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The Inverted Yield Curve, Austrian Business Cycle Theory, and the True Money Supply

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Abstract: Ever since Campbell Harvey's (1986) doctoral dissertation, academic economists have studied the ability of an inverted yield curve to "predict" an impending recession with impressive accuracy given suitable specifications. Many economists (including Campbell) explain the correlation by neoclassical "consumption smoothing," while others attribute the connection to monetary policy's ability to affect the business cycle. We agree with Cwik (2004 and 2005) that the Misesian circulation credit theory of the trade cycle, relying on both monetary and "real" (capital structural) elements, is superior to both flavors of mainstream explanation. In this paper, our contribution is to show that the growth rate of the Rothbard-Salerno measure of the "true money supply" tracks movements in Treasury bond spreads remarkably well. This provides additional support for our claim that the Austrian theory of the business cycle explains the "predictive power" of the yield curve better than the mainstream approach.

The yield curve on US Treasury securities inverted in 2019. This alarmed many investors and financial commentators, because an inverted yield curve (defined in a particular way) has been a

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perfect leading indicator of a recession going back at least fifty years. If we look at the last seven recessions, beginning with the downturn that began in December 1969, an appropriately defined yield curve inversion preceded all of them about a year ahead of time. Moreover, during this same fifty-year period the (appropriately defined) yield curve has only inverted when there would soon be a recession.[1] This perfect track record was once again upheld with the sharp contraction of 2020, which coincided with the coronavirus pandemic. (This article was originally prepared before the panic hit, when the 2020 recession was still an open question.)

Naturally, economists have written on this amazing empirical regularity. Campbell Harvey's (1986) pioneering doctoral dissertation is perhaps the first systematic documentation of the yield curve's ability to "predict" recessions, while Estrella and Mishkin (1998) found that the measure performed favorably against other recession forecasting tools.

In addition to documenting the correlation between an inverted yield curve and an impending recession, economists have also tried to explain why the connection exists. These explanations typically involve neoclassical "consumption smoothing" coupled with investor expectations of an imminent slowdown or they rely on a Keynesian mechanism through which tighter money can slow

[1] The track record for the yield curve described in the text is based on the official recessions as defined by the National Bureau of Economic Research (NBER) and listed here: "Business Cycle Dating," NBER, accessed Sept. 15, 2021, https://www.nber.org/cycles.html. The specific measure of the spread is the difference between the *monthly average* of the Treasury ten-year bond constant maturity rate and the Treasury three-month bill secondary market rate (expressed as a bond equivalent). When using this specification, Estrella and Trubin (2006) show in their chart 1 (page 4) that the yield curve inverted *only* before each of the six recessions that occurred during the period from the late 1960s through 2006. We also know that the curve inverted before the Great Recession beginning in late 2007. Incidentally, we should clarify that there *was* a "false positive" inversion in the fall of 1966, which defenders of the yield curve's power explain by pointing to the economic slowdown a year later—which did not quite qualify as an official recession for the NBER. Another caveat for purists: If one attempts to reconstruct Estrella and Trubin's chart 1 using the Federal Reserve Economic Data (FRED) graphing tool, it appears that in the fall of 1989, the yield curve didn't *quite* invert, though it was close (meaning a false negative). This discrepancy is due to Estrella and Trubin's caveat that the three-month T-bill yield must be expressed "on a bond-equivalent basis." If one uses the "constant maturity" data for both the ten-year and three-month yields, then there is clearly an inversion in the summer of 1989.

growth. (Some economists favor a hybrid explanation invoking both flavors of theories.)

Although there is no doubt a grain of truth in these mainstream attempts to explain the yield curve's predictive power, we agree with Cwik (2004 and 2005) that the conventional Austrian theory of the business cycle provides a much more compelling explanation, relying as it does on both monetary and "real" (capital structural) elements. In retrospect, this should not be surprising: After all, if the Austrians have a better theory of the business cycle than the neoclassical and Keynesian mainstream—as we believe they do—then we should also expect the Austrians to have a better explanation of why a particular market phenomenon apparently goes hand in hand with the turning point of the cycle.

