Time Inconsistency, Inflation, and MMT

Jackson Mejia* and Brian C. Albrecht†

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Price stability is a stated policy objective for many economists, especially economists who subscribe to Modern Money Theory (MMT). To achieve price stability, MMT economists often argue for using a number of different policy tools; the most commonly referenced policies are a jobs guarantee program and using tax policy to temper aggregate demand. This paper focuses on the latter policy while acknowledging that the former is also important. We ask whether the promise to raise taxes is time consistent. Would a benevolent planner—completely versed and committed to the economic argument of MMT but with discretion in terms of policy-making—actually raise taxes when aggregate demand increases start to drive up inflation? By adapting a benchmark model of time consistency, we argue that raising taxes to the level necessary to generate price stability is time inconsistent. While it is optimal to promise to raise taxes, when inflation comes, the planner would not want to raise taxes as much as she ought to, leading to higher inflation than optimal. We conclude by arguing that a rules-based system, a large part of which may include automatic stabilizers like a jobs guarantee program that are being further fleshed-out in the MMT literature, can reduce the inflationary bias.

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*University of Minnesota, Department of Economics, 1925 Fourth Street South, Minneapolis, MN 55455. Email: mejia069@umn.edu.

†University of Minnesota, Department of Economics, 1925 Fourth Street South, Minneapolis, MN 55455. Email: mail@briancalbrecht.com. *(Corresponding Author)*

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1 Introduction

Economists who subscribe to Modern Money Theory, referred to here as "MMT" for short, are highly critical of standard economic approaches to the relationship between deficits, taxation, and inflation. They claim that, contrary to standard public finance, a government that can print its own money does not need to worry about deficits or debt to the extent they do today. Primarily, this is because "a government like the United States—i.e., one that issues a sovereign, non-convertible currency—can meet any and all outstanding financial obligations, provided the debts are denominated in the national currency" (Kelton 2011, p. 62).[1]

However, the perspective that "so long as there are keyboard keys to stroke, the government can always stroke them to produce interest payments" (Wray 2012, p. 70) has caused much mischief and misunderstanding. For example, Federal Reserve chairman Jerome Powell has interpreted MMT as claiming that "deficits don't matter" (Cohen 2019).[2] This is a common view among MMT's critics, who have also argued that MMT's stance on deficits inevitably leads to inflation (e.g., Palley 2015a).

But this is an unfair reading; MMT generally follows Lerner's prescription for full employment and a stable price level. Stable prices are achieved through changes in the level of taxation among other policy tools. Leão, for example, writes, "Does [deficit spending] pose a risk of inflation? No, if total spending becomes too great the government can raise taxes to reduce it back to full employment" (2015, p. 2). Similar examples

1. Much of this idea comes directly from Abba Lerner, whose functional finance has heavily influenced MMT fiscal policy prescriptions (Forstater 1999). Agnosticism regarding the deficit is evident in statements like "the government may find itself collecting more in taxes than it is spending or spending more than it collects in taxes...In neither case should the government feel that there is anything especially good or bad about this result; it should merely concentrate on keeping the total rate of spending neither too small nor too great, in this way preventing both unemployment and inflation" (Lerner 1943, p. 40).

2. This is one of the difficulties of discussing an entire school of thought, compared to a specific model. Some economists of that school of thought will argue "we don't say deficits don't matter" (Walsh 2018) while others title their papers "Deficit Hysteria Redux? Why We Should Stop Worrying About U.S. Government Deficits" (Nersisyan and Wray 2010a).

abound throughout the MMT literature, all of them following Lerner's dictum that "taxation should therefore be imposed only when it is desirable that the taxpayers shall have less money to spend, for example, when they would otherwise spend enough to bring about inflation" (Lerner 1943, p. 40).

Here, we take seriously the MMT claim that governments can use policy to stop inflation when necessary.[3] We talk about taxation specifically to focus the discussion and because it is frequently cited as a feasible and good policy for fighting inflation in the MMT literature.[4] But it is important to note that nothing in our argument relies on taxes being the sole policy lever to fight inflation. In a recent *Financial Times* piece, Fullwiler, Grey, and Tankus (2019) cite a range of policy tools to curb inflation.[5] Except for a jobs guarantee, all of their other proposals are mentioned in the MMT literature less frequently than taxes. Their policies are all worth thinking more about; we focus on taxes.

While it is surely possible for a government to *promise* to stop inflation through policy, it is substantially less clear whether it is something a government would choose to do. To check the feasibility of such a policy prescription, our paper formally asks a common question within macroeconomics and public finance: is MMT's proposed policy prescription time consistent? Would a policymaker, in the face of pending inflation and discretion over policy, follow the policy prescription to raise taxes and stop inflation? Perhaps more

3. To clarify, we mean using policy when there is "excess aggregate demand" and the economy is at or above full employment. In our model, that is the only source of inflation. Wray (2016, p. 10) claims that inflation before full employment is possible when spending increases too much in "sectors with a low elasticity of output (where additional demand causes prices to rise without increasing output much)."

4. See Wray (1998a, p. 8-10), Bell (1999), Semenova and Kelton (2008, p. 15-16), Mosler (2010, p. 17), Nersisyan and Wray (2010a, p. 14), Nersisyan and Wray (2010b, p. 20) Tymoigne and Wray (2015, p. 26-8), Wray (2016, p. 10), and Nersisyan and Wray (2019, p. 8-9), all of whom advocate using taxes as one policy tool to fight inflation. While these authors do not explicitly argue such, we assume they mean an increase in taxes that someone needs to decide to do since they never mention an entirely mechanical, rule-based tax system.

5. They also point out that the economy, at least from the perspective of MMT, has not been at full capacity for quite some time and inflationary pressures have mainly arisen from bottlenecks. Taking that as given, we aim to operate in an MMT world where those bottlenecks have been addressed already, there is full employment, and the policymaker has to choose between increasing taxes.

importantly, would a policymaker raise taxes *to the extent necessary to reduce inflation to its optimal level*?

We show that it is time inconsistent to raise taxes, contrary to the implicit assumption made by MMT. In other words, when it is optimal to raise taxes according to MMT proponents' recommendations, the planner will not raise taxes to the level consistent with optimal inflation.[6] We prove our result in the "best-case" scenario when a benevolent planner has access to non-distortionary, lump-sum taxes. The reasoning comes directly from Kydland and Prescott (1977). Suppose the fiscal authority promises to reduce inflation in the future by raising taxes. When the future arrives and inflation with it, the fiscal authority is incentivized to tax less than it should to maintain the optimal rate of inflation because it can move along the relevant short-run Phillips curve toward a lower rate of unemployment. With taxation as an instrument for maintaining inflation at its optimal level, the tendency toward higher rates of inflation is greater than it otherwise would be because people also do not like new taxes, so the planner will want to avoid implementing new taxes.

