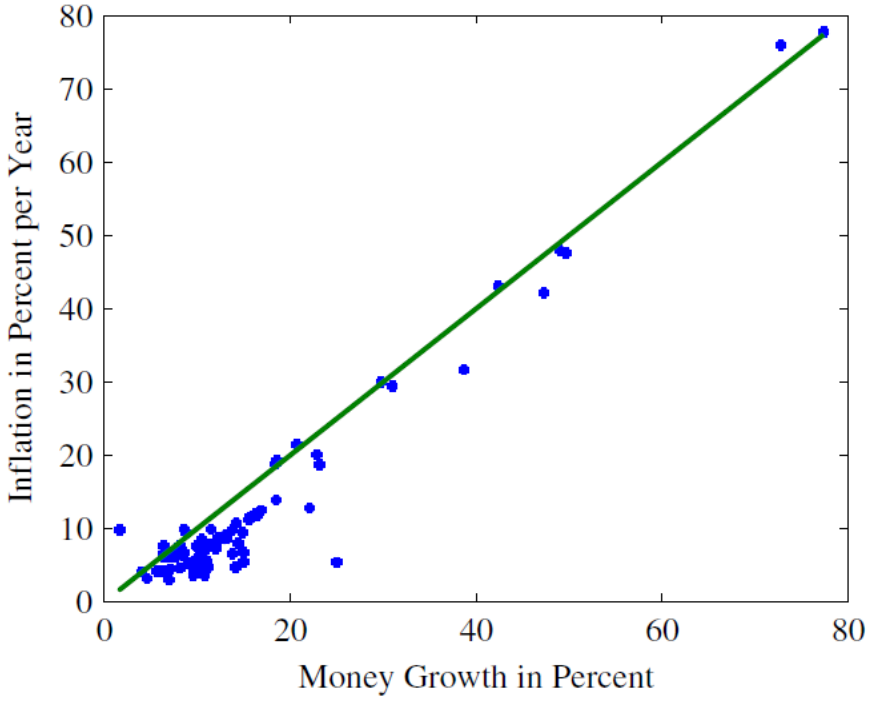
[11] As Friedman (1970) puts it: "Clearly, the transactions and income versions of the quantity theory involve very different conceptions of the role of money. For the transaction version, the most important thing about money is that it is transferred. For the income version, the most important thing is that it is held".

[12] Note that the quantity theory of money is a general approach rather than a well-identified theory (Friedman 1956).

[13] Note that our terminology ("popular") differs from the one used in McCallum & Nelson (2010). The QTM defined such amounts as the claim that actual economies possess the properties that imply long-run monetary neutrality (McCallum & Nelson 2010). It *implies* that a hypothetical exogenous increase in M would only affect the price level (and other nominal variables), by similar proportions, with no change in the value of any real variable, in the long-run (which is the standard narrative of the QTM, sometimes considered as the basic proposition

Lucas (1996) refers when showing in his Nobel address the popular 45-degree line graph, which we put below in Figure 2 (and which we will later argue is a misleading empirical application of the QTM). It is also the version of the QTM which is often used implicitly or explicitly as a shortcut in opinion pieces, for example, recently by Blanchard & Pisani-Ferry (2019) or De Grauwe & Diessner (2020).[14]

Figure 2: Popular stated illustration of the QTM



Note: This Figure is taken from Teles et al. (2016) and gathers data for 70 countries from the 1950s to 1990. Lucas (1996) presents the same 45-degree line graph, but uses more countries and slightly fewer years (he uses data from McCandless & Weber (1995), covering 110 countries over the period 1960-1990), to make the same observation, namely that money growth and inflation seem to lie on a 45-degree line over the long-run.

Applying the popular version of the QTM literally to the data by using the quantity equation, as the above-mentioned authors do, would thus require starting by making two claims: that physical output is not sensitive to money moves in the long run and that velocity is constant in the long run. These are two necessary conditions for a hypothetical exogenous increase in the money supply

characterising all the versions of the QTM). See McCallum & Nelson (2010) for an exhaustive discussion on the definition of the QTM.

[14] "In the euro area, the ratio of non-interest-paying money to GDP is roughly 10%. This ratio implies that a money-financed increase in the fiscal deficit of one percentage point for one year would lead to a 10% increase in money, thus eventually to a 10% increase in the price level." (Blanchard & Pisani-Ferry 2019)

to produce a proportional increase in P. We will take the first condition as given in this paper[15] to focus the discussion on the second element, which we believe to be the most contentious and which requires much discussion to fairly interpret monetary changes in the current context.

3 Assumptions behind a "constant velocity" assumption

Discussing the assumption of "constant velocity" first requires one to correctly interpret the velocity concept. We thus start this section by arguing that velocity should not be taken as a behavioural concept, but rather as a variable summarising a system of long-run parameters and variables related to money demand. This then allows us to discuss the assumptions behind a constant velocity.