Important as these theoretical considerations are, the main contribution of our paper is an empirical one. Specifically, we show that movements in the Austrian "true money supply" (TMS) measure, developed by Murray N. Rothbard and Joseph T. Salerno (Salerno 1987), accord very closely with changes in the yield curve. In particular, rapid growth of the TMS coincides with a "normal," upward-sloping yield curve, while sudden decelerations in the growth of the TMS coincide with an inversion of the yield curve. Couched in this framework, it is not surprising that a large slowdown in money supply growth would precede the 'bust.' In fact, close attention to traditional Austrian Business Cycle Theory would suggest that the slowdown in money supply growth that we identify *should* precede correction of an unsustainable boom.

The paper is organized as follows: first, the mainstream and Austrian economists' explanations for the yield curve's predictive power are contrasted. Then, the Austrian true money supply metric is defined in conceptual terms, and the method of estimating it is explained. Finally, changes in growth of the TMS are compared with the yield curve spread. The last section concludes.

EXPLAINING THE YIELD CURVE'S "PREDICTIVE POWER": MAINSTREAM VS. AUSTRIANS

Mainstream economists have offered two general varieties of theoretical explanations of the yield curve's predictive power, relying either on a consumption smoothing approach (in the tradition of Irving Fisher) or on the well-known empirical proposition that central bank monetary policy seems capable of affecting the business cycle. A more sophisticated approach is a hybrid, combining both elements. As Estrella and Trubin (2006) explain:

> [T]here is no shortage of reasonable explanations, many of which date back to the early literature on this topic and have now been extended in various directions. For the most part, these explanations are mutually compatible and, viewed in their totality, suggest that the relationships between the yield curve and recessions are likely to be very robust indeed. We give two examples that emphasize monetary policy and investor expectations, respectively.
>
> Monetary policy can influence the slope of the yield curve. A tightening of monetary policy usually means a rise in short-term interest rates, typically intended to lead to a reduction in inflationary pressures. When those pressures subside, it is expected that a policy easing—lower rates—will follow. Whereas short-term interest rates are relatively high as a result of the tightening, long-term rates tend to reflect longer term expectations and rise by less than short-term rates. The monetary tightening both slows down the economy and flattens (or even inverts) the yield curve.
>
> Changes in investor expectations can also change the slope of the yield curve. Consider that expectations of future short-term interest rates are related to future real demand for credit and to future inflation. A rise in short-term interest rates induced by monetary policy could be expected to lead to a future slowdown in real economic activity and demand for credit, putting downward pressure on future real interest rates. At the same time, slowing activity may result in lower expected inflation, increasing the likelihood of a future easing in monetary policy. The expected declines in short-term rates would tend to reduce current long-term rates and flatten the yield curve. Clearly, this scenario is consistent with the observed correlation between the yield curve and recessions. (Estrella and Trubin 2006, 2)

Although Estrella and Trubin offer a sophisticated hybrid account, in practice many economists emphasize the investor expectation channel. For example, in his *New York Times* column and blogging platform, Paul Krugman over the years has clearly singled out investor expectations as the driving force behind the historical pattern. Here is Krugman in late 2008:

> **The reason for the historical relationship between the slope of the yield curve and the economy's performance is that the long-term rate**

> **is, in effect, a prediction of future short-term rates.** If investors expect the economy to contract, they also expect the Fed to cut rates, which tends to make the yield curve negatively sloped. If they expect the economy to expand, they expect the Fed to raise rates, making the yield curve positively sloped. (Krugman 2008, bold added)

Then, in his column from mid-August of 2019—commenting on the then recent inversion of the two-year and ten-year yields that was rattling markets—Krugman applied his framework to the data:

