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Japan's Liquidity Trap: Gesell Money and other Fool-Proof Solutions?

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Abstract

This paper studies the host of proposed 'fool-proof' solutions to spring the liquidity trap in Japan. In particular, the paper will concentrate on the use of Gesell Money and its associated taxes to overcome the zero-bound in nominal interest rates. Founded on a specially tailored variant of the Dornbusch-Mundell-Fleming Overshooting Model, it is thereby argued that Gesell Money and the recommendations found in the literature today can indeed spring the liquidity trap. Moreover, the paper will reconcile the various competing proposals and show that these proposals actually complement rather than contradict each other. However, this variant of the model will also show that whilst all of the solutions are necessary, it is nevertheless the macroeconomic structural reforms, in particular the formulation of the Taylor rule, that take precedence above all.

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1. Introduction

The liquidity trap is by no means a new phenomenon. Despite having been postulated by Keynes and Hicks as a theoretical possibility, the liquidity trap has always been regarded, until more recently, as a mere thought experiment. However, the liquidity trap made a comeback following Japan's collapse of the asset pricing bubble in the early 1990s, when the Japanese economy followed a slow but steady decline.

In view of the persistent economic malaise of Japan over the past two decades and assuming assuredly that the Bank of Japan (BOJ) and the preceding Japanese governments have already done their best in whatever they could have possibly done, it would be worthwhile to investigate other less conventional solutions for resolving the current economic predicament of Japan. Assuming in this case that conventional monetary and fiscal policies have already failed one possible but rather unconventional solution would be the use of Gesell Money.

The results of this paper has shown that Gesell Money, combined with a fixed exchange rate regime, appropriate currency controls as well as appropriate policy measures such as structural reforms and a different Taylor rule, can indeed spring the liquidity trap. It must be cautioned however that either a fixed exchange rate or a Gesell Money regime alone or together, cannot spring the liquidity trap. More specifically, structural changes in the macro-economy and in particular in the Taylor rule is the way forward. These conclusions were derived upon an analysis of a variant of the Dornbusch-Mundell-Fleming Overshooting Model. The model specifics will be discussed in due course in the following sections of this paper.

Much of the existing literature on springing the liquidity trap largely revolves around yen depreciation, fixed exchange rate regimes, expansionary monetary policies or attempts to change inflation expectations through a guided price path. Bernanke (1999) has pointed out, by using the IS-LM model, that massive reductions in consumption and investment have shifted the IS curve left, thereby reducing the real interest rate and proposes a significant yen depreciation to jump start the inflationary process. Fujiki *et al.* (2001) also takes a similar viewpoint that a yen depreciation can revitalise exports and thereby inflation and economic growth. McCallum (2001) goes one step further by proposing a policy rule that temporarily

makes exchange rate the instrument variable, rather than interest rate, which also calls for currency depreciation. Meltzer (2002) has also found, through an analysis of economic history, that a yen depreciation can also restore price stability to compensate for declining productivity.

McKinnon (2007) takes the view that a credible fixed exchange rate will stimulate consumption by the virtue of higher wages since employers no longer have to fear an appreciating yen in the future. Svensson (2000) has also approved of the usefulness of the fixed exchange rate regime and has also further proposed the use of a guided price path as a part of a larger inflation targeting framework aimed at changing the inflation expectations of the economic agents.

Eggertson (2001) on the other hand opines, using a Aggregate Supply (AS) equation and an IS or Euler equation which introduces short term interest rate, that the government should cooperate with the BOJ in indulging in a deficit spending policy to raise inflation. Krugman (1999) has also pointed out that expansionary fiscal policy is the conventional answer to the liquidity trap problem but he also admits that the fiscal policy can only be considered successful insomuch that the economy begins to recover from the stimulated private demand.

The use of the Dornbusch-Mundell-Fleming Overshooting Model in the analysis of the liquidity trap in the literature is rare. Similarly, little research effort has also been devoted to the prospective use of Gesell Money in springing a liquidity trap. Buiter (2001) deserves special mention in his use of the Overshooting Model with a modification that the existence of a floor for the instantaneous nominal interest rate is recognised in a Taylor rule. In order to overcome the floor, Buiter (2001) proposes that that the monetary authorities follow a rule for the nominal interest rate on money which ensures that the nominal interest rate on non-monetary securities is always above the own nominal interest rate on money. He has essentially spoken of Gesell Money.

Given all of the above competing policy propositions for springing a liquidity trap, this paper here will show that all of the abovementioned contrasting proposals can be reconciled. More precisely we will argue that all of the above plans are viable, necessary and even complement each other. However, we will also show, whilst these policies are important, they can only be implemented after the effecting changes to the larger economic structure.

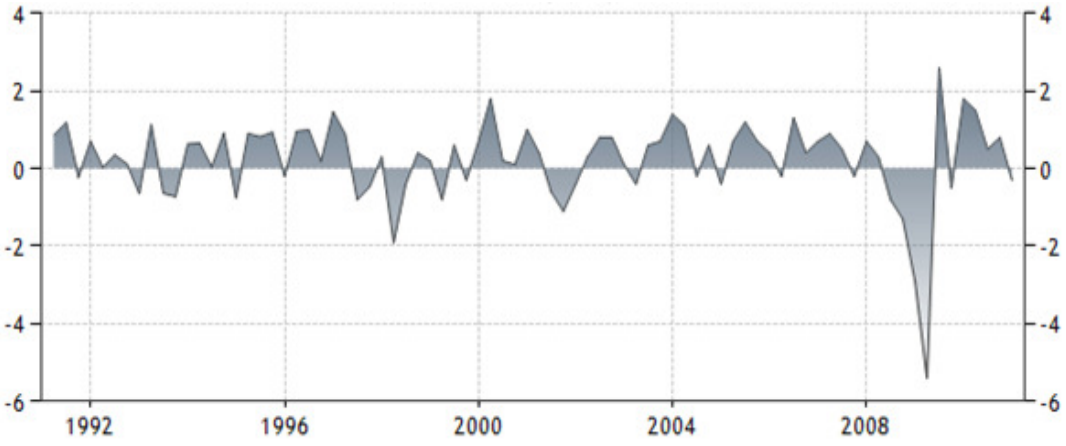
In this paper, we will first look into the current economic conditions in Japan, before proceeding to review the previously proposed solutions to Japan's economic woes. Thereafter the idea of Gesell Money will be briefly examined. We will then look into our variant of the Dornbusch-Mundell-Fleming Overshooting Model, solving for it and discussing the implications of the results. Following that, we will look into the theoretical usefulness of Gesell Money in accordance to the results of our investigation. We will also discuss how the BOJ could implement a Gesell Money regime as well as propose an appropriate exit strategy.

2. Current Economic Conditions in Japan

In the decades from the end of the Second World War right up to the last decade of the 20th century, Japan registered spectacular economic growth, eventually becoming the second largest economy in the world. However ever since the early 1990s, Japan has seen a deadly concoction of sluggish economic growth, rising unemployment and deflation shown in Figures 1, 2 and 3 respectively. In spite of the best efforts of the BOJ to stimulate aggregate demand and hence economic growth through the use of various instruments and policies cumulating in the famous 'zero- interest rate policy' in 1999, little has changed since.