3.1 The irrelevance of velocity as a behavioural concept

Let us begin by building on the textbook of Blanchard (2017, p70) to define a behavioural concept as a concept that captures some aspects of behaviour, in this case, the behaviour of individuals. Then, if transaction velocity, to start with, were a relevant behavioural concept, that would essentially mean that there would be such a thing as a "desired speed of circulation of money", in the sense that individuals would aim at "making money circulate at a certain speed". Taken literally, this would mean that individuals would make sure that they engage in transactions at a certain frequency, whatever the object of the transaction. Transactions, part of which being expenses in goods and services, would thus be driven by *"a desire to make money change hands at a certain speed"*. If individuals in a specific country happened not to have made the average number of transactions they usually make per unit of money during a certain period, this mere fact would be enough to motivate them to increase their transactions. Arguably, this would be a theory difficult to defend. However, the concept of velocity is sometimes popularly used in the economic debate as if such a view would implicitly be relevant.[16] This has for example been the case with some views asserting that the lockdown policies related to the COVID-19 crisis, associated with the increase in the money supply, would be at risk of generating inflation "if the speed of circulation of money would get back to its normal level".[17]

[15] Although there are dissonant views, this is often considered as a sensible assumption by most monetary economists, as put by Bullard (1999). This is arguably a separate question in itself, that this paper does not intend to address, see Lucas (1996) or Bullard (1999) for useful elements.

[16] This is how we interpret Bloomberg (2021), The Economist (2020) or Wolf (2020) for example.

[17] We acknowledge that if households spend significantly less during COVID-19 times and significantly more afterwards (so that consumption is smoothed over the two periods), this would lead to an increase in PY in

Assuming the existence of a "desired speed of circulation of money", and thus, accordingly, of a particular optimal value for the speed of circulation of money that could be derived from preferences and other parameters, seems not only of little conceptual relevance, but also at odds with empirical evidence. Stella et al. (2021), for example, show very illustrative figures on this aspect. They gathered data from the Federal Reserve Board on U.S. demand deposits[18] and their "turnover", defined as the total amount of debits on demand deposits during a given year as a ratio to average demand deposits during this year. The turnover figures they provide are thus a good proxy[19] for the transaction velocity of demand deposits. Their figures show that the demand deposits turnover went from 57 in 1967 to 922 in 1996 (Table 1, column 6). In other words, velocity increased by about 1518%. Figures for velocity were also about 1000% higher in 1987 as compared with 1967. Such figures illustrate well, in our view, that velocity cannot be thought of as a behavioural concept. If there were a desired speed of circulation of money for all transactions, it would arguably be very difficult to explain its evolution for demand deposits as shown in the figures of Stella et al. (2021) with the help of some economic theory. It would also be difficult to argue that such a behavioural feature would concern only the final goods' transactions and not the rest of the transactions, so that a non-constant V in Equation 1 would be consistent with a constant V in Equation 2. This should make clear that the assumption of constant velocity made in Equation 3 cannot be seen as the result of a constant "desired speed of circulation of money". Besides, Fisher (1911) was not seeing the transaction velocity as a behavioural concept.[20] We argue in the following that velocity should rather be seen solely as a reduced-form variable obtained from a larger system of parameters and variables related to money demand.

Equation 2 in the post-pandemic time, and thus lead to an increase in V. However, the increase in V would be a natural consequence, not a driving factor, of such an outcome. Focusing on V appears to be meaningless here: V is not a behavioural concept.

[18]Demand deposits are deposits of money that can be withdrawn without prior notice. They represent today about 40% of US M1 (consisting of currency, demand deposits, and other checkable deposits). Note that they exclude interbank deposits and collection items.

[19]It is not precisely known as to whether cash withdrawals are considered as debits or not, but if these are included, this should likely not matter significantly for the core message of the authors. Additionally, debits related to cash management (transfers between different accounts of the same holder) are included. This likely contributes to increase the velocity measure, as the world moves towards more efficient management methods, but that is again unlikely to play significantly on the related conclusions. See Garvy (1959) for an exhaustive analysis of this measure.

[20]Our interpretation is that Fisher saw velocity as a residual measure ultimately determined by behavioural, technological and organisational aspects (Chapter 5). The behavioural aspects he mentions can be thought of, in our view, as stemming from money demand considerations.

3.2 The relevance of velocity as a variable summarising money demand consideration

The view that income velocity should be seen as a reduced-form variable obtained from a larger system containing parameters and variables related to money demand is clearly put in many previous works and lies at the core of the modern approach of the QTM (Bordo 1989).

In the Cambridge cash-balance approach depicted previously, k in $M = kPY$ is seen conceptually as a parameter stemming from money demand considerations. It is the desired average proportion of real cash balance as a fraction of total income. Taken literally, such a conceptual meaning of the inverse velocity parameter (k) implies a specific story behind the QTM mechanism. If a hypothetical exogenous increase in M would arise, the Cambridge cash-balance approach would lead us to think that individuals would try to get rid of the excess money balances, *because they now have too much money as compared with the quantity they demand.*[21] Clearly, the emphasis here is put on a money demand mechanism.