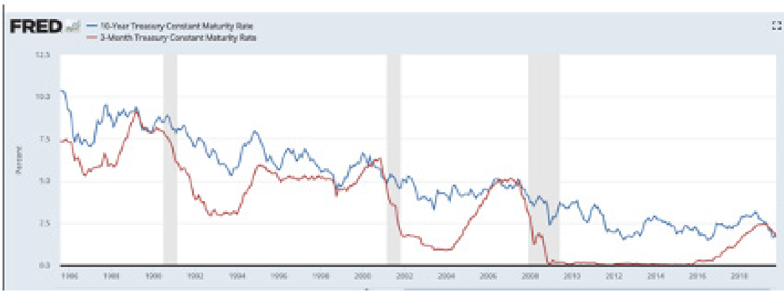
> An old economists' joke says that the stock market predicted nine of the last five recessions. Well, an "inverted yield curve"—when interest rates on short-term bonds are higher than on long-term bonds—predicted six of the last six recessions. And a **plunge in long-term yields, which are now less than half what they were last fall, has inverted the yield curve once again**, with the short-versus-long spread down to roughly where it was in early 2007, on the eve of a disastrous financial crisis and the worst recession since the 1930s.
>
> Neither I nor anyone else is predicting a replay of the 2008 crisis. It's not even clear whether we're heading for recession. **But the bond market is telling us that the smart money has become very gloomy about the economy's prospects. Why? The Federal Reserve basically controls short-term rates, but not long-term rates; low long-term yields mean that investors expect a weak economy, which will force the Fed into repeated rate cuts.** (Krugman 2019, bold added)

As the above quotations make clear, Krugman is confidently telling his readers that "[t]he reason" that the yield curve flattens/inverts before a recession, is that investors forecast trouble ahead. There are two problems with this approach.

First, it is odd that an inverted yield curve would rattle investors if the *reason* it is inverted is that investors already expect an imminent recession.

Second and more significantly, Krugman's explanation would make sense if yield curve inversions typically occurred when the long bond yield collapses. But in fact, as figure 1 makes clear, the yield curve inverts primarily because the short rate spikes before a recession.

Figure 1. Three-month and ten-year Treasury yields, July 1985–October 2019 (monthly constant monthly maturity rate)



A crisp counterexample to Krugman's explanation is the yield curve inversion that occurred before the 2007–09 Great Recession. In late 2006/early 2007, when the three-month Treasury yield (red line in figure 1) was higher than the ten-year yield (blue line), this clearly occurred because of tightening monetary policy. Far from showing a collapse in investor optimism, the ten-year yield at the time was the highest it had been in several years, and it even popped up just as the three-month yield began falling off a cliff. Krugman's explanation therefore cannot explain why the yield curve inverted before the Great Recession. This wasn't a story of bond investors in late 2006 and early 2007 realizing how rapidly the Fed was about to slash short-term rates.

In contrast, canonical Austrian business cycle theory (ABCT) is quite compatible with the evidence presented in figure 1. In the Misesian framework, the unsustainable boom is associated with "easy money" and artificially low interest rates. When the banks (led by the central bank, in modern times) change course and tighten, interest rates rise and trigger the inevitable bust.[2]

Now in standard expositions of the ABCT, it is common to refer to "the" interest rate, and how it swings during the boom-bust cycle. Yet if we ask more specifically *which* interest rate, it clearly would

[2] Although he does not name other economists the way we have singled out Krugman, Shostak (2017) too distinguishes the conventional expectations explanation from the Austrian account. In other words, like us, Shostak has pointed out that mainstream economists argue as if the yield curve inverted because of a collapse in long rates, whereas the Austrian story involves a spike in short rates. (We thank an anonymous referee for providing this citation.)

be *short-term* rates over which the banks have the most control. (This is not an Austrian point per se; typical economists—including Krugman in the quotations above—agree that the central bank has more control over short-term interest rates than long-term ones.) When the banks issue more money during the boom, they will push down short-term interest rates more than long-term rates. Indeed, rising expectations of price inflation might even lead to *higher* long-term interest rates under certain circumstances. Going the other way, when the banks tighten, it will be short-term interest rates that will rise most aggressively in response.

In light of these considerations, standard ABCT carries the corollary that during an unsustainable boom, the yield curve steepens, while going into the bust, the yield curve flattens.