Figure 1

Japan Annual GDP Growth Rate (Inflation Adjusted)



Source: TradingEconomics.com; Economics and Social Research Institute, Japan

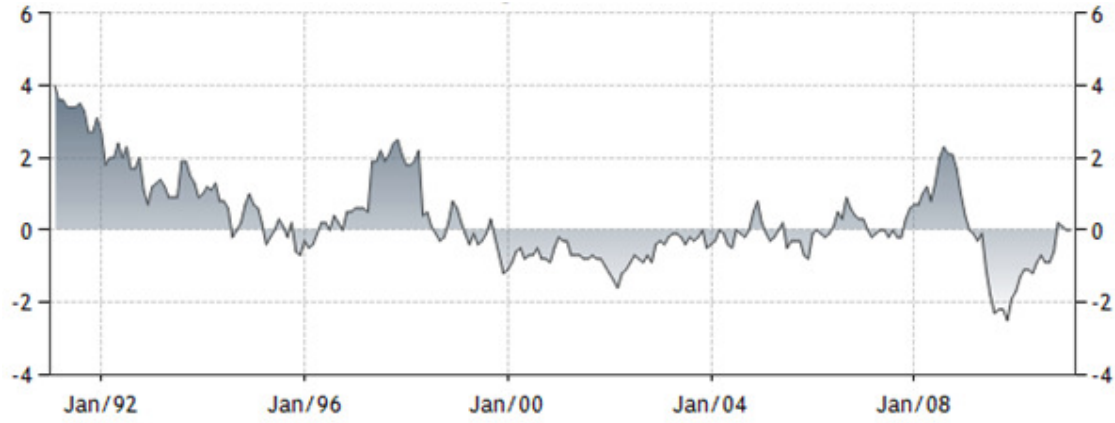
Figure 2

Japan Unemployment Rate (% of Labour Force)

Source: TradingEconomics.com; Ministry of Internal Affairs and Communications, Japan

Figure 3

Japan Inflation Rate: Rate of Change in CPI



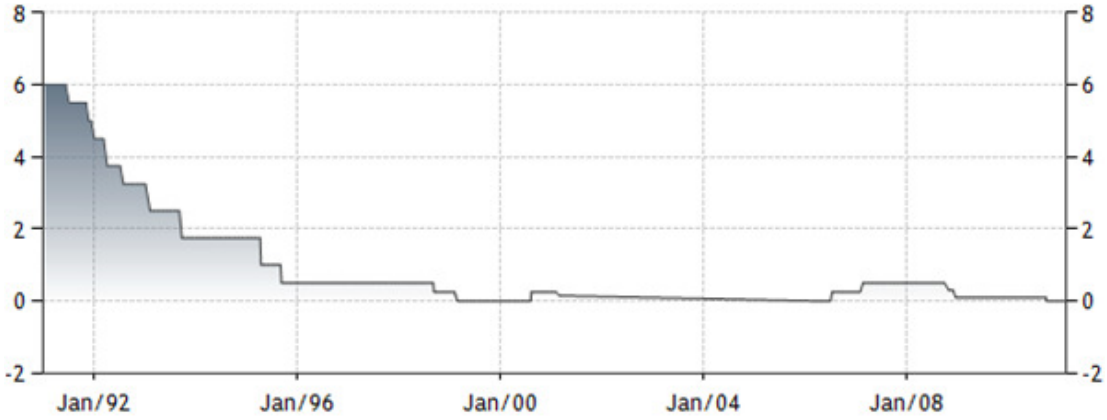
Source: TradingEconomics.com; Ministry of Internal Affairs and Communications, Japan

Today, even as this paper is in the works, Japanese interest rates have fallen so low that they approximate to zero, as seen in Figure 4. Under such conditions, bonds and cash become (almost) perfect substitutes. This is shown by the meagre increase in broad money supply with respective to the monetary base in Figure 5 and the relative flat yield curve for Japanese government bonds of various maturities in Figure 6 even though the government debt has spiralled. It appears that the Japanese people as a whole are content to hold cash and government bonds in spite of the increasing risk of default as the government debt continues

to increase and is projected to reach 234% of GDP by 2014, according to The Economist (2009).

Figure 4

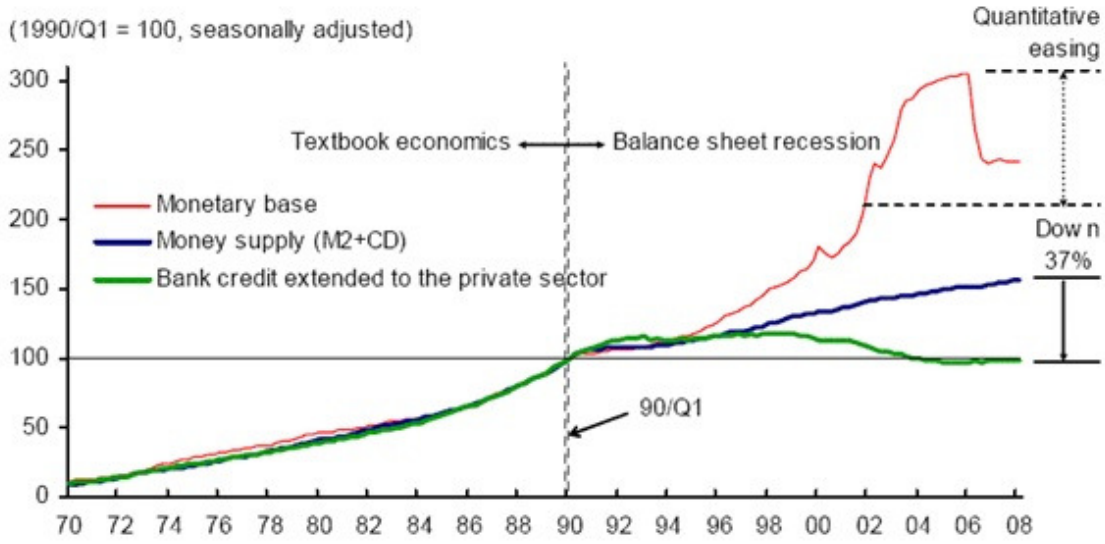
Japan Interest Rate: Benchmark Interest Rate



Source: TradingEconomics.com; Bank of Japan

Figure 5

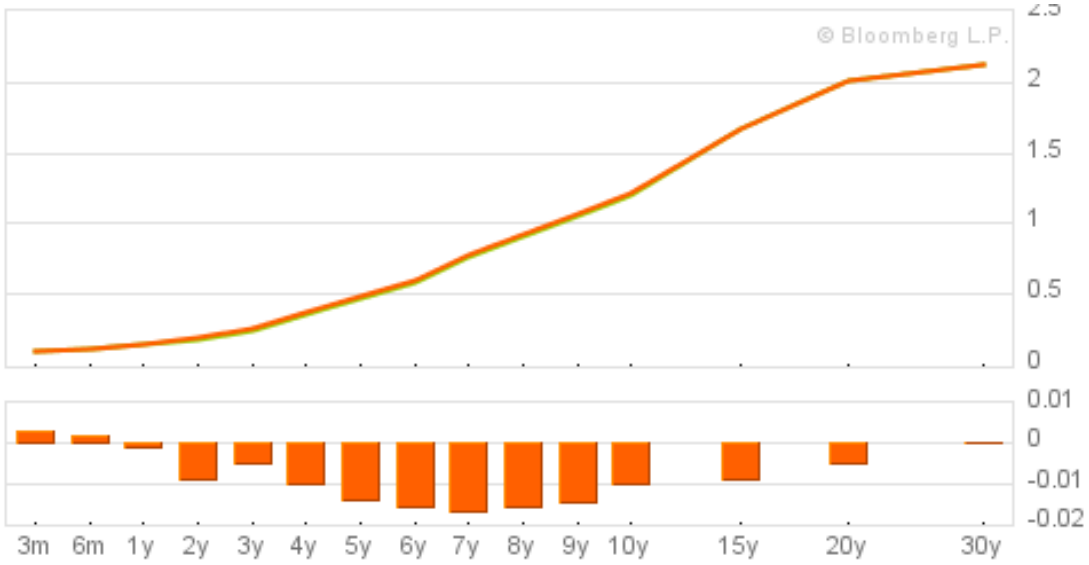
Japan Money Supply Trend



Source: Bank of Japan

Figure 6

Japan Yield Curves



Source: Bloomberg L.P.

This peculiar situation, in which Japan finds herself, is dubbed 'a liquidity trap'. A liquidity trap is a particular scenario in which monetary policy has no direct effect on aggregate spending since any change in money supply has no direct effect on the interest rates (Mishkin, 2007). More precisely, monetary policy has been rendered near-impotent in Japan.