The restatement of the QTM by Friedman (1956) takes a more comprehensive model for the demand for money to retrieve the quantity equation and the associated QTM prediction. In his model, velocity will be constant only under some particular assumptions. The demand for money is assumed to depend on several parameters. We can take the below standard money demand equation as a simplification of the one made by Friedman (1956), which is very much non-exhaustive but loyal enough to make the point we want to make:

$$\frac{M}{P} = f(Y, R, u) \tag{4}$$

Equation 4 assumes that the demand for real cash balances is a function f of real income Y[22] and of a representative real interest rate R, which we can see as an average real interest rate on financial assets (other than money) for this exercise. The parameter u captures exogenous changes in portfolio preferences and technological innovations. Thus, the demand for money is now also assumed to be affected by the interest rate. The mechanism is the conventional money demand mechanism seeing money as an asset competing with other assets as a store of value: the higher the interest rate, the higher the opportunity cost of money and thus the lower the desired real

[21] Seeing V as a behavioural concept, one would otherwise say that individuals would try to simply make more transactions *because they want to make a certain amount of transactions on average proportional to their money holdings.*

[22] In Friedman (1956), total wealth appears rather than current real income, and in Friedman (1970), current real income appears, as a proxy for total wealth. Our choice has no impact on the point we want to make. Our illustrative specification is closer to the specification displayed by McCallum & Nelson (2010). Note that there has always been a wide range of money demand specifications in practice.

money balances, everything being equal. Assuming that Equation 4 is homogenous of degree 1 in Y, we can multiply both sides by $\frac{1}{Y}$ to then write:

$$\frac{M}{PY} = f(R, u) \tag{5}$$

or, put differently:

$$MV' = PY \tag{6}$$

with $V' = \frac{1}{f(R,u)}$. This illustrates that the quantity equation can be retrieved from a money demand equation, when one makes the assumption of homogeneity of degree 1 in Y (what applies in the concrete case of a unitary income elasticity of money demand), with V' being a variable summarising the information of our money demand function. Velocity thus appears as a variable that only reflects money demand considerations, with no relevance in itself.

3.3 When can velocity be said to be constant?

It appears relatively well from Equation 5 that velocity cannot be assumed to be always constant: it will depend here on the level of the real interest rate, portfolio preferences and technological innovations. If these factors were to change in the short run, one should not expect a constant value for the velocity. In fact, early users of the QTM recognized the volatility of the velocity as a normal feature in the short run (Friedman (1970), Lucas (1996)). The non-constancy of the velocity in the short run is also a standard feature emphasized by Milton Friedman when discussing the effect of a hypothetical exogenous increase in M.

In Milton Friedman's view, depicted pedagogically in Friedman (1996), starting from an equilibrium position, a hypothetical exogenous (and unexpected) increase in M would theoretically, in the first instance, lead to a money supply greater than money demand. This would in itself disturb the pre-existing equilibrium. Individuals would then, over a certain time horizon, take actions to rearrange their portfolios. In his simplified exposition, Friedman (1996) mentions two likely possibilities here: individuals will either (a) try to obtain durable goods for their money balances (which can be used as a store of value for wealth), or (b) try to obtain financial assets for their money balances. These are two potential stores of value that represent an alternative to money.[23] If all the adjustments were to be made through goods purchases (a), in an economy

[23]Note that the intuitive model we presented above did not consider durable goods as a store of value. The way it is taken into consideration in Friedman (1970), for example, is by assuming that money demand depends on the expected rate of change of prices of goods. This is a key aspect in the difference in the conceptions of portfolio

where physical output is influenced by real factors only, individuals will simply bid up the prices of existing goods, until real money balances are restored to their initial proportion level. If all the adjustments were to be made through purchases of financial assets (b), individuals would simply bid up the prices of existing assets, until the interest rate adjusts. In this case, income velocity would naturally fall.[24] If a lower real interest rate then induces spending (as is usually assumed), the outcome would be an increase in aggregate spending. We would conceptually return to case (a) in which individuals would be bidding up the prices of existing goods. Real money balances would then fall, inducing a lower demand for financial assets, leading to higher interest rates. In a simple world, this mechanism would stop once interest rates were back to their previous equilibrium level. In the end, prices will have increased in proportion to the growth of money. Velocity will have decreased in the short run, before being back to its "normal level". Though the mechanism depicted here is obviously a simplification of a more complex system involving different sectors (see Bridges & Thomas (2012)), abstracting from a discussion on expectations, the main valid point it makes is that the QTM message is consistent with a non-constant income velocity in the short-run.

At this stage, several observations are worth making:

- the theoretical adjustments depicted above are assumed to take time in practice. This is in itself consistent with the fact that the QTM is a theory about the long run (McCallum & Nelson 2010).

- if some variables were to change value between the increase in M and the adjustments, e.g., if Y increases (due to changes in real factors) or if relevant technological innovations arise, the change in P would likely not be proportional to M. This would be the case with our money demand specification in Equation 5.