To check the time consistency of taxing inflation, we model a consolidated fiscal and monetary authority controlling inflation with tax policy. By focusing on a benevolent planner, we stay within the technocratic tradition of MMT.[7] Importantly, we are not considering an ill-functioning Congress that needs to make the taxing decision in real-time, nor implying that MMT economists think the ideal policy is for the United States Congress to pass legislation to raise taxes when inflation arises. Largely following White's (1999, pp. 193-214) textbook adaptation of Kydland and Prescott (1977) and Barro and

6. For recent critiques along different lines, see Palley (2015b), Coats (2019), Edwards (2019), and Mankiw (2019).

7. MMT is more properly called a school of thought or theory than a model. By that, we mean, following Leijonhufvud (1997), that MMT is a system of beliefs about the world, compared to a model which is a formalization of particular aspects of those beliefs. The difference is not about mathematics. Many famous economists have worked through logical models without needing mathematics. For examples, see Albrecht and Kogelmann (2018).

Gordon (1983) time inconsistency of monetary policy model, we add choice over taxation and fiscal control of monetary policy and examine the implications.[8] We show that the MMT policy recommendation to raise taxation in the face of inflation is time inconsistent. *Even a benevolent planner* would not raise taxes to the requisite level when the theory tells her to and so inflation will run higher than optimal.

We are establishing a benchmark; if we cannot expect a disinterested technocrat to successfully reduce inflation with taxation, then it follows that an agent operating at a higher time discount with greater self-interest will likewise fail and to a greater degree; any real-world decision-maker will do even worse than our benchmark case and therefore the equilibrium inflation rate would be higher.

For those who dislike our specific model, it is important to note that our main result, that a policymaker without commitment will be more inflationary than the optimal policy, is quite general. The result relies on two, hopefully, uncontroversial assumptions. First, we make an assumption about preferences: the policymaker is willing to trade off inflation for unemployment. Second, we make an assumption about feasible outcomes: there exists some level of unemployment where a further decrease in unemployment will increase inflation. These two assumptions combine to give the result. If the policymaker can decrease unemployment through an increase in inflation, she will want to, contrary to the optimal policy according to MMT proponents.

Of course, there are problems with focusing on one specific model in isolation, as well as issues with extracting a single element of the MMT policy prescription bundle.[9]

8. See Lucas and Stokey (1983) for a related discussion of time inconsistency and taxation.

9. It may be objected that we cannot separate taxing to stop inflation from MMT as a whole, and therefore from automatic stabilizers like the jobs guarantee in particular. We think our approach is defensible for two reasons. First, they are discussed as separate policies to address inflation. Second, it may not be the case that the entire MMT package is adopted immediately. The fiscal authority may not opt for some form of a jobs guarantee because it seems extreme to her or the public, and would then rely on more ancillary policies like using taxes to control inflation and address bottlenecks. In this case, taxes would necessarily be the primary tool along with the regulation of relevant sectors (Fullwiler, Grey, and Tankus 2019). Mosler (1997, p. 168-69) acknowledges the political difficulties associated with a jobs guarantee program.

We need to make explicit assumptions about the existence and relevance of the Phillips curve, some of which may be rejected by MMT economists. For example, Tymoigne and Wray (2015, p. 40-1) dispute the relevance of the Phillips curve trade-off because of a jobs guarantee program where the government is an employer of last resort. However, the two topics are conceptually distinct; how the Phillips curve operates in a world without a jobs guarantee program (such as the world we have right now) is a separate topic from whether the implementation of a jobs guarantee program changes the nature or relevance of the Phillips curve.[10] We believe it is helpful to first discuss the two conceptually distinct topics and then receive input from MMT economists on the time inconsistency of controlling inflation with taxes.[11]

MMT writers argue that stable prices should be one of the main goals for policymakers.[12] Therefore, we see our point as not a minor mathematical technicality, but a vital issue for economists to grapple with. However, that does not mean time inconsistency is a unique concern for MMT or that there are not solutions. Indeed, far from being exclusive to MMT, the problem we identify with using taxes to control inflation applies just as well to textbook Keynesianism. We finish up by discussing how rules-based approaches to taxation, like rules-based approaches to monetary policy, can be used to overcome the time inconsistency problem, at least partially.[13]

10. For some policy proposals, the jobs guarantee *is* monetary policy. In that case, one must talk about a jobs guarantee and the Phillips curve together. See Thompson (1982), Glasner (1989), and Hendrickson (2018).

11. Besides, some MMT economists embrace the Phillips curve. For example, Mitchell (1998) takes a positive view, writing that "the Phillips curve is alive and well" (p. 550) and "this is a Phillips curve world. To stop inflation, the government has to repress demand" (p. 551). Moreover, it is widely accepted within the economics profession and therefore serves as a useful tool for translating MMT into a more conventional model.

12. For example, Tymoigne and Wray (2015, p. 25) put price stability on par with full employment: As such, this type of "government is not financially constrained in the way that non-sovereign units are; it can focus on issues such as full employment and price stability."

13. While we think rules can generally be used to enhance the credibility of the fiscal authority and thereby reduce inflation, some economists have pointed out that *discretion* rather than rules leads to greater credibility (see, e.g., Cowen, Glazer, and Zajc (2000)). We do not engage that argument here.

2 Would a Benevolent Planner Raise Taxes to Stop Inflation?

To clearly explain the persistence of an inflationary bias, we adapt a standard time inconsistency of monetary policy model by allowing for taxes to control inflation. Following Kydland and Prescott (1977) and Barro and Gordon (1983), we will show that combating inflation with taxes is time inconsistent; attempting to control inflation with discretionary fiscal policy faces the same problem as controlling inflation with discretionary monetary policy. That is, fiscal policymakers may promise to reduce inflation to some optimal rate π^* but will be incentivized to reduce inflation only to a rate $\pi > \pi^*$ because they will be able to temporarily reduce unemployment and can avoid imposing misery-inducing taxes. We also show that using fiscal policy rather than monetary policy to control inflation yields a higher equilibrium inflation rate.

2.1 The Benevolent Planner and the Optimal Rate of Inflation

Let us assume that we have a benevolent, unelected technocrat who runs fiscal policy and has control over the inflation rate π. This control follows directly from the fiscal authority's control over taxation, which is used as an instrument to control the inflation rate, π. Mirroring the Barro-Gordon model, we can see this control over taxation as symmetric to control over the growth of the money growth rate, gM.[14] We also make the simplifying assumptions that there is a constant velocity of money gV, or at least that changes in tax policy do not affect gV. This implies that any change in tax policy necessarily results in changes in $\pi + gy$.