Noteworthy is however, this notion of a 'liquidity trap' is still open to debate. More specifically, there is no convincing consensus among economists that Japan is indeed in a liquidity trap. While Krugman (1998), Krugman (1999), Eggertsson (2001) and Mckinnon (2007) argue that Japan has indeed fallen into a liquidity trap, other economists are more cautious or doubtful. Bernanke (1999) for instance, while believing that Japan is in a liquidity trap, does not consider monetary policy to be completely impotent. Hutchison (2000) on the other hand merely classifies Japan's current economic malaise as a 'credit crunch'. Buiter (2005) even went as far as to reject the idea of a 'liquidity trap', asserting that more still can be done by way of other transmission channels, since long term interest rates in Japan are still positive.

However, in spite of the divergence of views regarding Japan's current monetary situation, all economists agree that something needs to be done to extricate the Japanese economy from her current state. We will examine the proposed solutions in greater detail below.

3. Review of proposed solutions

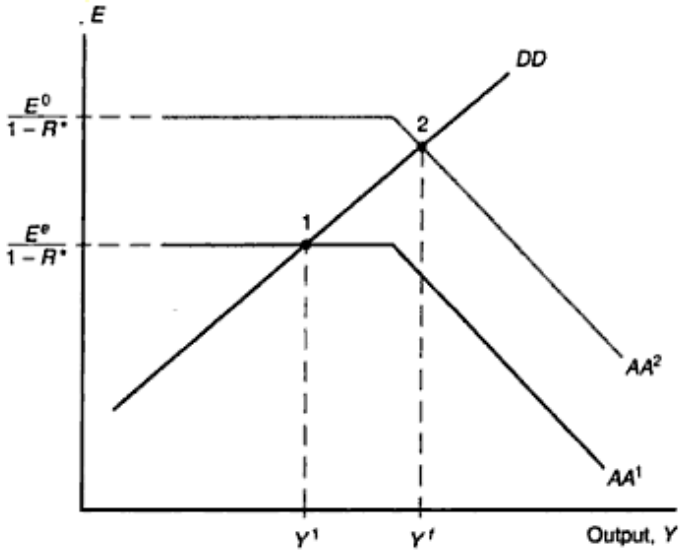
In order for Japan to 'kick start' the Japanese economy or 'spring the liquidity trap' as some economists would call it, a wide range of solutions have been proposed by various economists as potential remedies to Japan's current economic problems.

Bernanke (1999) proposed that the BOJ should try to achieve a drastic depreciation of the Yen by an increased issuance of money, thereby affecting prices. This view is also shared by Fujiki *et al.* (2001), who also assert that substantial intervention in the foreign exchange market can make the yen depreciate through portfolio rebalancing effects and expectations for the yen's depreciation, and thereby provoke a rise in the inflation rate. Fujiki *et al.* (2001) and Spiegel (2000) also postulate that exchange rate depreciation may raise the level of exports which in turn leads to increase in aggregate demand, raise real activity, and ultimately put upward pressure on the price level. McCallum (2001) also takes a similar view that that currency depreciation plays a role in springing the liquidity trap.

McKinnon (2007) takes this one step further by proposing that a credible fixed yen dollar rate, with the BOJ allowing domestic nominal interest rates to rise, would spring the liquidity trap. Svensson (2000) also sees the commitment to an exchange rate peg as an essential component to his 'price-level path targeting' framework. In fact, the textbook solution in form of the AA-DD model would be to fix the exchange rate at a certain depreciated value E^0, the changes in market expectations will shift the AA schedule upward; AA^1 moves to AA^2. Via the increase in nominal interest rate, the currency depreciation and the increase in output due to higher demand for Japanese goods; Y^1 increases to Y^f, Japan will be able to successfully disentangle itself from the liquidity trap and its current recession, as seen in Figure 7.

Figure 7

AA-DD Schedule



However, as Ito (2002) has pointed out, the BOJ has not been very successful to force a Yen depreciation through foreign exchange market interventions. Schwartz (2000) also argues that monetary authorities are unable to successfully intervene in foreign exchange markets to achieve target level rates. Hence, foreign exchange market interventions may not be a sufficient answer to Japan's problems.

According to Krugman (1999) "pump-priming" fiscal policy is the conventional answer to a liquidity trap. However for fiscal expansion to be successful, it must be able to sufficiently enhance private demand such that no further expansion is necessary. In addition, given the already high level of government debt, according to Meltzer (2001), the risk increased that the government would have to renege partially on its pension and healthcare promises and hence the public responded by increasing saving relative to GDP, offsetting part of the effect of fiscal stimulus. Thus expansionary fiscal policy has also failed to provide a satisfactory solution to Japan's woes, despite having already accumulated an astronomical level of government debt.

What is then left, given that the conventional solutions have failed? An interesting alternative to all of the above might be in Gesell money. Buiter and Panigirtzoglou (1999), Buiter (2001)

and Buiter (2005) have all proposed levying a tax on currency, as per Gesell money, as a way to spring the liquidity trap. The idea of using Gesell money will be further examined below.

4. Gesell Money

Silvio Gesell, was a little known quirk whom Keynes (1936) has consistently praised and upheld. According to Iigmann (2010), Gesell is best known as the first proponent of negative nominal interest rates and a handful of authors have taken up Gesell's idea of taxing money as a means of overcoming the zero bound on interest rates in the event of a liquidity trap, which renders monetary policy useless in fighting deflation and recession.

Blanc (2006) proposes that, given money has no carrying costs and general liquidity, a solution to hoarding, as a result of the liquidity trap, is to give money an artificial carrying cost, or a negative liquidity premium to facilitate circulation. Iigmann (2010) also agrees that as long as the money holders are able to store money without carrying costs, an increase in the amount of money alone is not able to boost effective demand.

Gesell (1958) proposes the circulation of *Freigeld* or free money for the specific purposes of placing aggregate demand under the same immediate constraint as supply is subject to. In order to do so, Gesell (1958) proposes the use of stamps on notes, the former of which have to be purchased in order render them valid. The purchase of stamps on those notes creates an artificial negative liquidity premium. It is thereby hoped that the negative liquidity premium will raise the velocity of circulation and encourage consumption.

Fukao (2004), Buiter and Panigirtzoglou (1999), Buiter (2001) and Buiter (2005), have all proposed its use, and have argued favourably for the use of Gesell money to spring the liquidity trap and restore economic growth. The success of this experiment has been seen particularly in Wörgl, a little town in Austria, in 1932-33 (Blanc, 2006). How useful will Gesell money be to Japan's problems will be discussed in the following sections.

5. The Model

The model that will be used here will be a modified version of the Dornbusch-Mundell-Fleming Overshooting Model. In this model, Dornbusch (1976) draws on the role of asset markets, capital mobility, rational expectations and the different adjustment speeds in goods and asset markets; exchange rates and asset markets are assumed to adjust more quickly than the goods market.

Since the focus is on short-run price dynamics, level of aggregate supply y^s is taken to be fixed to the long run level of output.

$$y^s = \bar{y} \tag{1}$$

Demand for domestic output y^d depends on the real exchange rate σ and the real domestic interest rate r.

$$y^d = \alpha\sigma - \beta r + g \tag{2}$$

Here g represents the level of government spending. In addition, $\sigma = s + p^* - p$ and that, $r = i - \pi$ where s is the natural log of the nominal exchange rate, p^* and p are foreign and domestic price levels respectively, i is the domestic nominal interest rate and π is the domestic rate of inflation. Note that s in this case refers to the quantity of domestic currency required to purchase a unit of foreign currency. α and β are constants and that $0 < \alpha < 1$ and $0 < \beta < 1$.

In the new expectations augmented Phillips Curve, inflation is determined by expected inflation and by the output gap. In our paper however, we will use instead the rate of accelerating inflation $\dot{\pi}$ which depends on the output gap and current inflation.

$$\dot{\pi} = \delta(y^d - y) + \tau\pi \tag{3}$$

δ and τ are constants and that $0 < \delta < 1$ and $\tau \in \mathbb{R}$.