Naturally, for those who independently *endorse* Mises's theory of the business cycle, it must be the case that the pattern of yield curve inversions can be reconciled with the theory; we are merely pointing out that this reconciliation is quite straightforward.

Cwik (2005) too argues that the standard Austrian approach of what Garrison (2001) calls capital-based macroeconomics allows the Austrians to naturally explain the connection between the yield curve and the business cycle in a way that eludes the typical mainstream economist, who focuses on *either* monetary *or* real factors:

> Macroeconomic theories attribute economic downturns to either monetary or real factors. The capital-based approach allows for both. A disaggregated approach allows for analysis and insights that other theories cannot provide. Unlike the capital-based approach, most macroeconomic theories that examine the upper-turning point focus on the immediate causes of the downturn. They do not include the underlying capital structure as a part of the theory, because this structure is viewed as an unnecessary complication to the theory. By ruling out capital (and the malinvestments that could be built up during the expansionary phase), the leading macroeconomic theories focus on more aggregated causes—such as monetary or real shocks to the economy. (Cwik 2005, 2)

And thus the Austrians have the best of both worlds.[3] As Machlup (1976, 23) described it, in the Austrian explanation "monetary

[3] Johnson (2002) also supplements the neoclassical consumption smoothing explanation of the yield curve's predictive powers with insights from the Austrian school.

factors cause the cycle but real phenomena constitute it." This marriage of monetary and real factors has always been present in Austrian business cycle analysis, which can be seen, for example, when using Wicksell versus Fisher effects in explaining the upper and lower turning points of the boom-bust cycle (Cwik 2004, 125–39; and 2005, 7–9, 23–24). Rather than the somewhat *ad hoc* and unnatural hybrid explanation embraced by their mainstream colleagues, the Austrians' account of the business cycle all along implied the connection between the slope of the yield curve and the turning point that neoclassicals were left trying to explain only after observing the pattern.

THE ROTHBARD-SALERNO "TRUE MONEY SUPPLY": CONCEPTUAL DEFINITION AND EMPIRICAL ESTIMATION

At the center of the Austrian explanation of the business cycle and its relationship with the yield curve enumerated above is the money supply. How do changes in the money supply affect the yield curve?[4]

First, we will define what we mean by "the money supply," or as Rothbard and Salerno put it: the *true* money supply. In addition to the outstanding *level* of the money supply at a particular time, we also consider the *rate of change* in the money supply. At least in a fiat monetary regime, the usual scenario involves almost perpetual growth in the quantity of money, with the only change being the *rate* of growth; this is why we find it useful to couch the analysis in terms of the first derivative of the (true) money supply.

In other words, in modern times, when a central bank (or the commercial banks) "tighten," this can often mean merely a slowdown in the injection of new money into the system, rather than an outright reduction in the stock of money (although it may mean that, too, at times). As Mises (1998, 552) explained: "The

[4] A note for purists: Strictly speaking, it would be more accurate to refer to "the stock of money" rather than "the money supply," since the latter reference could be taken to mean an entire supply *schedule* rather than the quantity supplied at a particular moment. However, in this context it is typical to use the term "money supply," and indeed the concept we are discussing is literally named the "true money supply."

boom can last only as long as the credit expansion progresses at an ever-accelerated pace."

Other things equal, we expect *accelerating (monetary) inflation* to lead to a decline in short- relative to long-dated yields. In other words, we expect a loosening of monetary policy to push down shorter-term interest rates more than longer-term rates.

On the other hand, other things equal, we expect *decelerating (monetary) inflation*—which can include outright *deflation* of the money stock but need not—to lead to an increase in short- relative to long-dated yields. In other words, we expect a tightening of monetary policy to raise shorter-term rates more than longer-term rates.

We calculate the TMS in accordance with theoretical expositions by Rothbard (2000, 1978, 2008) and Salerno (1987, 2018). All data are monthly, non–seasonally adjusted, and sourced from the Federal Reserve Bank of St. Louis's Federal Reserve Economic Data (FRED) online database.