14. Note that this follows from the equation of exchange in its dynamic form:

$$gM + gV = \pi + gy$$

Here we make an explicit assumption about the shape of the aggregate supply curve for a good approximation of a plausible MMT model. The short-run aggregate supply curve is horizontal until full employment followed by an upward sloping curve after (Palley 2015a). As Wray (1997, p. 547) explains, "If resources are fully employed, any extra demand would cause input prices to rise, which could be expected to be passed on in the form of higher taxes." Moreover, constructing the model in this way provides policymakers in the model with the easiest signal for when to increase taxes.

Further, we assume that consumers form linear short-run Phillips curves (SRPCs) given by

$$U = U_n - k(\pi - \pi^e), \tag{1}$$

where k is a positive constant that gives the sensitivity to unexpected inflation, π is the current inflation rate, and π^e is the currently expected inflation rate. SRPCs give the set of feasible (short-run) inflation-unemployment combinations available to the fiscal authority, which takes the public's expected inflation as given.

Note that, to model MMT and the claims of functional finance correctly, there must exist some trade-off between inflation and taxation so that taxes can be used as an instrument to control inflation. Taking one example among many from the MMT literature, Mosler writes, "To prevent the government's spending from causing that kind of inflation, the government must take away some of our spending power by taxing us, not to actually pay for anything, but so that their spending won't cause inflation" (2010). Hence, the fiscal authority trades off inflation against new taxes; positive new taxes result in lower inflation. For simplicity, this relationship is linear. We also assume that there is exogenously given some optimal "target" inflation rate π^* consistent with the goals of the fiscal authority. It does not matter what specifically this inflation rate is—we normalize π^* to zero following the convention of Barro and Gordon (1983) and reflecting MMT's

desire for price stability mentioned above. All else equal and given a vertical long-run Phillips curve, it is better to have a zero rate of inflation than one that is positive or negative, a convention that is especially justifiable with increasing menu costs from inflation or deflation.[15]

Since in the MMT, functional finance world, taxes are the instrument for removing money from the economy, we assume there is a direct relationship between initial inflation, realized inflation, and taxes so that

$$\pi = \left(\frac{-\pi_0}{\tau^{SP}}\right)\tau + \pi_0 \tag{2}$$

where π is the inflation rate, π_0 is the initial inflation rate, τ^{SP} is the optimal level of new taxes that corresponds to stable prices, and τ is the level of actual new taxes. Given some optimal inflation rate, there exists a unique τ^{SP} that can give optimal inflation, i.e., is consistent with stable prices.[16] Notice that, from (2), if the actual level of new taxes τ equals τ^{SP}, then the realized inflation rate $\pi = \pi^*$, the optimal inflation rate.

To follow the MMT story, we assume that π_0 is positive; the fiscal authority wants to *reduce* inflation to its optimal level. To be clear, we are augmenting the Barro-Gordon model by adding taxes. To do so, we need a relationship between new taxes and inflation, and equation (2) describes it. The fiscal authority must follow a path from initial inflation to final inflation by changing the level of new taxes, which we assume to be linear for convenience. If initial inflation is even higher, $\pi_0' > \pi_0$, so is the required level of taxation to return to stable prices, $\tau^{SP'} > \tau^{SP}$. Figure 1 below shows a simple illustration of the relationship between inflation and new taxes.

15. Note that we could, following Friedman (1969), also rationalize a negative target, or a positive rate for seigniorage revenues (Selgin and White 1999). Ultimately, *the exact target is irrelevant for time consistency*.

16. Notice that this relationship doesn't need to be linear for the argument to proceed; it is a mathematical simplification. All that is necessary is for *some* inverse relationship to exist between taxes and inflation.

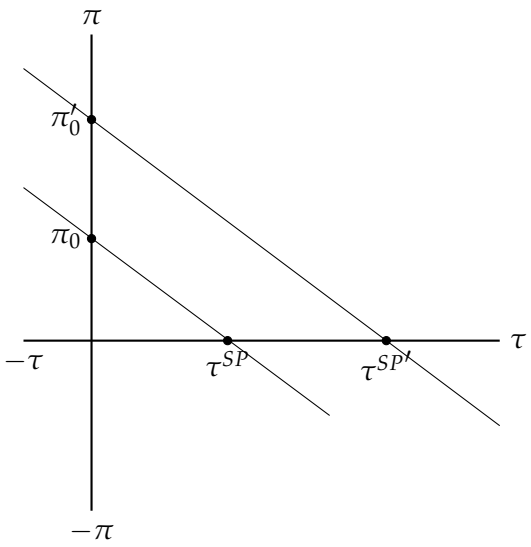

Figure 1: Taxes vs. Inflation Trade-off

The taxation level τ is meant to capture those taxes that are explicitly meant to cut inflation, or they can be thought of as new taxation. More precisely, it is those new taxes that are collected and not spent by the fiscal authority. This reduction in aggregate demand is what drives down inflation.

To reiterate, it is crucial to understand that our result does not depend on what the optimal inflation rate is or whether the relationship between new taxes and inflation is precisely linear with the specified slope. These are simplifications made for analytical convenience. All that matters is there exists a qualitatively inverse relationship (of whatever form) between new taxes and inflation and that there exists a target inflation rate for the fiscal authority.

The policymaker's preferences reflect consumers in the economy.[17] Preferences can be represented by isomisery (social indifference) curves over inflation, deviations from the desired unemployment rate, and deviations from the desired level of new taxes, where all

17. We abstract from the possibly redistributive effects of a change in the money supply engendered by new taxes, as well as from any temporary effect of a change in inflation on real income. We also assume that the inflation rate, even after being altered by changes in the tax level, always equals its steady-state equilibrium value and that the economy is always on its long-run money demand curve.

are treated as bads; the benevolent fiscal authority seeks to minimize over them. In particular, the fiscal authority chooses the level of new taxes τ to minimize the present value of the stream of future misery indices.[18] That is, the fiscal authority's objective is to choose the level of new taxes such that the level of misery given by unemployment, inflation, and taxation is minimized. Defined over U (unemployment), inflation π, and new taxes, isomisery curves are given by

$$Z = a\,(U - pU_n)^2 + b\pi^2 + c(\tau - q\tau^{SP})^2 \tag{3}$$

where Z is the misery index, a is the misery coefficient on unemployment, and pU_n $(0 < p < 1)$ is the desired rate of unemployment as a fraction of the unemployment rate when at full employment U_n. In Section 2.4, we argue that this assumption (that the policymaker's desired rate of unemployment would be below U_n) is reasonable. The coefficient b is the misery coefficient on deviations of π, c is the misery coefficient on new taxes, and $q\tau^{SP}$ $(0 < q < 1)$ is the desired level of new taxes as a fraction of the required level of new taxes to ensure optimal inflation.