In the original Dornbusch-Mundell-Fleming Overshooting Model, the asset market is represented by a LM money demand schedule. We believe however that the Taylor rule provides a better approximation of monetary policy and so this takes the place of the money demand schedule. The Taylor principle is embodied in the Taylor rule and according to Woodford (2003), the Taylor principle is a proposition that central banks can stabilize the macro-economy by adjusting their interest rate instrument more than one-for-one with inflation (or setting $x_1 > 0$ in our model).

$$r = x_0 + x_1(\pi - \hat{\pi}) + x_2\sigma \tag{4}$$

Here $\hat{\pi}$ represents the inflation rate target that the central bank should set. Note that the Taylor rule given here does not take into account output gap, since as we have assumed in (1) that $y^s = \bar{y}$ and thus the output gap plays no role in short-term rule setting. x_1 and x_2 are constants and that $x_1 \geq x_2$.[2]

Lastly, the Dornbusch-Mundell-Fleming Overshooting Model also assumes perfect international capital mobility thus satisfying the condition of Uncovered Interest Rate Parity.

$$r = r^* + \dot{\sigma} \tag{5}$$

Where r^* represents the foreign real interest rate and $\dot{\sigma}$ represents the rate of change of the real exchange rate.

Thus in our model the only endogenous variables are r and σ. The variables g and r^* are taken to be exogenous. Since the rest of the world is assumed to be free from the clutches of a liquidity trap $r^* > 0$.

[2] We assume that the Taylor rule gives priority to domestic price stability rather than an exchange rate target, thus justifying $x_1 \geq x_2$.

6. Deriving the Laws of Motion

To derive the Law of Motion for the rate of change of the real exchange rate $\dot{\sigma}$, we substitute (4) into (5).

$$\dot{\sigma} = r - r^* = x_0 + x_1(\pi - \hat{\pi}) + x_2\sigma - r^* \tag{6}$$

To derive the Law of Motion for the accelerating rate of inflation $\dot{\pi}$, we substitute (2) into (3).

$$\dot{\pi} = \delta(\alpha\sigma - \beta r + g - y) + \tau\pi \tag{7}$$

And substituting (4) into (7),

$$\dot{\pi} = \delta\{\alpha\sigma - \beta[x_0 + x_1(\pi - \hat{\pi}) + x_2\sigma] + g - y\} + \tau\pi$$

Here we arrive at a system of two equations with two unknowns given as

$$\begin{bmatrix}\dot{\sigma}\\ \dot{\pi}\end{bmatrix} = \begin{bmatrix}x_2 & x_1\\ \delta(\alpha - \beta x_2) & \tau - \delta\beta x_1\end{bmatrix}\begin{bmatrix}\sigma\\ \pi\end{bmatrix} + \begin{bmatrix}x_0 - x_1\hat{\pi} - r^*\\ -\delta\beta(x_0 - x_1\hat{\pi}) + \delta g - \delta y\end{bmatrix}$$

7. Solving for the Dynamics and the Steady State

With the purpose of solving for the dynamics of the aforementioned Laws of Motion for the real exchange rate and the accelerating rate of inflation, we employ the use of eigenvectors.

Let $A = \begin{bmatrix}x_2 & x_1\\ \delta(\alpha - \beta x_2) & \tau - \delta\beta x_1\end{bmatrix}$ and setting $A - zI = 0$, where I is an identity matrix, we find the following eigenvalues z_1 and z_2 for A :

$$z_1 = \frac{1}{2}[\, x_2 + \tau - \delta\beta x_1 - \sqrt{(x_2 + \tau - \delta\beta x_1)^2 + 4\alpha\delta x_1 - 4\tau x_2}\,]$$

$$z_2 = \frac{1}{2}[\, x_2 + \tau - \delta\beta x_1 + \sqrt{(x_2 + \tau - \delta\beta x_1)^2 + 4\alpha\delta x_1 - 4\tau x_2}\,]$$

To ensure that the model converges to a steady state, we require that $z_1 < 0$ and $z_2 > 0$ and hence:

$$x_2 + \tau - \delta\beta x_1 < \sqrt{(x_2 + \tau - \delta\beta x_1)^2 + 4\alpha\delta x_1 - 4\tau x_2}$$
$$\tau < \alpha\delta\frac{x_1}{x_2}$$

This sets the limit for τ in terms of the other constants for the model to be viable.
In order to find the eigenvectors, we set $(A - z_1 I)\mathbf{v} = \mathbf{0}$ and $(A - z_2 I)\mathbf{v} = \mathbf{0}$. We have

$$\mathbf{v}_1 = \begin{bmatrix} \dfrac{x_2 + \beta\delta x_1 - \tau - \sqrt{(x_2 + \tau - \beta\delta x_1)^2 + 4\alpha\delta x_1 - 4\tau x_2}}{2\delta(\alpha - \beta x_2)} \\ 1 \end{bmatrix}$$
$$\mathbf{v}_2 = \begin{bmatrix} \dfrac{x_2 + \beta\delta x_1 - \tau + \sqrt{(x_2 + \tau - \beta\delta x_1)^2 + 4\alpha\delta x_1 - 4\tau x_2}}{2\delta(\alpha - \beta x_2)} \\ 1 \end{bmatrix}$$

Using the eigenvectors and eigenvalues, we can hereby derive the law of motion for the endogenous state variables,

$$\begin{bmatrix} \sigma' \\ \pi' \end{bmatrix} = k_1\mathbf{v_1}\mathbf{e}^{-\mathbf{z_1}A} + k_2\mathbf{v_2}\mathbf{e}^{-\mathbf{z_2}A} + A^{-\mathbf{1}}\begin{bmatrix} x_0 - x_1\hat{\pi} - r^* \\ -\delta\beta(x_0 - x_1\hat{\pi}) + \delta g - \delta y \end{bmatrix}$$

Where k_1 and k_2 are constants and that k_1 and $k_2 \in \mathbb{R}$.

We now proceed to find the steady state conditions for our model. By setting $\begin{bmatrix} \dot{\sigma} \\ \dot{\pi} \end{bmatrix} = \mathbf{0}$,

$$\begin{bmatrix} \sigma \\ \pi \end{bmatrix} = \begin{bmatrix} \dfrac{(\delta\beta x_1 - \tau)r^* + \tau(x_0 - x_1\hat{\pi}) + \delta x_1(y - g)}{\alpha\delta x_1 - \tau x_2} \\ \dfrac{\delta[\alpha(r^* - x_0 + x_1\hat{\pi}) + x_2(g - \beta r^* - y)]}{\alpha\delta x_1 - \tau x_2} \end{bmatrix}$$

According to the steady state conditions, the real exchange rate depends positively on foreign real interest rate r^* and output y but negatively on inflation target $\hat{\pi}$ and government spending g. On the other hand, the rate of inflation depends positively on the inflation target $\hat{\pi}$ and government spending g but negatively on foreign real interest rate r^* and output y. An analysis of the steady state and the implications for the conduct of monetary policy will be further elaborated in the following sections.

8. Analysis of the Steady State

In order to better understand the steady state, we require the first order derivatives of σ and π with respect to the other constants and variables present in the steady state conditions. Thereafter we will proceed to interpret the results of the first order conditions and their possible implications for our model.

Since it is already previously established that $\tau < \alpha\delta\frac{x_1}{x_2}$, this implies that the term $\alpha\delta x_1 - \tau x_2$ is always positive. Also, we require a positive steady inflation rate, implying that $\pi > 0$,[3] which in turn signifies that the term $\delta[\alpha(r^* - x_0 + x_1\hat{\pi}) + x_2(g - \beta r^* - y)] > 0$. In addition, σ can take any real value.