We follow Salerno (2018) in determining whether to include an item in the TMS:

> Thus for an asset to be included as a component of TMS … it must be either generally and routinely accepted in exchange as a final means of payment for goods and services, like dollar bills issued mainly by the Federal Reserve or immediately redeemable for dollar bills at par on demand by the depositor…. Or, if we wish to put it in these terms, all components of TMS are "money of zero maturity," dollars that are instantly accessible by their owners at par value. (Salerno 2018)

In order to understand the decisions that Rothbard and Salerno made when choosing the components of the TMS, one must realize that strictly speaking it's irrelevant whether a given financial instrument is truly redeemable on demand for standard money. What matters is whether market participants *believe* the instrument serves as a genuine substitute for money proper.

For example, "[i]t is important to recognize that demand deposits are not automatically part of the money supply by virtue of their very existence; they continue as equivalent to money only so long as the subjective estimates of the sellers of goods on the market think that they are so equivalent and accept them as such in exchange"

(Rothbard 1978).[5] Therefore, insofar as people believe that a given financial instrument is redeemable at par for standard money on demand—even if the depository institution has the legal or contractual ability to *delay* redemption—economically we consider it a perfect money substitute and its balance is counted in the TMS.

Mises too agreed that commercial practice, not the letter of the law, is what counts when deciding whether to classify a claim on money as a money substitute (and hence part of TMS, for our purposes). When developing his framework for monetary theory, Mises argued:

> **Economic discussion about money must be based solely on economic considerations and may take legal distinctions into account only in so far as they are significant from the economic point of view also**. Such discussion consequently must proceed from a concept of money based, not on legal definitions and discriminations, but on the economic nature of things. It follows that our decision not to regard drafts and other claims to money as constituting money itself must not be interpreted merely in accordance with the narrow juristic concept of a claim to money. **Besides strictly legal claims to money, we must also take into account such relationships as are not claims in the juristic sense, but are nevertheless treated as such in commercial practice** because some concern or other deals with them as if they actually did constitute claims against itself. (Mises 2009, 54, bold added)

To calculate the TMS we begin with the M2 money stock (M2NS) and subtract the following data: small time deposits (STDNS), traveler's checks (TVCKSNS), and retail money funds (RMFNS). Our rationale is as follows.

Small time deposits are not redeemable at par on demand, nor are they generally believed to be. Technically, a traveler's check is "a credit claim on the investment portfolio of the issuing company … not the final means of payment in a transaction" (Salerno 1987). Nor are they believed to be otherwise, evidenced by the fact that

[5] In his explanation of the causes of the Great Depression, Rothbard (2000) included the cash surrender values on permanent life insurance policies, because he believed they satisfied the criteria for money substitutes. However, the decision is controversial, and moreover these data are more difficult to acquire than those of the other components. In any event, the numbers here are small enough that they don't significantly change the picture of what is happening to "the money supply" if, for example, we want to characterize the Fed's stance in the 1920s (Salerno 2018).

"the sellers who receive travelers checks in exchange quickly and routinely present them for final payment at a bank" (Salerno 1987). Retail money funds, also known as money market mutual funds, are excluded from the TMS, since the balance represents a stake in "equity shares in a portfolio of short-term assets, like high-grade commercial paper and Treasury bills, whose value fluctuates proportionally to the gains and losses to the value of the underlying assets" (Salerno 2018). In other words, they are not instantly redeemable claims to base money at par, nor do they constitute a final means of payment.

Therefore, small time deposits, traveler's checks, and retail money funds are excluded from our TMS calculation.

In contrast, what remains of M2 meets our TMS inclusion criteria. This includes currency outside the US Treasury, demand deposits, and other checkable deposits. Each of these is generally perceived to be either base money or instantly redeemable claims to base money at par.

We then add data presently *not* counted in M2, including deposits with Federal Reserve Banks other than reserve balances: the US Treasury general account (WTREGEN) and international deposits at the Fed (WOTHLB).

The Treasury's general account at the Fed is the "primary operational account of the US Treasury at the Federal Reserve. Virtually all US government disbursements are made from this account" (FRED description). As such, its balance constitutes an instantly redeemable claim to base money, the use of which in exchange is accepted as final payment for the settlement of transactions. The same logic applies to deposits made at the Fed by foreign institutions.