- the above analysis assumes a real interest rate with a natural long-run level that is unchanging over time.

These three remarks, though they are based on an intuitive and obviously simplified interpretation of the modern QTM approach, help explain why when the QTM is taken to the data (assuming one can do such a thing),[25] one should not expect a 45-degree line as presented in Figure 2. If data were to be presented on a similar kind of graph, a good practice would be to first correct

adjustments between Friedman and Keynes (Tavlas 1998).

[24] In the case where the elasticity of the money demand with respect to interest rates would be infinite, channel (b) would be of little relevance. To the extent that the adjustment cannot be assumed to entirely take place through channel (a), that would consistently hamper the relationships depicted by the QTM. This observation is relevant for the standard liquidity trap case, where short-term bonds and money become close to perfect substitutes.

[25] This point will be discussed in the next section.

the price change figures from the changes in real output and the changes in the real interest rate, as done, for example, by Teles et al. (2016). This has not been done in Figure 2, where countries with high-digit inflation numbers drive the appearance of the graph. In such countries, the inflation rates have been much higher than the growth rate of real output, making the changes in real output a relatively negligible number. Once we eliminate them, we are left with countries where the growth rate of output is not negligible relative to the inflation rate. The proportional relationship between money growth and inflation is therefore much less obvious, as shown by Teles et al. (2016). The fact that innovations and preferences affect velocity can also explain why the link between M and P may likely not be proportional in the data analysis, even after correcting for the change in output and interest rate, and why cross-country comparisons may be misleading.[26] Another way to put these remarks is that even if the QTM were to hold, a hypothetical exogenous increase in M would be unlikely to appear as leading to a proportional increase in P in the data because several factors are likely to move between the increase in M and the end of the adjustment, "absorbing" part of the increase in M.

4 The quantity theory of money in the current world

4.1 Relevance and irrelevance in a world with endogenous money supply

At this stage, let us start by taking as given the central prediction of the QTM, namely that a hypothetical exogenous increase in M would cause an increase in P in the long run. How could the QTM then be useful in practice in the current world?

It is often accepted that the QTM offers a potentially relevant description of how economic variables would evolve in the long run in a world where the money supply would be controlled by a monetary authority, or exogenously changed with metal discoveries (in some kinds of metallic standard monetary system). It has accordingly often been used in models with such frameworks. However, this is not the world in which the vast majority of countries have been living for several decades.[27] Most central banks, in the current world, conventionally set a short-term interest rate, which bears no automatic and immediate relation with monetary aggregates.[28] The usefulness of the QTM to describe real-world conventional monetary policy mechanisms has accordingly been

[26] McCallum & Nelson (2010) insist on this aspect and on the need to put fixed effects in any empirical test of the QTM involving panel analysis.

[27] Even for countries under so-called "monetary targeting", there has always been a debate on whether central banks could really control monetary aggregates. See Friedman (1984), Friedman (1988), McCallum & Nelson (2010) or McLeay et al. (2014) for recent insights.

[28] See Goodhart (1984) or McLeay et al. (2014) on this aspect, among others.

very limited.[29] To investigate which aspects the QTM bear some remaining relevance to explain the impact of monetary policies in the current world, it is useful to start by distinguishing two components of what is most usually called "money" nowadays: currency in circulation and bank demand deposits (the two standard components of the M1 aggregate).

In today's economies, currency in circulation (cash)[30] is supplied on demand. When individuals do not have enough cash, they simply ask for more from their bank: they change bank deposits for cash. Banks obtain cash (usually in advance) by changing bank reserves for cash with the central bank. We are not aware of any central bank in an advanced economy having voluntarily constrained the amount of cash desired by consumers, directly or indirectly, to control this component of M for monetary policy implementation.[31] This part of money today is and has most often been completely endogenous: mostly because PY increases, M increases. Consequently, it would be very difficult today to use the QTM approach with practical relevance by starting from a hypothetical monetary experiment like the ones that were sometimes given as examples in past centuries. When David Hume, for example, at a time when metallic standards were relevant, started his theoretical exposition by "suppose that, by miracle, every man in Great Britain should have five pounds slipped into his pocket in one night" (Hume 1752) or when Milton Friedman famously took the helicopter example by saying "Let us suppose now that one day a helicopter flies over this community and drops an additional $1,000 in bills from the sky" (Friedman 1969), both monetary experiments required making currency in circulation increase. Such exogenous changes in currency in circulation are not imaginable today in advanced economies.[32] Cash increases simply when more is demanded. Consequently, any long-term correlation between currency in circulation and nominal income should be interpreted as a causality ranging from PY to M (cash here).

Bank demand deposits mostly evolve with banks' net credit creation and portfolio adjustments in conventional monetary policy times.[33] When a bank makes a credit, it creates a deposit. However, the credit is generally followed by a transaction from the individual or company that contracted the credit. When the transaction relates to final goods or services, money is thus created *almost at the same time* as the transaction is made: M increases almost at the same time

[29] Borio & Disyatat (2009) argue that "any thought experiments that assume an exogenous change (in money) (...) obscure, rather than illuminate, the mechanisms at work". See also Stella et al. (2021) on this aspect.