Since the misery index Z depends on the unemployment rate, which in turn depends on the level of new taxes, the current-period inflation rate (the latter of which is exogenously given), and the public's π^e, the fiscal authority must determine the public's π^e to solve for the level of new taxes. Following the standard models, the public determines its expected inflation rate through common knowledge of the natural rate of unemployment and the understanding that the fiscal authority's chosen level of new taxes (and, in turn, the inflation rate), will depend on the fiscal authority's solution to minimizing the misery index subject to the relevant SRPC. In essence, the rational public forms an expected in-

18. Note that, following White (1999), that means this reduces to a one-period problem since, by assumption, future unemployment and expected inflation rates are independent of the current period inflation rate.

flation rate based on the knowledge it has about SRPCs and the fiscal authority's choice problem.

Note that, in equilibrium, it must be the case that the chosen level of new taxes τ necessarily implies the realization of some inflation rate π^r. It must be the case that $\pi^r = \pi^e$. Were it otherwise, the fiscal authority could exploit the SRPC further for a lower unemployment rate, which would mean that an equilibrium would not yet have been reached. For an equilibrium to be reached, it must be that there is no incentive for the fiscal authority to exploit taxes such that a temporarily low unemployment rate is achieved (relative to the natural rate).

With taxes as an instrument for controlling inflation, notice that we can rewrite the formula for the short-run Phillips curves. In particular, we can substitute equation (2) for π:

$$U = U_n - k\left(\left(\frac{-\pi_0}{\tau^{SP}}\right)\tau + \pi_0 - \pi^e\right) \tag{4}$$

We can likewise replace π with equation (2) in equation (5).

$$Z = a(U - pU_n)^2 + b\left(\left(\frac{-\pi_0}{\tau^{SP}}\right)\tau + \pi_0\right)^2 + c(\tau - q\tau^{SP})^2 \tag{5}$$

This can be solved in the standard fashion by minimizing Z, the misery function. Substituting equation (4) for U in the misery function, we get the following minimization problem:

$$\min_{\tau} Z = a\left(U_n - k\left(\left(\frac{-\pi_0}{\tau^{SP}}\right)\tau + \pi_0 - \pi^e\right) - pU_n\right)^2 + b\left(\left(\frac{-\pi_0}{\tau^{SP}}\right)\tau + \pi_0\right)^2 + c(\tau - q\tau^{SP})^2. \tag{6}$$

Taking the first-order condition of (6), we obtain:

$$\frac{\partial Z}{\partial \tau} = \frac{ak\pi_0 U_n}{\tau^{SP}} + \frac{ak^2\pi_0^2}{(\tau^{SP})^2}\tau - \frac{ak^2\pi_0^2}{\tau^{SP}} + \frac{ak^2\pi_0\pi^e}{\tau^{SP}} - \frac{ak\pi_0 pU_n}{\tau^{SP}} + \frac{b\pi_0^2}{(\tau^{SP})^2}\tau - \frac{b\pi_0^2}{\tau^{SP}} + c\tau - cq\tau^{SP} = 0 \tag{7}$$

Rearranging terms and solving for τ yields

$$\tau = \frac{-a\tau^{SP}k\pi_0 U_n + \tau^{SP}ak^2\pi_0^2 + \tau^{SP}ak\pi_0 pU_n - \tau^{SP}ak^2\pi_e\pi_0 + \tau^{SP}b\pi_0^2 + cq(t^*)^3}{ak^2\pi_0^2 + b\pi_0^2 + c(\tau^{SP})^2}. \tag{8}$$

Plugging this into equation (2), after simplifying and rearranging terms, gives us

$$\pi = \frac{ak\pi_0^2 U_n(1-p) + ak^2\pi_e\pi_0^2 + \pi_0 c(\tau^{SP})^2(1-q)}{ak^2\pi_0^2 + b\pi_0^2 + c(\tau^{SP})^2}. \tag{9}$$

Equation (9) defines the fiscal authority's reaction function to changes in the public's expected inflation rate. Solving for this allows us to recursively define the level of new taxes.

2.2 Strategic Behavior and Discretionary Taxation

Returning explicitly to the model, let us examine two scenarios involving the fiscal authority's reaction function followed by a graphical illustration. In the first case, inflation is expected to be optimal by the public, but this expectation is irrational. In the second case, expected inflation can only be rational if it is greater than zero and therefore greater than optimal. Subsequently, a graphical illustration will show that there is only one solution.

Scenario 1: Discretionary Policy with the Promise of Optimal Inflation

Suppose that the fiscal authority promises to set taxes such that inflation will equal zero, the optimal rate. For whatever reason, the public thinks this is credible and therefore expects inflation to be optimal. Given the policymaker's reaction function, this expectation would be irrational. When $\pi^e = 0$, we have

$$\pi = \frac{ak\pi_0^2 U_n(1-p) + \pi_0 c(\tau^{SP})^2(1-q)}{ak^2\pi_0^2 + b\pi_0^2 + c(\tau^{SP})^2} > 0 = \pi_e = \pi^*, \tag{10}$$

which implies

$$\tau = \frac{\tau^{SP}\left(ak^2\pi_0^2 + b\pi_0^2 - ak\pi_0 U_n(1-p) + c(\tau^{SP})^2 q\right)}{ak^2\pi_0^2 + b\pi_0^2 + c(\tau^{SP})^2}. \tag{11}$$

If we compare equation (11) to τ^{SP}, it becomes clear that the level of new taxes will be less than optimal:

$$\tau - \tau^{SP} = \frac{ak\pi_0 U_n(p-1) + c(\tau^{SP})^3(q-1)}{ak^2\pi_0^2 + b\pi_0^2 + c(\tau^{SP})^2} < 0. \tag{12}$$

Therefore, when the public expects inflation to be zero, or to be at its optimal rate, the fiscal authority will not raise taxes to the requisite level. Inflation rises above the public's expectation and as a result, that expectation was not rational. Beyond the promise made by the fiscal authority, the public has no relevant information that inflation will be zero. Consequently, no promises made by the fiscal authority regarding inflation would be taken seriously anymore; it would lose all credibility. Relatedly, any expectation of optimal inflation would be completely impermissible within the bounds of rational decision-making. It is, therefore, irrational to expect optimal inflation.