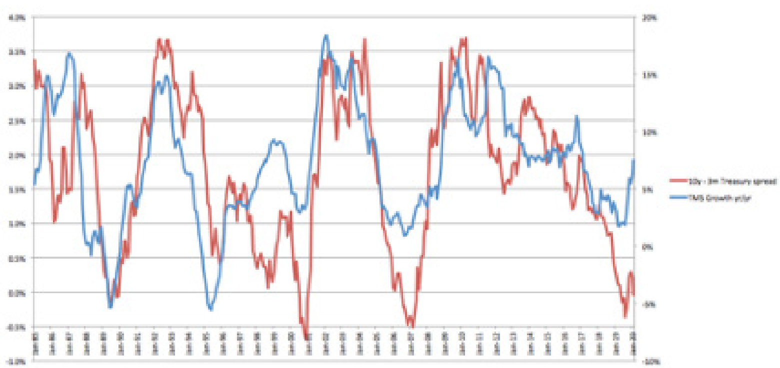
Close observers of FRED data will be aware of the data series Treasury Deposits at Federal Reserve Banks (TREASURY) and may wonder why this data is not included in the TMS. We learned through correspondence with St. Louis Federal Reserve Bank staff that WTREGEN and TREASURY are averages sourced from "the same root series." However, because WTREGEN is reported in Fed press releases as of the date of this writing and TREASURY is not, we chose to use WTREGEN to account for balances held at Federal Reserve Banks by the US Treasury in the TMS rather than TREASURY.

GROWTH IN THE AUSTRIAN TMS VS. THE YIELD CURVE SPREAD

Using the Austrian TMS as explained in the preceding section, here we plot the TMS's twelve-month growth rate against the spread between the ten-year and three-month Treasuries. As we will see, there is a remarkably tight relationship between these series.

Because of data availability, we must switch the FRED series that we use when constructing the yield curve spread depending on the time period. Specifically, from 1985 onward we use the FRED series T10Y3M, which directly calculates the spread (when quoting the yields on a "constant maturity" basis). The growth in the TMS is contrasted with this particular measure of the spread in figure 2. However, if we wish to go back to 1962, we must switch to FRED's DGS10 and TB3MS series and then subtract to obtain the spread between them. The growth of the TMS is contrasted with this particular measure of the spread in figure 3.

Figure 2. Twelve-month TMS growth versus ten-year-three-month Treasury spread, January 1985–February 2020 (monthly constant maturity rate)



Source: Data from FRED.

Figure 3. Twelve-month TMS growth versus ten-year-three-month Treasury spread, January 1962–February 2020 (constant maturity rate for ten-year, secondary market yield for three-month, monthly)

Source: Data from FRED.

Note: The blue line rises above 50 percent in the early 1980s. In order to keep the scaling convenient for the entire period, we have decided to let this unusual spike in TMS growth remain "off the charts."

Figures 2 and 3 display a remarkably tight connection between the twelve-month growth in the Austrian TMS and the slope of the yield curve.[6] Generally speaking, when the TMS growth increases (i.e., the blue line rises), the spread increases between the monthly yields on the ten-year and three-month Treasuries (i.e., the red line rises). And likewise, when money growth decreases, the yield curve flattens.

Although the present authors believe the graphical presentations above are more appropriate, standard econometric analyses also confirm the suggested relationship. Using monthly data for the variables defined in figure 3, from January 1962 through May 2020, a standard ordinary least squares (OLS) regression shows a positive relationship between growth in our TMS measure and the yield spread, at a 0.01 level of significance (though with strong autocorrelation, meaning that the result itself doesn't imply causality).

[6] The reader should look carefully at the axes in figures 2 and 3, as they have been adjusted to make the connection between the two series easier to spot.

Likewise, it can be shown that the TMS and yield spread variables "Granger cause" each other, at least with a 0.05 level of significance, for all but two out of eighteen lags (see Appendix).