[30] Most central banks nowadays denote by "currency in circulation" the amount of banknotes and coins (thus cash) in circulation.

[31] In particular: central banks usually do not restrict the amount of bank reserves to indirectly limit the availability of cash to individuals. Most central banks today accommodate the demand for bank reserves at a given interest rate in conventional times. See Bindseil (2004), Borio & Disyatat (2009), or Stella et al. (2021) on this point.

[32] Note also that nowadays, when individuals have too much cash, they can usually simply change it for bank deposits. Commercial banks thereby take the cash, and can either keep it as such or change it for bank reserves.

[33] See McLeay et al. (2014) for an exhaustive and educational description.

as PY.[34] Bank deposits created in this scenario cannot be considered as purely exogenous through the quantity equation lens, in the sense that they come together with a quasi-simultaneous increase in PY. In fact, there are few cases in which an increase in bank deposits can be argued to not automatically come with a quasi-simultaneous increase in PY. The following operations are such examples:

- when a bank makes a credit to a non-bank and the credit which gave rise to the deposit creation is used to buy an asset.
- when banks decrease their non-deposit funding, for a given balance sheet size, attracting deposits instead.[35]
- when banks buy assets from non-banks by creating new deposits.
- when the central bank buys assets from non-banks.[36]

In all the above operations, M can increase without PY simultaneously increasing.[37] However, in all these situations, if we naturally depart from an equilibrium situation in which the extra money created is not desired in itself *ex-ante*, an adjustment is theoretically needed to make the extra money balances willingly held. A decrease in the opportunity cost of money could arise from portfolio rebalancing in most of these cases,[38] so that velocity (V' in Equation 6) would be the variable to adjust initially.

The main point we want to make is that it is extremely difficult to capture a purely exogenous increase in M in the data, to make a completely faithful test of the basic narrative of the QTM. In the real world, M most often increases at the same time as PY, and a core fact is that there is

[34] This is particularly true for credits resulting from credit card payments. For a conventional loan, this statement may be validly discussed. What matters for the point made here, more generally, is that the ultimate purpose of such a credit is an expense.

[35] A reverse operation happens when, for a given balance sheet size, banks issue debt or equity, with non-banks paying with bank deposits.

[36] In this case, the immediate money holders of the newly created deposits are usually financial companies (see Bridges & Thomas (2012)). Note that when central banks buy private assets, there may be additional significant behavioural reactions, given that the operation may ultimately involve fiscal losses. We do not here discuss these aspects as we are focused only on the direct monetary impact, but acknowledge their potential relevance (the same applies for money created directly through direct monetary financing of state expenses, which we do not discuss here - see Stella et al. (2021)).

[37] Of course, it all depends on what the ultimate holder of the deposit is doing, and what time frame is considered in defining "simultaneously".

[38] In the second operation, the decrease in the opportunity cost could come from banks giving a higher remuneration to deposits to attract them. It is possible that such factors have, for example, contributed to the important remuneration of sight deposits in the euro zone after 2012 (see Pinter & Boissel (2016)).

often either a direct causality from PY to M, or simultaneity in PY and M. Situations in which M increases at the same time as V' decreases should also naturally be expected. This does not mean, of course, that the QTM is theoretically useless or that its predictions are not empirically testable. We showed in the previous section that the QTM could essentially be seen as a theory of money demand. From then on, the monetarist approach of the QTM can provide a useful framework of analysis when money supply would initially come to exceed money demand. In the short run, the general case in which changes in M are not accompanied by proportional changes in PY could thus be analysed through the mechanism described in the monetarist approach of the QTM, assuming that the money supply appearing as in excess from the quantity identity be not demanded initially. This general case can be considered relevant to analyse the effects of recent unconventional monetary policies implemented by many central banks. In the long run, one could argue that controlling for the long-run evolution of real factors (and assuming that these are not affected by moves in M), the residual moves in M should have proportional effects on P, according to the definition of the QTM we considered in this paper.[39]

4.2 How central banks' unconventional asset purchases policies directly affect the money supply

Unconventional monetary policies consisting of asset purchases will generally directly affect the bank deposit component of monetary aggregates. This is the case because such asset purchases are usually conducted not only with banks but also with non-banks. Indirect effects are also likely to be present.

When central banks buy bonds from non-banks, they directly increase the amount of bank deposits non-banks hold. This is because the following takes place: the central bank creates reserves to pay for the bonds, the bank where the non-bank has an account receives these reserves on its asset side, and creates a liability towards the non-bank in the form of a bank deposit. Unconventional monetary policies in the form of asset purchases from non-banks thus directly increase M. This point is explained in detail by McLeay et al. (2014).