Unexpectedly lower taxes and higher inflation give us another result. When this occurs, deficits will also be higher than expected, causing unexpected changes in the inter-

est rate.[19] Nominal contracts will systematically fail to take into account real prices to the requisite degree and will favor debtors over creditors. It is true that as inflation expectations become more rational over time, nominal contracts will likewise become more rational, but the initial contracts made will bring persistently lower welfare to creditors, wage-earners, and so on.

It is worth investigating why this might occur. First, it is clear that in the model, the public dislikes taxes more than inflation, so that is one reason. Second, we know that unexpected inflation can bring lower unemployment, something further discussed below. Yet there is another: the fiscal authority has an incentive to cut taxes so that it can temporarily reduce the real cost it pays on bonds. Since we know that the nominal rate of interest i is approximately the expected real interest rate r^e plus expected inflation π^e, we have:

$$i = r^e + \pi^e. \tag{13}$$

When the government borrows from the public, the real cost it pays is the real interest rate on bonds. That cost is the nominal interest rate minus actual inflation π:

$$r = i - \pi. \tag{14}$$

Combining equations (13) and (14), we obtain:

$$r = r^e + \pi^e - \pi. \tag{15}$$

Equation (15) shows why the fiscal authority has the incentive to reduce taxation below the public's expectations—that is, to destroy less money through taxation than they promise to. If new taxes are lower than optimal, then the real interest rate $r < r^e$. Even

19. Because of differences of opinion between us and MMT regarding the effect on interest rates unexpected deficits will have, we will abstain from discussing this in detail.

so, we can think of other reasons for the fiscal authority to allow excessive inflation. By raising new taxes and spending those taxes (i.e., not destroying them), the fiscal authority can redistribute purchasing power from the public to itself and at the same time increase public goods provision.[20] Consequently, in this narrow context, the fiscal authority has a clear incentive to set expected taxation above actual taxation.

Such a maneuver by the fiscal authority, while rational, is exacerbated by the high discount nature of electoral politics. Elected officials concerned about upcoming elections necessarily have higher discount rates than technocrats and will have a greater incentive than some technocratic fiscal authority to manipulate the inflation rate to serve their ends. While this is not formally examined in this paper, it remains an area ripe for further research within the context of MMT.

Scenario 2: Discretionary Policy and Rational Expectations

Instead, suppose the public carefully analyzes the incentives facing the fiscal authority and is aware of her reaction function. Plugging in $\pi = \pi^e$ and rearranging gives us the equilibrium inflation rate:

$$\pi_{eq} = \frac{ak\pi_0^2 U_n(1-p) + \pi_0 c(\tau^{SP})^2(1-q)}{b\pi_0^2 + c(\tau^{SP})^2} > \pi^* = 0 \tag{16}$$

Recall that $a, b, k, \pi_0, \tau^{SP}, U_n > 0$ and $0 < p < 1$ and $0 < q < 1$, so equilibrium inflation $\pi_{eq} > 0$. Therefore, equilibrium inflation is greater than the optimal level, which is normalized to zero. When the trade-off between unemployment and inflation exists—and it surely does in the short run—then the fiscal authority will have a clear incentive to not raise taxes to the required level for optimal inflation to result. Rather, the fiscal authority

20. Paradoxically, increasing lump-sum taxation to reduce the money supply and thereby reduce inflation may reduce total revenues because the decrease in seigniorage may be greater than the required increase indirect taxation.

is determined to not raise enough taxes and to instead allow the subsequent inflation to occur.

We can then determine the equilibrium level of new taxes. Equilibrium taxes is given by plugging π_{eq} into (2), so that $\tau_{eq} = \left(\frac{-\tau^{SP}}{\pi_0}\right)(\pi_{eq} - \pi_0)$:

$$\tau_{eq} = \frac{\tau^{SP}\left(c(\tau^{SP})^2 q - ak\pi_0 U_n(1-p) + b\pi_0^2\right)}{b\pi_0^2 + c(\tau^{SP})^2} \tag{17}$$

To verify that this is smaller than "optimal," we take $\tau_{eq} - \tau^{SP}$:

$$\tau_{eq} - \tau^{SP} = \frac{c(\tau^{SP})^3(q-1) - ak\tau^{SP}U_n(1-p)}{b\pi_0^2 + c(\tau^{SP})^2} < 0. \tag{18}$$

Hence, the equilibrium level of new taxes is smaller than optimal.

In the rational expectations equilibrium, where the fiscal authority provides the best response to the public's inflation expectations, which in turn are based on the fiscal authority's reaction function, the fiscal authority cannot credibly raise taxes to the optimal level and therefore cannot effectively reduce the actual inflation rate with tax policy. Presumably, that is because the public rationally anticipates that some of the new taxes would lead to increased government spending meant to temporarily decrease the unemployment rate rather than to retirement of currency.

While the result appears similar to the standard Barro-Gordon result and, in fact, implies time inconsistency for the same reason, there is a crucial difference: agents would be expected to evaluate the trade-off between unemployment and inflation differently. Because here the new instrument is a tax, there will be relatively less weight placed on inflation because it is directly misery-inducing to use taxes to control inflation. In contrast, the tools available to control inflation with monetary policy—open market operations, reserve requirements, and interest on reserves—are either neutral or indirectly misery-

inducing to consumers. Consequently, the equilibrium level of inflation will be higher under an MMT regime than one where taxes are not the instrument because the cost of reducing inflation will be perceived as higher.

It is worth discussing further why there will exist an inflationary bias under a discretionary fiscal policy meant to control inflation. Relovsky (2004) identifies two reasons for this. First, the fiscal authority sees the possibility of greater revenue from inflation higher than expectations. Second, the public expects inflation to be greater than optimal, so it will respond accordingly.

We must alter these claims to our particular case. First, the revenue trade-off exists but is less clear in our situation. Since the fiscal authority is controlling inflation with direct taxation and the degree to which it does so trades off with seigniorage revenue, it is not clear whether there will be more or less revenue. However, in our situation that is not the most important point. Here, inflation is being controlled with taxation, something that the public does not like to pay and the fiscal authority does not like to levy. In this case, then, the primary reason to expect taxation to be too low to control inflation optimally is political.

As with monetary policy, our result suggests fiscal policy must be constrained with some Pareto-superior rule that brings the equilibrium rate of inflation to a lower level, something which will be discussed later.