8.1. The Parameters of Aggregate Demand for Domestic Output

Differentiating with respect to α, where α reflects the importance of foreign demand for domestic output and domestic demand for foreign goods:

$$\frac{\partial\sigma}{\partial\alpha} = -\frac{\delta x_1[(\delta\beta x_1 - \tau)r^* + \tau(x_0 - x_1\hat{\pi}) + \delta x_1(y - g)]}{(\alpha\delta x_1 - \tau x_2)^2} = -\frac{\delta x_1\sigma}{\alpha\delta x_1 - \tau x_2}$$

$$\frac{\partial\pi}{\partial\alpha} = \frac{\delta(r^* - x_0 + x_1\hat{\pi})(\alpha\delta x_1 - \tau x_2) - \delta^2 x_1[\alpha(r^* - x_0 + x_1\hat{\pi}) + x_2(g - \beta r^* - y)]}{(\alpha\delta x_1 - \tau x_2)^2}$$

$$= \frac{\delta}{\alpha\delta x_1 - \tau x_2}[r^* - (x_0 + x_1\pi - x_1\hat{\pi})]$$

[3] We do not take into account that the rate of inflation could also be negative, even though the BOJ could possibly desire a guided price path consisting of a series of decreasingly negative rates of inflation.

The steady state real exchange rate changes negatively with α if and only if $\sigma > 0$. The steady state rate of inflation on the other hand changes positively with α provided that $x_1 < \frac{r^* - x_0}{\pi - \hat{\pi}}$.[4]

If α increases whilst $\sigma > 0$, or when there is high foreign demand and a high domestic demand for domestic production due to an undervalued (strong) domestic currency, domestic inflation increases as a result. Hence, according to Uncovered Interest Parity (UIP) as given in (5), the real exchange rate must decrease due to the increasing price level *ceteris paribus*. On the other hand, when $\sigma < 0$, or when the currency is overvalued (weak), foreign demand and domestic demand, the latter through the import substitution effect, for domestic output must decline. Hence if α increases in this case, deflation occurs. Under UIP, deflation has the effect of increasing the real exchange rate since the domestic price level declines, with everything else constant.

Differentiating with respect to β, where β represents the significance of domestic demand for domestic output:

$$\frac{\partial \sigma}{\partial \beta} = \frac{\delta x_1 r^*}{\alpha \delta x_1 - \tau x_2}$$

$$\frac{\partial \pi}{\partial \beta} = -\frac{\delta x_2 r^*}{\alpha \delta x_1 - \tau x_2}$$

The real exchange rate changes positively with β. Inflation on the other hand, changes negatively with β. However note also that in the case of $x_2 = 0$ then $\frac{\partial \pi}{\partial \beta} = 0$; the parameter β can no longer influence inflation.

Domestic aggregate demand is negatively related to nominal interest rates; high nominal rates of interest and consequently high real interest rates constraint investment and hence reduce domestic aggregate demand. As β increases for a given real rate of interest, reflecting the

[4] Using a *reductio ad absurdum* argument, suppose if $\sigma > 0$ but $x_1 > \frac{r^* - x_0}{\pi - \hat{\pi}}$, if σ increases, domestic aggregate demand increases, hence resulting in inflation acceleration via the Phillips curve, and hence rate of inflation must also increase. Otherwise the Phillips curve cannot hold. Thus $\sigma > 0$ and $x_1 < \frac{r^* - x_0}{\pi - \hat{\pi}}$ must be simultaneously true.

greater sensitivity of domestic demand for domestic output, the demand for domestic output declines *ceteris paribus*. Deflation then takes place and under UIP, the real exchange rate will increase by virtue of a declining price domestic price level.

Differentiating with respect to g, where g represents the level of government spending:

$$\frac{\partial \sigma}{\partial g} = -\frac{\delta x_1}{\alpha \delta x_1 - \tau x_2}$$

$$\frac{\partial \pi}{\partial g} = \frac{\delta x_2}{\alpha \delta x_1 - \tau x_2}$$

The real exchange rate is negatively related to the level of government expenditures. Inflation on the other hand, is positively related to government spending. Note however that in the case of $x_2 = 0$ then $\frac{\partial \pi}{\partial g} = 0$; the government expenditure parameter has no effect on inflation.

Increased government spending has the consequence of creating inflation by increasing domestic aggregate demand for domestic output. Since the output is fixed, an increased domestic aggregate demand implies that increased inflation is the logical consequence. Under UIP, increased inflation leads to lower real interest rates and hence the real exchange rate must decrease by the virtue of increased domestic price level.

8.2. The Parameters of Expectations Augmented Phillips Curve

Differentiating with respect to δ, where δ implies significance of output dynamics on inflation dynamics which in turn depends on nominal rigidities such as the level of price stickiness:

$$\frac{\partial \sigma}{\partial \delta} = \frac{(\alpha \delta x_1 - \tau x_2)(\beta x_1 r^* + x_1 y) - \alpha x_1[(\delta \beta x_1 - \tau) r^* + \tau(x_0 - x_1 \hat{\pi}) + \delta x_1 (y - g)]}{(\alpha \delta x_1 - \tau x_2)^2}$$

$$= \frac{x_1}{\alpha \delta x_1 - \tau x_2}(\beta r^* + y - \alpha \sigma)$$

$$\frac{\partial \pi}{\partial \delta}$$

$$= \frac{(\alpha\delta x_1 - \tau x_2)[\alpha(r^* - x_0 + x_1\hat{\pi}) + x_2(g - \beta r^* - y)] - \alpha x_1 \delta[\alpha(r^* - x_0 + x_1\hat{\pi}) + x_2(g - \beta r^* - y)]}{(\alpha\delta x_1 - \tau x_2)^2}$$

$$= \pi(\frac{1}{\delta} - \frac{\alpha x_1}{\alpha\delta x_1 - \tau x_2})$$

The real exchange rate changes positively with δ provided that $\beta r^* + y > \alpha\sigma$. Inflation changes negatively with δ provided that $\tau > 0$.[5] A peculiarity to note here is that when $x_2 = 0$, then $\frac{\partial \pi}{\partial \delta} = 0$; inflation is no longer dependent on the output gap.

Hence as δ increases *ceteris paribus*, inflation also increases. Assuming that $\beta r^* + y > \alpha\sigma$, the domestic currency is overvalued (weak) for all other factors constant. Hence the foreign demand component for domestic output declines due to the comparatively more expensive domestic goods. Demand for domestic output thus declines *ceteris paribus*. A low demand for domestic output will lead to increased deflation as δ increases which in turn results in an increasing real exchange rate under UIP due to a rising real interest rate as the domestic price level declines. On the other hand when $\beta r^* + y < \alpha\sigma$, the currency is undervalued (strong). The foreign demand component for domestic output hence increases due to the comparatively less expensive domestic products. This increased demand for domestic output feeds inflation expectations, which results in even greater inflation should δ increase as well, resulting in declining real interest rates and hence real exchange rate declines as the domestic price level increases *ceteris paribus*.

Differentiating with respect to τ, where τ represents the significance of current inflation on inflation dynamics:

$$\frac{\partial \sigma}{\partial \tau} = \frac{(\alpha\delta x_1 - \tau x_2)(x_0 - x_1\hat{\pi}) + x_2[(\delta\beta x_1 - \tau)r^* + \tau(x_0 - x_1\hat{\pi}) + \delta x_1(y - g)]}{(\alpha\delta x_1 - \tau x_2)^2}$$

$$= \frac{1}{\alpha\delta x_1 - \tau x_2}(x_0 - x_1\hat{\pi} + x_2\sigma)$$

[5] By applying a *reductio ad absurdum* argument, one can easily see that when $\beta r^* + y > \alpha\sigma$, $\tau > 0$ must be both true at the same time. If $\beta r^* + y > \alpha\sigma$ but $\tau < 0$, real exchange rate changes positively with ∂ but inflation changes positively with ∂, then UIP cannot hold. Therefore $\beta r^* + y > \alpha\sigma$ and $\tau > 0$ must be true at the same time *ceteris paribus.*

$$\frac{\partial \pi}{\partial \tau} = \frac{x_2 \delta[\alpha(r^* - x_0 + x_1\hat{\pi}) + x_2(g - \beta r^* - y)]}{(\alpha\delta x_1 - \tau x_2)^2} = \frac{x_2 \pi}{\alpha\delta x_1 - \tau x_2}$$

The real exchange rate changes negatively with τ provided that $x_0 + x_2\sigma < x_1\hat{\pi}$. Inflation changes positively with τ.[6] However note also that in the case of $x_2 = 0$ then $\frac{\partial \pi}{\partial \tau} = 0$; the parameter τ can no longer influence inflation.