One may also expect indirect effects from central bank asset purchases on M. First, because banks are left with more reserves in proportion to their total assets than they previously potentially desired (which is evident in the case where the central bank buys large quantities of bonds from non-

[39]Denoting by V_t^s (Y_t^s) the value that would theoretically be associated with velocity (output) if it were at its long-run steady state value at time t (for velocity, such a value should therefore be derived from the long-run steady state values of the underlying variables determining it in our money demand specification), one may thus be able to derive relevant conclusions from the monetarist approach of the QTM whenever M is such that $M_t \neq \frac{1}{V_t^s} P_t Y_t^s$.

banks), one may expect portfolio adjustments to take place. Banks may individually intend to get rid of their reserves by buying bonds, including from non-banks, thereby increasing bank deposits (in addition to bid up bond prices). This "reserve channel" is depicted in Christensen & Krogstrup (2021). Secondly, to the extent that the central bank asset purchases bid up asset prices and lower interest rates on the relevant assets,[40] this may in turn trigger portfolio adjustments between banks and non-banks. Such portfolio adjustments, ultimately depending on the preferences of each actor, could potentially take the form of banks buying assets from non-banks, in that case creating bank deposits. Banks may also sell bonds to the central bank in a first stage to then buy new bonds from non-banks, creating new deposits in the operation, though one should look at the ultimate equilibrium in terms of portfolio adjustments to see the ultimate result in terms of deposit creation (see Borio & Disyatat (2009) and Bridges & Thomas (2012) on this aspect). Banks may also choose to discourage bank deposits and increase their funding in the form of bank debt, as well as to increase credit if credit demand picks up with lower rates, as detailed in Bridges & Thomas (2012).[41]

Overall, unconventional monetary policies in the form of asset purchases by the central banks from all actors including non-banks are close to an "exogenous" increase in M through the quantity equation lens. They come with an increase in M, without coming with a simultaneous increase in PY. From then on, the monetarist approach that we described above can be seen as relevant, as thoroughly analysed in Bridges & Thomas (2012).

4.3 What shall we conceptually expect from the high money growth following the COVID-19 outbreak, reading through the QTM lens?

The unconventional monetary policies implemented by central banks in advanced economies to respond to the COVID-19 pandemic crisis have been accompanied by significant increases in

[40] This is expected to be the case to the extent that long-term bonds and reserves (or bank deposits for non-banks) are not considered as perfect substitutes, and that the reserves are not demanded *ex-ante*. The imperfect substitutability under these conditions should in itself trigger bond price changes: banks, e.g., would not accept to swap long-term bonds for reserves and then hold the latter unless the price proposed for bonds is higher.

[41] Note that it is sometimes considered that unconventional (or conventional) monetary policies affect the money supply through the so-called "money multiplier" effect; the increase in bank reserves would end up increasing monetary aggregates by some fixed proportion. This concept has been deeply criticised for lacking inherent relevance (Goodhart 1984) or for being simply useless in describing the way conventional and unconventional monetary policies work (Bindseil (2004), McLeay et al. (2014)). In the current world in which reserves are provided on demand by central banks and the central bank interest rate is controlled at some level, the impact of unconventional monetary policies cannot be analysed through the lens of the money multiplier, as also argued in Borio & Disyatat (2009).

monetary aggregates, as shown in Figure (1).[42] Such increases are partly the result of the large-scale asset purchases implemented by these central banks, for example, it is said to be "its largest source" in European Central Bank (2020), consistent with the channel described in the previous section. In addition, other policies, in particular those aimed at supporting banks in extending credit, arguably positively contributed to this increase in the money supply. The Targeted Longer-Term Refinancing Operations (TLTROs) and the Main Street Lending Program are examples of such programs for the European Central Bank and the Federal Reserve, respectively.[43] Higher credit demand stemming from emergency liquidity needs or other aspects linked to the economic downturn created by the pandemic has also contributed to the high increase in M1 (see e.g., European Central Bank (2020)).[44] This later aspect, coupled with a different economic and financial context, is likely what made the COVID-19 policies have a much higher impact on monetary aggregates than those implemented after the 2008 crisis. What should one expect from these large increases in M, reading through the QTM lense? Let us proceed in several steps to propose an answer to this question.

- a large part of this increase in M has likely been easily "absorbed" by individuals and companies because short-term interest rates have been lowered concomitantly in most of the associated countries, thereby making the opportunity cost of money lower. Likely, the significant increase in M has also prompted a decrease in long-term interest rates, so that the extra money balances are willingly held, as the standard asset purchase transmission mechanism assumes (Bridges & Thomas (2012), McLeay et al. (2014)).

- if we consider that portfolio adjustments are made only with financial assets and not with durable goods, as could be defended (Appendix 1), the causal effect of this increase in the money supply on inflation is then likely to be indirect. It would indeed rely on the links between the interest rates and the economic activity at first, and secondly, on the links between economic activity overheating and inflation.

[42] M1 in the US has, for example, increased from about 50% between November 2019 and November 2020, while the annual growth rate between 2014 and 2019 was around 6 % on average. In the UK, M1 increased from approximately 18% for the same period, for an average annual growth rate of approximately 6 %. For M3, the US and the UK saw an increase of about 25% and 11% respectively, for an average annual growth rate of about 5% and 4% respectively, for the same stated periods.