A Graphical Illustration

In Figure 2, we graph the reaction function against the 45° line that gives what would occur if at every point expected inflation equaled actual inflation. As shown, there is only one solution where expected inflation equals actual inflation, i.e., where the reaction function intersects the 45° line. This also implies that there is only one solution where expectations are rational. Equilibrium inflation is given by the intersection:

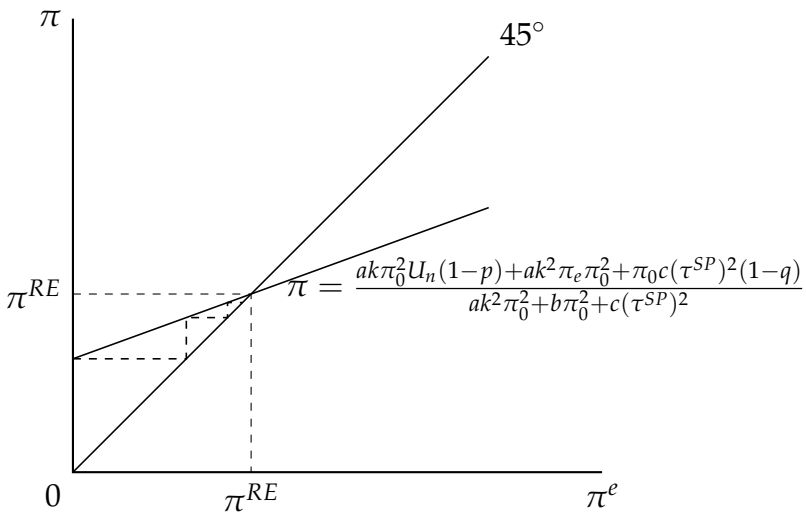

Figure 2: Determination of equilibrium inflation rate from reaction function.

Given the assumption of rational expectations, it is clear that on either side of the intersection, a pattern of progressively more accurate predictions prevails until, in the long run, expectations converge toward actual inflation at the intersection point. Due to the incentives facing the fiscal authority, we are more interested in the left-hand side of the intersection. As before, suppose the public expects the optimal inflation rate, zero, to prevail. This point represents the largest divergence between actual and expected inflation possible and is, therefore, the best position for the fiscal authority because it can extract the largest possible advantage at the margin. However, the George W. Bush adage holds for the public here: "fool me once, shame on you. Fool me—you can't get fooled again." Persistent divergences between actual and expected inflation cause the public to catch onto the fiscal authority's scheme, making their predictions progressively better until they finally converge.

A Comparison to Monetary Policy

Simple algebra reveals that using fiscal policy to control inflation yields an equilibrium inflation rate relative to monetary policy that may or may not be higher. If we solve

the model without taxes, so that it devolves to the original (simplified) Barro-Gordon model where the monetary authority chooses inflation with preferences over inflation and unemployment subject to a Phillips curve relation, we have the following problem:

$$\min_{\pi} \left\{ Z = a(U - pU_n)^2 + b(\pi)^2 : \; U = U_n - k(\pi - \pi^e) \right\} \tag{19}$$

Solving the model, the equilibrium inflation rate is

$$\pi_{eq} = \frac{ak}{b}\left(1 - p\right) U_n \tag{20}$$

We can compare this to the equilibrium inflation rate in the model with taxes:

$$\frac{ak\pi_0^2 U_n(1-p) + \pi_0 c(\tau^{SP})^2(1-q)}{b\pi_0^2 + c(\tau^{SP})^2} - \frac{ak}{b}\left(1 - p\right) U_n = \frac{c(\tau^{SP})^2\left(\pi_0(1-q) - \frac{ak}{b}(1-p)U_n\right)}{b\pi_0^2 + c(\tau^{SP})^2} \tag{21}$$

To simplify the discussion, set the parameters $a, b, c = 1$, so that the deciding factor is whether $\pi_0(1-q) - (1-p)U_n > 0$. What this amounts to saying is the following. In the situation where inflation is presently higher than optimal, if initial inflation times the externality on reducing inflation with taxes is greater than the natural rate of unemployment times the externality on unemployment, then the equilibrium inflation rate will be higher in the model where taxes are used as an instrument. What this amounts to is not surprising, since all it really tells us is that if agents hate taxes more than they hate unemployment, then the equilibrium rate will be higher in the taxes model.

2.3 Complicating the Model

We could further complicate the model in many ways, but the spirit of our result still would go through. For example, we assumed that the aggregate supply curve takes a backward L shape when it is more standard to assume an upward-sloping or doubly kinked aggregate supply curve. However, that would have little effect on the outcome of the model beyond slightly altering the calculations. This would introduce further complications and uncertainty by making it more difficult for the policymaker to determine when full employment has been reached, to what extent taxes would be necessary to reduce inflation, and so on.

It is possible to list many other complications. We could, for example, have assumed a more complicated form for preferences over unemployment, such as by allowing the planner to value some jobs more than others. Surely, this would have changed the calculations, at least superficially. Yet there is little reason to believe that these would alter the qualitative results. All that is necessary for time inconsistency is a trade-off between inflation and unemployment, a policymaker willing to make that trade-off, and some level of unemployment where a further decrease in unemployment will increase inflation.

It is also worth considering whether a politician could do better than a technocrat. Contrary to the complications mentioned above, using a choice model within the context of political competition could change the results. For example, a politician facing frequent elections may be forced to credibly commit to a low-inflation rate even if she has a higher discount rate than the technocrat. Even so, it would be reasonable to suppose that since politicians seeking reelection generally have higher discount rates than technocrats, the results of our model are generally the same except the inflation rate is even higher. A politician could, for example, increase the divergence between the desired unemployment rate and the natural rate by implementing more and longer unemployment insurance programs, thereby increasing the negative fiscal externality of unemployment.

On the other hand, it could be that all of the above results go through except the politician chooses to make any new taxes meant to lower the inflation rate redistributive by placing them entirely on the losing coalition. Any of these thoughts represent a fruitful avenue for further research.

2.4 Reasons to Prefer Unemployment Below U_n: A Brief Explanation

It is worth investigating, if only briefly, why we might have a desired unemployment lower than the natural rate so that $p < 1$, or a desired level of new taxes less than optimal so that $q < 1$. Let us begin with unemployment since that is the thornier issue. Following other economists, we could reasonably assume that the desired rate of unemployment is less than the natural rate because there is a fiscal externality associated with unemployment (White 1999, pp. 200-201). All else equal, higher rates of unemployment lead to higher tax bills for employed citizens who must pay to support the unemployment. Barro and Gordon (1983, p. 593-594) similarly argue that distortions emerge from fiscal decisions relating to unemployment compensation, taxation, etc. In any case, "given that some government expenditures are to be carried out, it will generally be infeasible to select a fiscal policy that avoids all distortions and yields $p = 1$."