In the case that $x_0 + x_2\sigma > x_1\hat{\pi}$ for any given rate of inflation implies that the nominal interest rate and hence the real interest rate must be higher than in the case that $x_0 + x_2\sigma < x_1\hat{\pi}$ *ceteris paribus*. A higher real rate of interest leads to credit rationing and hence reduces domestic demand for domestic output. At this point, a certain given increase in τ cannot offset the shrinking output gap and hence deflation subsequently occurs. Under UIP this leads to an increase in the real exchange rate. In the case however that $x_0 + x_2\sigma < x_1\hat{\pi}$, domestic demand for domestic output is higher than in the aforementioned case since the real interest rate is lower. Thus, the same given increase in τ results in greater inflation acceleration and under UIP, the real exchange rate must decrease.

An increase in τ *ceteris paribus* implies that economic actors place a greater emphasis on present inflation when forming inflation forecasts. Hence the rate of accelerating inflation increases according to the Phillips Curve given in (3) and consequently inflation also increases.

8.3. The Parameters of the Taylor Rule

Differentiating with respect to x_0:

$$\frac{\partial \sigma}{\partial x_0} = \frac{\tau}{\alpha\delta x_1 - \tau x_2}$$

$$\frac{\partial \pi}{\partial x_0} = -\frac{\alpha\delta}{\alpha\delta x_1 - \tau x_2}$$

[6] By means of a *reductio ad absurdum* argument, one can see that $x_0 + x_2\sigma < x_1\hat{\pi}$ and $\pi > 0$ must be simultaneously true. Suppose if $x_0 + x_2\sigma < x_1\hat{\pi}$ and instead $\pi < 0$, the real exchange rate and rate of inflation both change negatively with τ. When this happens, UIP is violated, and hence $x_0 + x_2\sigma < x_1\hat{\pi}$ and $\pi > 0$ must be true at the same time *ceteris paribus.*

The real exchange rate changes positively with x_0 provided that $\tau > 0$ but the rate of inflation changes negatively with x_0.

Differentiating with respect to x_1, where x_1 represents the significance of the inflation target in monetary policy:

$$\frac{\partial \sigma}{\partial x_1} = \frac{(\alpha\delta x_1 - \tau x_2)[\delta(\beta r^* + y - g) - \tau\hat{\pi}] - \alpha\delta[(\delta\beta x_1 - \tau)r^* + \tau(x_0 - x_1\hat{\pi}) + \delta x_1(y - g)]}{(\alpha\delta x_1 - \tau x_2)^2}$$

$$= \frac{1}{\alpha\delta x_1 - \tau x_2}[\delta(\beta r^* + y - g) - \tau\hat{\pi} - \alpha\sigma]$$

$$\frac{\partial \pi}{\partial x_1} = \frac{\alpha\delta\hat{\pi}(\alpha\delta x_1 - \tau x_2) - \alpha\delta^2[\alpha(r^* - x_0 + x_1\hat{\pi}) + x_2(g - \beta r^* - y)]}{(\alpha\delta x_1 - \tau x_2)^2} = \frac{\alpha\delta}{\alpha\delta x_1 - \tau x_2}(\hat{\pi} - \pi)$$

The real exchange rate changes positively with x_1 provided that $\delta(\beta r^* + y - g) - \tau\hat{\pi} > \alpha\sigma$. The rate of inflation changes positively with x_1 since we have previously assumed $\hat{\pi} > \pi$.

Differentiating with respect to x_2, where x_2 represents the significance of the exchange rate target in monetary policy:

$$\frac{\partial \sigma}{\partial x_2} = \frac{\tau[(\delta\beta x_1 - \tau)r^* + \tau(x_0 - x_1\hat{\pi}) + \delta x_1(y - g)]}{(\alpha\delta x_1 - \tau x_2)^2} = \frac{\tau\sigma}{\alpha\delta x_1 - \tau x_2}$$

$$\frac{\partial \pi}{\partial x_2} = \frac{(\alpha\delta x_1 - \tau x_2)(g - \beta r^* - y) - \tau\delta[\alpha(r^* - x_0 + x_1\hat{\pi}) + x_2(g - \beta r^* - y)]}{(\alpha\delta x_1 - \tau x_2)^2}$$

$$= \frac{1}{\alpha\delta x_1 - \tau x_2}(g - \beta r^* - y - \tau\pi)$$

The real exchange rate changes positively with x_2 as the domestic currency depreciates if $\tau > 0$ and further given if $\sigma > 0$. The rate of inflation on the other hand changes negatively with x_2, since $g - \beta r^* - y - \tau\pi < 0$ as $g < y$.

Differentiating with respect to $\hat{\pi}$, where $\hat{\pi}$ is the targeted level of inflation:

$$\frac{\partial \sigma}{\partial \hat{\pi}} = -\frac{\tau x_1}{\alpha\delta x_1 - \tau x_2}$$

$$\frac{\partial \pi}{\partial \hat{\pi}} = \frac{\alpha \delta x_1}{\alpha \delta x_1 - \tau x_2}$$

The real exchange rate changes negatively with $\hat{\pi}$ since we have assumed beforehand that $\tau > 0$. The rate of inflation however changes positively with $\hat{\pi}$.

A higher targeted rate of inflation $\hat{\pi}$ according to the Taylor rule would imply that the central bank would need to reduce the nominal interest rate so as to reduce real interest rate r *ceteris paribus*. The reduced real interest rate will lead to a drop in the real exchange rate as given under UIP. The reduced real rate of interest also has the effect of stimulating domestic demand for domestic output. This has the effect of accelerating inflation through the expectations channel as expressed in the Phillips Curve in (3).

8.4. The Curious Case of $x_2 = 0$

At this point, it would be useful to address the curious question when $x_2 = 0$ and the consequences that arise thereof. When $x_2 = 0$, the real exchange rate has no influence on the Taylor rule and on the conduct of monetary policy. However, this particular case has also far-reaching consequences for our model. Noting that when $x_2 = 0$ then $\frac{\partial \pi}{\partial \beta} = 0, \frac{\partial \pi}{\partial \delta} = 0, \frac{\partial \pi}{\partial \tau} = 0$ and $\frac{\partial \pi}{\partial g} = 0$, without an exchange rate target in the Taylor rule, the level of domestic consumption, the Phillips Curve and fiscal policies will no longer have any impact on domestic inflation.

In other words, it would appear that by giving up a real exchange rate target, the monetary authorities and the government lose the ability to create inflation through the above mentioned parameters. Hence it is vital that a minimal exchange rate target should also be set.

9. Implications for Policymaking

The conclusions that we have derived from our variant of the Dornbusch-Mundell-Fleming Overshooting Model carries repercussions for macroeconomic policy making. We

will further discuss the results derived from the section above and their possible consequences on monetary, fiscal, structural and exchange rate policies.

9.1. Monetary Policy

From (4), or the Taylor rule, the results of the last section indicate ideally that x_0 should be small, x_1 should be large and x_2 should be small, but not zero, so as to stimulate inflation. Noting when $x_2 = 0$ the monetary authorities will no longer be able to influence the steady state rate of inflation through government spending, the Phillips Curve and the domestic component of domestic aggregate demand. Furthermore, the targeted rate of inflation $\hat{\pi}$ should ideally be set such that $x_0 + x_2\sigma < x_1\hat{\pi}$ in order for accelerating inflation to occur. These findings also correspond to the Taylor rule estimates of Ito (2010), who has found that the Taylor rule for BOJ has no exchange rate target, which in turn partially explains for the failure of BOJ's monetary policies.