[43] Specific regulatory effects should partly explain the figures for M1 in the US, as detailed in Federal Reserve Bank of Saint-Louis (2021). For details on the mentioned programmes, see *www.ecb.europa.eu/mopo/implement/omo/tltro/html/index.en.html* for the TLRTOs, and *www.federalreserve.gov/monetarypolicy/mainstreetlending.htm* for the Main Street Lending Program.

[44] The fact that most of these increased money holdings remained in M1 rather than in (M2-M1) can probably be explained by the "low opportunity cost of holding the most liquid forms of money" as mentioned in European Central Bank (2020).

- these adjustments are more likely to arise through a long-time horizon. Naturally, some factors are likely to change by the time of the adjustment. A key factor will be the change in the money supply in the years following the pandemic. The exceptional increase in M may be temporary. Factors making M decrease would be, for instance, a future negative net credit creation, central banks unwinding their balance sheets by selling bonds, or central banks issuing bonds.

- to limit the risks of excessive inflation stemming from economic activity overheating, central banks may need to raise interest rates once economic activity picks up.[45] In theory, they can increase short-term rates by conventional methods, assuming that they are not subjected to further constraints. This increase in rates should, in turn, make money balances less desired, and lead to new portfolio adjustments, increasing the demand for financial assets. In a world where central banks pin down the short-term interest rate, with large excess money balances that could mean that *term premia* become pressured. Central banks may thus need to implement specific policies to better control long-term rates.

Considering all the above points, the monetarist approach of the QTM *in itself* should not lead us to confidently predict that the large increase in M will be followed by proportional moves in P. The fact that rates are close to zero makes money and short-term financial instruments closer substitutes, and thus weakens one of the underlying portfolio adjustment channels of the QTM, which is probably the main one using the Japanese experience as a benchmark (Appendix 1). The fact that low interest rates are not particularly propelling spending in the current context also weakens an important channel underlying the QTM. If this channel were to become more effective or if the large amounts of money were to lead to portfolio adjustments in the form of individuals buying durable goods, central banks may need to increase interest rates to deal with the inflation risks. They may also need to decrease M through appropriate methods (for example by issuing or selling bonds), to effectively increase long-term interest rates. This naturally requires that central banks would not be subjected to other constraints and, in particular, not be tied by fiscal solvency or financial stability considerations.

[45] That will naturally depend on the central bank's relative preference for inflation. Central banks such as the Federal Reserve, for which a low level of unemployment is part of the central bank objective, and which follows an "average inflation targeting" approach, may respond less or later than other central banks such as the European Central Bank.

5 Conclusion

This paper has intended to clarify some key aspects of the modern approach of the quantity theory of money, to correctly use this approach to make predictive statements on the effect of the significant increase in the money supply seen since the beginning of the COVID-19 pandemic. We have argued that velocity should not be seen as a behavioural concept: there is no such thing as a "desired speed of circulation of money". Rather, velocity should be seen as a variable deriving from a larger system of parameters and variables related to money demand, and thus not inherently constant. From then, one can recognise that moves in the money supply indirectly connect to inflation, and consistently look at the underlying channels. The ultimate inflationary impact of money supply increases such as the ones seen nowadays in advanced economies can then be thought of as depending on factors such as the degree of substitutability between money and bonds, the link between interest rates and economic activity, the link between economic activity and inflation, and the way portfolio adjustments are made. We have argued that the modern approach of the QTM still has some relevance in the current world, even though money is mostly endogenous nowadays. One of the cases in which the QTM approach can provide a useful framework of analysis is the case of unconventional monetary policies consisting of asset purchases. More generally, we have argued that the QTM framework can be relevant when money balances would exceed the amount of money that would be demanded if all other variables relevant for money demand would be at their long-run equilibrium value.

For the current context of the COVID-19 pandemic, we have argued that if the money stock remained relatively high once output returned to a long-run equilibrium level, dangers for inflation could arise if central banks were to face constraints in increasing interest rates. Such constraints could, for example, stem from fiscal solvency or financial stability considerations. We have not, in this paper, discussed the other inflationary forces arguably resulting from the COVID-19 shocks, such as supply chain bottlenecks, labour shortages in some sectors, rising commodity prices, the release of pent-up demand, and the fiscal stimulus. These are to our view distinct from the monetary factors this paper analyses, and thus independently linked to inflation.[46]

The claims and models used in this paper are intended to be illustrative rather than to thoroughly and exhaustively depict an economic theory. In the simple models we alluded to, we abstracted from any thorough consideration of expectations and from any well-specified general equilibrium analysis, in particular, to focus on the primary mechanisms behind the QTM and render the analysis accessible to a wide audience. While we do not believe being more exhaustive

[46]See International Monetary Fund (2021) for an exhaustive policy analysis.

would change the core messages of this paper, we acknowledge the obvious limits of the method used: this paper should be taken for what it is, i.e., a take on how not to misapply the quantity theory of money.