No doubt, such an explanation will be unsatisfactory to an MMT economist. And so we argue that there are two further possible explanations, neither of which are mutually exclusive. First, it may be that unemployed workers could cause headaches for the fiscal authority through political unrest, and so the fiscal authority would attempt to keep unemployment lower than the natural rate to avoid this issue.[21] Second, unions could put pressure on the fiscal authority (or more realistically, the government) to reduce unemployment. and therefore drive the desired unemployment rate down. This pairs nicely

21. As we will discuss below, a jobs guarantee program could eliminate this problem. Of course, the problem is that this could increase the distortion associated with the first reason–the fiscal externality associated with unemployment.

with the fact that unions can increase the natural rate of unemployment and, in doing so, increase the gap between the desired and natural rate of unemployment.[22]

While we consider the empirical and theoretical evidence sufficient to justify $p < 1$, there has been some debate in the literature regarding whether that assumption is justified or even necessary to generate the result. For example, Blinder (1998) challenges the empirical validity of $p < 1$ since, in his view, bankers target the natural rate of unemployment in practice. McCallum (1997) argues that since central bankers understand that the Phillips curve is vertical in the long-run, they would not target an unobtainable goal. On the other hand, Ruge-Murcia (2003) and Cukierman and Gerlach (2003) have demonstrated that inflation bias can result even when $p = 1$. If, for instance, there is uncertainty in the economy and the central bank is more concerned about excessive unemployment than excessive overemployment, an inflation bias can result. Hence it is not strictly necessary for our model to have $p < 1$, but it does illustrate the result most clearly. Moreover, there is empirical evidence that central banks act as Barro and Gordon describe, as shown by Ireland (1999).

It is significantly simpler to justify $q < 1$. Fundamentally, people dislike taxes and they generally dislike taxes more than they dislike inflation. Another reason may be that there are positive externalities from a low rate of inflation where an individual member of the public would not want to bear the cost of paying for lower inflation, but she would want everyone else to. It is not difficult to see how this would translate into lower taxes than optimal as an outcome of the political process.

For our result to hold, it is only necessary that at least one of p or q is less than one, but we believe both are less than one for the reasons enumerated. Of course, one could always assume away any political economy tensions by assuming $p = q = 1$ and force politicians and citizens to be in perfect agreement. We do not take that approach.

22. Unions create unemployment by maintaining the real wage above its market-clearing level.

3 Why Not A Rules-Based Tax Policy?

Thus, a standard tool proposed by MMT economists to control inflation, tax policy, would ultimately fail in a discretionary setting. Of course, this applies to mainstream proposals to use contractionary fiscal policy during boom periods just as easily as it does to functional finance. What if the fiscal authority only wanted to impose taxes on particular sectors? The answer remains the same: discretionary tax policy to stop inflation *ultimately does not work.* In any case, it is time inconsistent; the form of the tax and who gets taxed is irrelevant.

The standard answer to a critique of this nature is that the monetary authority should impose a rule on itself so that it can credibly commit to an optimal rate of inflation (Taylor 2018). Other avenues for mitigating inflationary biases include using reputation (Backus and Driffill 1985) or establishing greater independence between the political authority and the monetary authority (Rogoff 1985).

Whereas time consistency under a discretionary monetary policy regime can be addressed with a strict rule, it is not clear whether a rule can be applied to fiscal policy because there are many other factors influencing taxation. Indeed, recent work has shown that even the most stringent of fiscal limitations fail to follow through on their promise (Eliason and Lutz 2018), while other results are more ambiguous (see, e.g., Fatas and Mihov (2006)). Since a prerequisite of functional finance is the idea that taxation should be used to influence the "social interest" (Lerner 1943; Forstater 2006) there will arise situations when social goals must be weighed against the prospect of inflation. If, for example, the rich are already taxed at what MMT has deemed to be the optimal redistributive rate and inflation is still a threat, then taxes would have to be raised on the poor. Even setting aside the problem of fiscal lags, it is not altogether clear how exactly taxes could be used to reduce inflation when the system is not lump-sum or flat. The array of indirect and

direct taxes, all interacting with each other, makes it exceedingly difficult to predict the quantity of dollars that could be raised and destroyed with a particular kind of tax increase. Moreover, central bank independence helps mitigate time inconsistency to some extent, but by definition, a fiscal policy controlled by politicians cannot use this solution.

MMT has offered one solution that provides both full employment and a strong degree of price stability without hindering discretionary fiscal policy: a jobs guarantee (Wray 1998b). Here, the government would give a job at a fixed wage to anyone willing to work at that wage, thereby eliminating involuntary unemployment. The size and average productivity of the jobs guarantee program would fluctuate countercyclically with the economy, getting larger and more productive during downturns and smaller and less productive during booms.[23] Importantly, it also stabilizes the price of one of the most important inputs in the economy, labor, and can, therefore, pair with taxation as a means of controlling inflation. Details of the program vary; MMT advocates equivocate about whether other safety net programs would be cut and what the specific jobs and benefits would be. In the most detailed proposal available, Tcherneva (2018) suggests following the New Deal model and doing public works projects such as restoring the environment, building gardens, building trails, and funding artist collectives.

The jobs guarantee can be conceived as a rule to push inflation and employment up, thereby avoiding deflationary spirals during a recession.[24] Since during recessionary periods workers laid off in the private sector can move into the jobs guarantee program, spending will be propped up and the unemployment rate would not drop as precipitously as it would otherwise. When the recession ends, workers can be attracted into the private sector with higher wages, but demand-side inflation from the private sector is not

23. See Tcherneva and Wray (2005) for a case study of a similar program in Argentina.

24. Indeed, Mitchell and Mosler (2001, p. 3) and Tcherneva (2012, p. 6) both refer to the jobs guarantee as a "price rule."

adequately controlled.[25] Thus, our results indicate the need for a second type of rule: to push inflation and employment *down*.

A possible strategy for reducing inflation is minimizing the gap between the desired rate and the natural rate of unemployment. Notice that in equation (16), the equilibrium inflation rate is determined by the gap between pU_n, the desired unemployment rate, and U_n.[26] As the divergence between desired unemployment and the natural rate of unemployment grows, the equilibrium inflation rate also grows. Reducing the fiscal externality created by unemployment reduces this gap and the equilibrium inflation rate. However, by increasing government sector employment, the jobs guarantee program inadvertently *increases* the fiscal externality associated with non-private sector employment, thereby increasing the equilibrium inflation rate and increasing the need for a rule.