This in turn implies that the Taylor rule of the BOJ should rightfully give priority to the inflation rate target rather than an exchange rate target. If the BOJ increases the target rate of inflation $\hat{\pi}$ *ceteris paribus*, real interest rate must decline by virtue of lowering the nominal interest rates on the part of BOJ, according to the Taylor rule in (4). In the unique case of Japan, real interest rates remain nevertheless positive because the 0% nominal interest rate is seen as a binding floor. The BOJ cannot bring nominal interest rates lower than 0% as much as it would have liked to, in face of stubborn deflation, in order to achieve its desired inflation rate. As we will see in the next section, the circulation of Gesell money could help alleviate this problem and surmount this perceivably binding nominal interest rate floor.

9.2. Fiscal Policy 'Pump-Priming'

As mentioned in the previous section, government spending has the ability to enhance inflation by increasing domestic aggregate demand for domestic output. Hence in order to spring the liquidity trap, government expenditure should not be reduced, but increased instead. However, since the fiscal expansion would contribute to a decline in the real exchange rate by the increase in domestic price level, it would be wise to fix an exchange rate at which the yen will be strong, so as to offset the negative effects on inflation through the channel of the declining real exchange rate. The exchange rate policy will be further discussed below.

However, it has been previously pointed out that greater government spending has failed to stimulate sufficient private demand to spring the liquidity trap, despite having already accumulated an astronomical debt. Meltzer (2001) notes that much of the fiscal expansion was directed towards costly public works with only marginal contribution to economic productivity in general instead of investing in projects which could result in higher future incomes to pay for pension and healthcare liabilities. Naturally when the people would not believe that the government will fulfil their promises in the future, they will continue to save rather than spend, thereby contributing to a deflation spiral. Instead Meltzer (2001) believes that the same amount government spending in form of tax cuts would be possibly more useful in spurring domestic consumption.

Even though a higher level of government expenditure can definitely contribute to the creation of inflation, it is also however important to make clear at this point that this option is not on the table for Japanese policy makers. The burgeoning level of debt that the government has already amassed over two decades of failed expansionary policies will rule out further deficit spending as a viable policy choice.

9.3. Structural Policies

Given that the rate of inflation changes positively with α when $\sigma > 0$ but negatively with β, the implication here is that demand for domestic output should be chiefly foreign whilst domestic demand should be minimised as far as possible. This allows the importing of inflation by increasing the relative importance of foreign demand for domestic output and domestic demand for foreign output.

For this to be achieved, the economy will need to re-orient its output from mainly satisfying domestic demand to export demand instead. This is done so as to increase α. For example, much of the domestic demand for output currently takes the form of consuming overly sophisticated electronic products tailored to the very specific needs of the domestic consumer that could not be sold anywhere else in the world. In order to minimise the domestic demand component for domestic output, production should be increasingly devoted to satisfying the demand for exported goods. The increase in α will allow inflation to be imported from the demand of foreign economic agents. This further raises the steady state level on inflation.

In addition, it is also worthwhile to mention that a Gesell Money regime also strives for a negative real interest rate. In this case, it would be useful if β were to be increased significantly as well so that inflation will also be given a boost when $r < 0$ by the channel of domestic consumption. One way to effect this structural change would be through an expansionary fiscal policy through reduced taxes, as pointed out earlier, which in turn encourages domestic consumption of domestic output. This also resolves the problem of demand side deficiency that Bernanke (1999) has previously spoken of.

9.4. Exchange Rate Policy

As given earlier in an earlier section, there arises a question of an appropriate exchange rate policy or regime and its usefulness. We shall attempt to address this question by referring to UIP, both real and nominal.

From the results of the earlier section, it would appear that a high real exchange rate or a strong yen is desirable as a way to stimulate inflation via the channel of foreign demand for domestic output; the real exchange rate needs to be positive. Given that $\sigma = s + p^* - p$, it is desirable that the nominal exchange rate s be pegged at a high level such that $s + p^* - p > 0$ in the short run. In this way, the changes in the nominal interest rate will not affect the nominal exchange rate. The change in the real exchange rate will arise from the changes in the domestic price level. The fixed exchange rate regime is extremely important since

$$i = i^* + \dot{s} \tag{8}$$

This equation implies that changes in the nominal exchange rate s can occur as a consequence of changes in the domestic nominal interest rate i. Hence when the nominal interest rate changes, the real exchange rate changes due to the change in the nominal exchange rate rather than the changes in the domestic price level, the latter of which is what policy makers should be aiming for.

Since policy makers can only control nominal variables, this relation will become defining for the purposes of this paper. The usefulness of this equation will be further illustrated in the following section. In addition, defending a strong currency is easier than defending a weak

one. For the former case, the central bank merely has to purchase foreign assets by printing more domestic currency, which is in essence, limitless.

9.5. Gesell Money - A Foolproof Method?

The given law of motion for the endogenous state variables and the steady state conditions also send an important message to policymakers. More precisely, policymakers cannot hope to raise the steady state levels of inflation by merely forcing exchange rate depreciation alone, implementing Gesell Money alone or both alone *ceteris paribus*. Any attempt to do so will only result in convergence to the unchanged steady state in the long-run according to the law of motion for the endogenous state variables. This conclusion stands in stark contrast to that espoused by Buiter and Panigirtzoglou (1999), Buiter (2001) and Fukao (2004) in which a Gesell Money regime is seen as a solution to all of Japan's woes without effecting broader structural changes. Our conclusion also contrasts that of McCallum (2001), Mckinnon (2007), Mckinnon and Ohno (2000) Meltzer (2002), Svensson (2000) who only mentioned the use of an exchange peg and a guided price path as a way to spring the liquidity trap.

The only way to raise the steady states of inflation is to effect the above mentioned structural changes, in particular to rethink the parameters in the Taylor rule and to raise the target rate of inflation. Bernanke (1999) further lends credence to this conclusion in highlighting the existence of an aggregate demand deficiency. This entails addressing the structural problems in the broader macro-economy, as we have also concluded. Eggertson (2001) also proposed deficit spending as a way to spring the trap as predicted in the model. Otherwise, any changes in the conduct of exchange rate and monetary policies will only come to nought.

10. The Use of Gesell Money

The policy recommendations discussed in the earlier section has allowed us to understand the necessary pre-requisites for a Gesell Money regime. This in turn allows us to visualise a theoretical framework for such a regime and its possible challenges and solutions, all of which will be discussed in this section.

As mentioned earlier, the monetary authorities or the BOJ in this case, has only control over the nominal variables and has no control over the real interest rate and real exchange rate. Hence, in the case of deflation, the real interest rate becomes positive since the 0% interest rate floor is quasi-binding in monetary policy. This is a logical consequence of inflation expectations, or in this case, the deeply rooted expectations of continued deflation. In order to overcome this supposedly binding interest rate floor, which renders monetary policy impotent and plunges the economy into a liquidity trap, Gesell Money could offer a solution to the woes of the BOJ.

Gesell Money creates a form of artificial inflation by gradually reducing the face value of the currency itself. This allows the BOJ to bring the nominal interest rate of the paper currency to less than zero. Since the exchange rate is already fixed as put forward in the earlier section, the changes in nominal rates will accrue to the real interest rate that is when the BOJ sets a certain high inflation target, according to the Taylor rule in (4).

In the short-run, this negative real interest rate will increase the domestic demand component for domestic output in (2) *ceteris paribus*; fixed exchange rate, for given levels of inflation and government expenditure. This increase in domestic demand will create an output gap which in turn accelerates inflation through the Phillips Curve in (3). The negative real interest rate has an unwanted side effect of creating an appreciating yen, through the UIP condition in (5) which will be in turn neutralised by a strong yen under a fixed exchange rate regime. Hence the liquidity trap is sprung through the increase in domestic demand for domestic output without having to resort to expensive expansionary fiscal policies with dubious effects. Given that now the exchange rate is already fixed, the decline in the real exchange rate comes from the increase in the domestic price level. This has the consequence of cycling back to reduce the demand for domestic output and henceforth reducing inflation acceleration through the Phillips Curve. The decline in real exchange rate and the subsequent reduction in domestic aggregate demand could well offset the effects of the Gesell Money created inflation.