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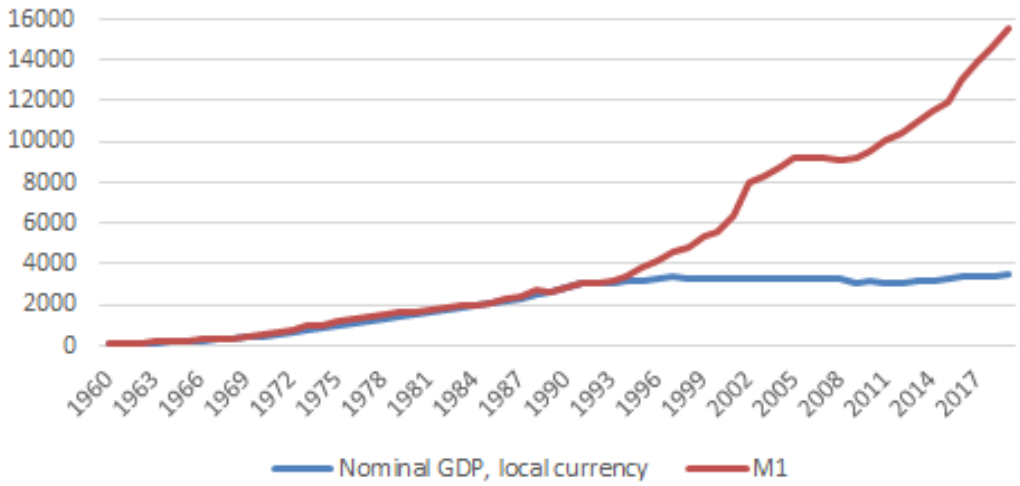
6 Appendix: the case of Japan

The case of Japan is interesting to analyse for the purpose of enlightening on the relevance of the QTM in the current context. It indeed gathers relevant features present in today's world:

- money growth has been very high relative to nominal income growth since the middle of the 1990s (Figure 3)
- interest rates have been close to zero (Figure 4), as they are now in most advanced economies.

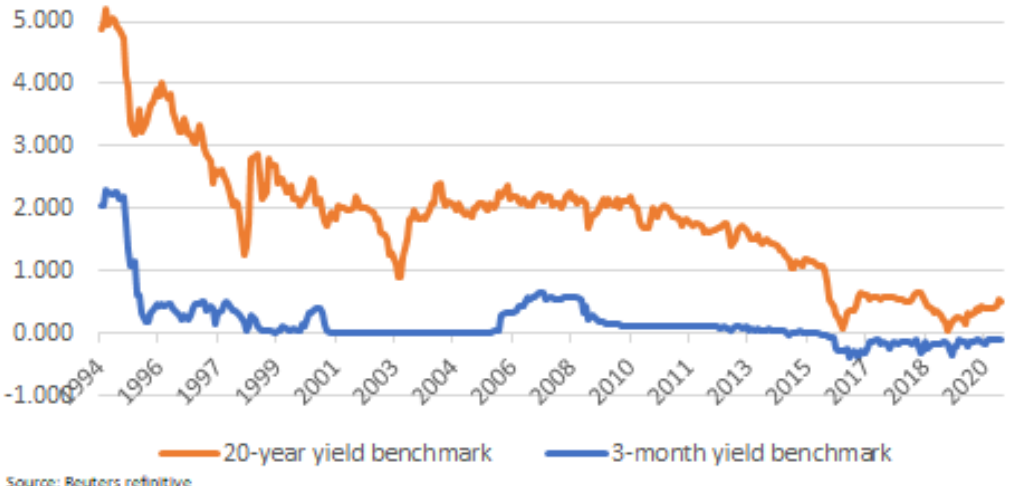
If portfolio adjustments in the form of individuals buying durable goods with the intention of getting rid of excess money balances would have been empirically significant at the macroeconomic level, significant moves in nominal GDP would have likely occurred.[47] As can be seen in Figure 3, we do not observe such a move. This suggests that such a channel was not of significant empirical relevance at the macroeconomic level. In contrast, we observe that the term spreads compressed significantly as the money stock was growing (Figure 4). This is in itself consistent with a falling velocity, and potentially indicative of the presence of significant portfolio adjustments through (long-term) financial assets.

Figure 3: Nominal GDP and M1 in Japan (base 100 in 1960)



[47] One could rightly argue that inflation expectations (determining the real return differential between money and durable goods) played a role here. However, figures for inflation expectations over this whole time period do not seem to indicate that inflation expectations were most often dramatically lower than inflation expectations seen in many advanced economies at the time this paper was written (which is evident, for example, if one looks at the 5-year to 5-year forward inflation swap rate). One cannot neglect the possibility that with higher inflation expectations, money increases would have propelled expenditures, but for reasonable inflation expectations numbers it is difficult to imagine that such a channel would be of high empirical relevance based on what Figure 3 shows.

Figure 4: 20-year versus 3-month bond yield benchmark for Japan



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