This suggests one possible rule. The fiscal authority could be legislated to make the presumably quantifiable fiscal externality a certain size every year and decrease it at a decreed rate. That is, suppose in year i the size of the fiscal externality is $\$X$. The legal

25. Tcherneva (2012, p. 5-6) admits that

> "the ELR (jobs guarantee) program does not eliminate all sources of inflation. Demand-side inflation generated by the private sector (e.g., credit expansion, speculative investment in the housing market) or from other public sector programs (e.g., military spending, no-bid contracts), or cost-push inflation (e.g., from speculation in commodities, oil embargoes) are still problems to be reckoned with."

Mitchell and Wray (2005, p. 238) second this: "The ELR (jobs guarantee) pool still allows the economy to operate with higher aggregate demand and lower inflation pressures, although inflation can still result." Consequently, the jobs guarantee does not fully address the inflation bias problem; it may prevent excessive inflation or deflation, but some inflation will remain. Additionally, Aspromourgos (2000) and Sawyer (2003, p. 885-888) cite other inflationary issues associated with the jobs guarantee, specifically concerning excess money. Briefly, suppose a jobs guarantee is financed with high-powered money and employment is full. Then someone with an excess supply of cash balances resulting from persistent cash infusions, assuming it is not hoarded entirely, would increase the price level until her real demand for cash balances is restored. In effect, if the increase in HPM is greater than "what the public wishes to hold, it will spill over into increased spending," leading to inflationary pressures (p. 887).

26. It is also determined by the gap between desired new taxes and optimal new taxes. This is a more fundamental issue than a desired unemployment rate below the optimal rate; people simply do not like taxes. Consequently, there may be little the fiscal authority can do to avoid a slight inflation bias resulting from this fact unless she can alter the society's preference for inflation over taxes.

authority could impose a rule on the fiscal authority where, starting from the baseline of X, the fiscal authority would be required to reduce the externality associated with unemployment by $y\%$ per year. Such a policy would be credible and would plausibly result in a lower equilibrium rate of inflation. While this would be painful for some because it would require the gradual elimination of unemployment benefits, food stamps, and so on, the gradualness of the policy would allow the relevant parties to adequately prepare.

Another possibility would be to use some form of automatic taxes. That is, assuming some empirical regularity between inflation and taxation could be established, the fiscal authority could be required to increase taxes some dollar amount for every inflation point and reassess the relationship every 5 years. This would allow the fiscal authority to credibly lower the equilibrium inflation rate.

This is already in place, albeit in an unsophisticated and possibly deleterious form. A progressive income tax structure is an automatic stabilizer that allows for a greater quantity of taxes to be collected when incomes increase during a boom and for a smaller quantity when incomes decrease during a bust. The problem, according to Wray (2007, p. 16-18), is that the current structure of fiscal policy creates substantial "fiscal drag" by causing tax burdens to rise too rapidly. In the MMT paradigm, this creates nearly insurmountable headwinds against reaching full employment, especially when programs like the jobs guarantee are not employed. For that reason, various reforms could be enacted, e.g., indexing tax brackets to some inflation target, presumably the optimal rate. Because demand for inefficient automatic stabilizers may be high from the public for redistributive reasons, it may then be wise to either allow a technocratic body to establish fiscal rules to counteract the legislatures or to have strict constitutional provisions to that effect.[27]

Some MMT economists have proposed a different kind of rule. Rather than allowing

27. Where "inefficient" refers to those stabilizers that create “fiscal drag.”

a fiscal authority to attempt to change taxes in real-time, Fullwiler, Grey, and Tankus (2019) suggest that "varying tax rates and other inflation offsets should be included in the budgeting process from the outset." This has the merit of allowing the legislature to specifically target industries that may suffer from "low elasticity of output" and the types of consumers who may be inclined to spend more than others and thereby increase inflation disproportionately. Unfortunately, it still suffers from the discretionary problem and seeks to make decisions using a form of point prediction that simply is not possible.[28]

It would also be possible to establish a Bureau of Full Employment Affairs. This would be the fiscal equivalent of the independent monetary authority, a technocratic body with the sole task of ensuring price stability. The body would manage some special lump-sum (or whatever distortion-minimizing tax the legislature desires) tax independent from the regular tax system meant to control inflation. As with an independent central bank, an independent fiscal authority would present a possible solution to managing inflation at a lower rate, but more stringent rules may need to be enforced in this case because, as Wray (2014) points out, independent monetary authorities are rarely as independent as the textbooks prescribe.

Of course, other rules could be considered. Certainly, the MMT jobs guarantee proposal has merit and there are similarities between their ideas and the automatic stabilizer envisioned by economists like Thompson (1982), Glasner (1989), and Hendrickson (2018).[29] However, the proposal ultimately fails to address the inflationary bias discussed in this paper and identified by Tcherneva above. While there would surely not be excessive inflation or deflation in this narrow context, we are confident that, short of correct,

28. Indeed, the authors take the position that "we are not against one or more agencies being given additional tools to collectively manage demand on a discretionary basis" (Fullwiler, Grey, and Tankus 2019) yet this is precisely the problem we have identified.

29. Future research should identify the similarities and differences between these proposals and the MMT jobs guarantee proposal. This may present common ground for mainstream economists and the MMT orbit, allowing for further integration on other issues.

credible rules, using fiscal policy to reach the optimal inflation rate would be untenable.

4 A Progressive Research Discussion

We are confident that the proponents of MMT will be dissatisfied with our model. As we stated in the introduction, it is *not* a complete analysis of MMT and that is on purpose. So instead of rehashing our results, let us conclude by proposing one way forward for fruitful discussions on the topic of MMT. We are slow learners, slower than most of the profession, and it is difficult for us to properly understand MMT journal articles when the methods and modeling techniques they use are substantially different from what we work on every day. It is very much like taking an Aztec and dropping her in Madrid—broadly, everything is the same, but all details from the architecture to the language are worlds apart. No doubt, the paradigm shift engendered by MMT's rising status is similarly disorienting for mainstream economists when they attempt to engage with the literature.

Consequently, it would be useful for furthering the discussion between MMT and mainstream economics and for understanding if more MMT ideas could be expressed within mainstream models. Andolfatto (2018) has set a wonderful example on the topic of banking. As with this paper, that often means extracting a slice of MMT rather than the whole system.

But that requires something of mainstream economists as well: reading and discussing outside of our particular framework, having the patience to work on ideas that do not come as natural, and fairly reading those we have disagreements with. Because we believe that MMT has something to offer the economics profession, we think this presents a feasible path forward for mutual understanding.

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