However, under the nominal UIP condition given in (8), a negative nominal rate of interest will result in an appreciation of the yen. As a result the real exchange rate declines since the yen appreciates and the domestic price level increases. In order to counteract these possible exchange rate side-effects of a negative nominal interest rate and negative real interest rate,

the BOJ will need to force a yen depreciation by pegging the yen to the dollar at a rate which the yen is strong. When this happens, the BOJ will be defending a strong currency, which can be easily done by simply printing yen to purchase foreign assets.

A strong yen allows the Japanese economy to better offset the effects of inflation on the real exchange rate. This however has a practical problem as one would have easily noticed; the holders of yen could change their yen holdings into dollars and wait for the Gesell taxes to kick in before re-converting their yen, gaining a profit in nominal terms as a result since the yen is fixed. Before discussing this particular loophole in greater detail, we will first look into the application of Gesell Money in practice.

11. Applying Gesell Money in Practice

After having discussed the theoretical usefulness and the theoretical feasibility of implementing a Gesell Money regime, we will now look further into the practicality and the potential problems that could be faced by policy makers in their attempt to promote Gesell Money. In practice Gesell Money involves issuing stamps which holders of banknotes must buy in order to render their banknotes valid for use. In the modern world today where much of the money is electronic, this practice is antiquated. However, this process of stamping can also take other forms, particularly in forms of inflation tax. This in turn requires the cooperation of the Japanese government with BOJ.

11.1. The Coordinating Policies

In order to prevent other forms of arbitrage across securities, BOJ would first need to engage in open market operations by purchasing government debt of various maturities, hence driving the yield down to 0%. This is done so as to make certain that holding a bond with a 30-year maturity is just as good as holding liquid cash in one's portfolio.

In addition, the yen needs to be allowed to depreciate, either forcefully through massive foreign exchange market interventions or through the above-mentioned open market operation which also results ultimately in currency depreciation.

11.2. Gesell Taxes on Liquid Currency

On liquid currency, the BOJ has two options. The first of which is to make stamp purchases a legal obligation and outlaw the circulation of banknotes without the appropriate number of stamps on the banknotes. For example, a stamp costing say 1% of the banknote's face value must be purchased quarterly and stuck on the banknote in order to make the note legal tender. Also the notes are required to be exchanged at the end of the year for fresh ones in order to ensure better control and that the BOJ has the right to refuse a note with an insufficient number of stamps.

Recognising that this may create inefficiencies, we also propose a second option to enforce the Gesell Money. The BOJ will need to issue a statement with legal force saying that the banknotes currently in circulation will need to be exchanged at the end of the year for another set of banknotes, with for instance a different set of serial numbers for better control. In the process of the exchange, the BOJ will also announce that the older notes will only be exchanged at a percentage, for instance 95%, of their nominal face value. Additionally the BOJ will announce that only the newer notes are legal tender and are distinguishable with different serial numbers.

11.3. Gesell Taxes on Deposits and Longer-term Currency Holdings

On the question of deposits of longer maturity, a Gesell tax could also be levied on longer-term deposits and currency holdings. One simple way would be to announce a currency tax starting from a certain date. On checking accounts, a tax in line with the Gesell tax on liquid currency could be levied on the principal amount itself, on the same frequency.

For long term deposits, the BOJ could tax the holdings, upon conversion to liquid currency, a tax that is the equivalent of compounded inflation tax over the years the withdrawal has not taken place, calculated from a previously given date.

11.4. The Tricky Question of Foreign Currency Holdings

Recognising that Gesell taxes will be in force, holders of the Japanese yen would like to exchange their yen holdings for the dollar, since the yen is allowed to depreciate against the dollar before the yen is pegged at a rate at which the yen is strong. This is done by the BOJ in order to prevent an appreciating yen from offsetting the effects of inflation through the channel of the foreign component of domestic aggregate demand. The deflation would

essentially entail a profit on moving into dollar deposits when the yen is still weak and re-converting back to the yen when the yen becomes stronger.

One answer to this problem is to institute currency controls. This is to restrict the Japanese at home from profiting from the gap between the fixed yen by moving into Eurodollar deposits and the Gesell taxes at home. Because of currency controls, the BOJ can restrict the holding of dollars at home. In order to further assist in currency controls, a simple expedient of implementing a conversion tax on agents who would like to exchange their dollars for Japanese yen. This conversion tax rate should be calculated in the same way as the previously mentioned tax for liquidating holdings, from a given date.

11.5. Exit Strategy

The exit strategy is straightforward. As soon as inflation has become positive and attained a certain desired level, the BOJ gradually phase out the Gesell Money regime. This entails a gradual reduction in the inflation and currency taxes. The process of gradual reduction allows the BOJ to accurately determine the effectiveness of the regime while at the same time giving the monetary authorities more policy freedom, in the event that the rate of inflation does not hold up to expectations. In addition, the yen can also be unpegged and a reversion to a floating exchange rate regime could be gradually envisaged by means of widening bands of exchange rate fluctuation.

However the BOJ should also emphasise that it will not hesitate to re-implement the Gesell Money regime should the economy fall into the liquidity trap again. This also in turn strengthens the credibility of the central bank and thus the people are more likely to adjust their inflation expectations if they know that the BOJ is intent on creating inflation.

12. Conclusion

The results of this paper have rightly shown that Gesell Money, used in conjunction with other appropriate policy measures, such as structural reforms, a Taylor rule with a fixed exchange rate regime and a much higher level of targeted rate of inflation will suffice to allow Japan to spring the liquidity trap and restore its lost decades of economic growth.

However policymakers should be cautioned against the use of Gesell Money alone without realising the necessary reforms, in particular, on the part of the Taylor rule and the targeted rate of inflation. Without the necessary reforms, Gesell Money will not change the steady state rate of inflation at all, even though short term inflation will be affected.

With this conclusion, we forsee a potential conflict with the viewpoints of Bernanke (1999), Fujiki *et al.* (2001), Krugman (1999), McCallum (2001), McKinnon (2007), Meltzer (2002) and (Svensson, 2000). Indeed this conclusion also does not fully correspond to the proposal advocated by Buiter and Panigirtzoglou (1999), Buiter (2001) and Fukao (2004) of the Gesell Money regime. However we would like to point out that whilst there is room for potential debate, we have reconciled the all of the opposing points of view in our model by also suggesting further that structural changes should take priority over the other non-fundamental policies.

In spite of the arguments that we have lined up in this paper, there are nevertheless some assumptions that should be relaxed in the real world. Firstly, UIP has no longer been substantiated after the 1990s, which is an especially important assumption in the model. In addition, we admit that whilst Gesell Money is theoretically and also practically feasible historically, the Gesell Money experiments have only been carried out on a small scale, in small towns with relatively closed economies. Therefore we do not discount the potential problems that could arise when Gesell Money is implemented in Japan; a large open economy. That notwithstanding, we would like to point out that while Gesell Money is to a certain extent feasible, further research is necessary to determine the suitability of Gesell Money in a large open economy setting.

Given the toll that the recent earthquake and tsunami has exacted from Japan, extensive reconstruction is now necessary. This entails an expansionary fiscal policy which, from the viewpoint of our model, is good for inflation. As much as we were reluctant to propose deficit spending as a viable solution, the exigencies of the devastation caused by the natural disaster necessitated such a policy move. This brings us into a ‘might-as-well’ situation which, its effects on national debt notwithstanding will prove beneficial for Japan in the longer term. Indeed, the importance of inflation for Japan should not be understated. Since Japan is in a danger of accumulating excess government debt, elevated rates of inflation will be able to reduce the real level of debt for the Japanese government.

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