In sum, the empirical results confirm our interpretation of the standard Austrian account of the boom-bust cycle: during periods when the Federal Reserve and / or private institutions are increasing the quantity of money (in the broader sense) at an accelerating pace, the yield curve is "normal" and upward sloping. When the Fed and banks become skittish and decelerate the pace of monetary inflation, the yield curve flattens and (in extreme cases) inverts.

CONCLUSION

At least since the late 1960s, given suitable specifications, an inverted yield curve has "predicted" an impending recession with impressive accuracy. We believe that the Austrian theory of the business cycle can explain this empirical pattern quite naturally, especially in comparison with attempted explanations from neoclassical economists.

In this paper, our contribution was to show that the one-year growth rate of the Rothbard-Salerno measure of the "true money supply" coincides with movements in the ten-year-three-month Treasury bond spread remarkably well. This provides additional support for the claim that the Austrian theory of the business cycle explains the "predictive power" of the yield curve better than the mainstream approach. It remains for future research to unpack the theoretical mechanisms involved and to develop more rigorous empirical tests.

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APPENDIX

Although the present authors believe the graphical presentations in the main text are more appropriate, standard econometric analyses also confirm the suggested relationship between the Austrian TMS and ten-year-three-month Treasury spreads. Using monthly data for the variables defined in figure 3—specifically, the twelve-month percentage growth in our TMS and the ten-year-three-month Treasury spread (at a constant maturity rate for the ten-year and a secondary market yield for the three-month Treasuries), from January 1962 through May 2020, a standard OLS shows a positive relationship between growth in our TMS measure and the yield spread, at a 0.01 level of significance (though with strong autocorrelation, meaning that the result itself does not imply causality). In the table below we present a summary of these regression results:

Table 1. Ordinary least squares regression on twelve-month percentage growth in true money supply and ten-year-three-month Treasury spread

Number of obs =						701
F(1, 699) =						187.17
Prob > *F* =						0.0000
R-squared =						0.2112
Adjusted R-squared =						0.2101
Root MSE =						0.1091
10yr–3mo	**Coefficient**	**Std. err.**	***t***	***P* > *t***	**[95% conf. interval]**	
TMS growth	.0780683***	.0057064	13.68	0.000	.0668646	.089272
_Constant	.0096193***	.000575	16.73	0.000	.0084904	.0107481
AutoC test	624.528***					

Likewise, it can be shown that the TMS and yield spread variables "Granger cause" each other, at least with a 0.05 level of significance, for all but two out of eighteen lags:

Table 2. Does TMS growth Granger cause ten-year-three-month yield spread?

Lags	Chi-Square	P-value	AIC
1	1.097	0.295	–14.070
2	12.381	0.002	–14.904
3	8.576	0.035	–14.917
4	10.211	0.037	–14.955
5	9.868	0.079	–14.946
6	13.724	0.033	–14.963
7	15.633	0.029	–14.959
8	18.091	0.021	–14.948
9	18.609	0.029	–14.947
10	28.660	0.001	–14.967
11	28.890	0.002	–14.970
12	30.161	0.003	–14.982
13	31.192	0.003	–15.005
14	29.713	0.008	–15.126
15	30.367	0.011	–15.130
16	30.450	0.016	–15.118
17	32.266	0.014	–15.124
18	32.497	0.019	–15.115

Table 3. Does ten-year-three-month yield spread Granger cause TMS growth?

Lags	Chi-Square	P-value	AIC
1	1.872	0.171	–14.070
2	15.196	0.001	–14.904
3	15.955	0.001	–14.917
4	20.338	0.000	–14.955
5	20.936	0.001	–14.946
6	32.003	0.000	–14.963
7	31.435	0.000	–14.959
8	31.633	0.000	–14.948
9	32.228	0.000	–14.947
10	34.800	0.000	–14.967
11	31.859	0.001	–14.970
12	34.264	0.001	–14.982
13	44.065	0.000	–15.005
14	43.218	0.000	–15.126
15	51.437	0.000	–15.130
16	52.503	0.000	–15.118
17	54.829	0.000	–15.124
18	58.484	0.000	–15.115