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THE FALLACY OF THE NATURAL RATE OF INTEREST AND ZERO LOWER BOUND ECONOMICS: WHY NEGATIVE INTEREST RATES MAY NOT REMEDY KEYNESIAN UNEMPLOYMENT

Thomas Palley*

ABSTRACT

This paper provides a critique of zero lower bound (ZLB) economics which has become the new orthodoxy for explaining stagnation. ZLB economics is an extension of pre-Keynesian economics which attributes macroeconomic dysfunction to rigidities and market imperfections. The ZLB is the latest rigidity in that pre-Keynesian tradition. The paper argues negative nominal interest rates, even if feasible, may be unable to remedy Keynesian demand shortage unemployment, and might even aggravate the problem. That is because there exist non-reproduced assets whose return dominates that of investment, and saving may also increase in response to negative rates. Consequently, there may be no natural rate of interest.

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Abstract

This paper provides a critique of zero lower bound (ZLB) economics which has become the new orthodoxy for explaining stagnation. ZLB economics is an extension of pre-Keynesian economics which attributes macroeconomic dysfunction to rigidities and market imperfections. The ZLB is the latest rigidity in that pre-Keynesian tradition. The paper argues negative nominal interest rates, even if feasible, may be unable to remedy Keynesian demand shortage unemployment, and might even aggravate the problem. That is because there exist non-reproduced assets whose return dominates that of investment, and saving may also increase in response to negative rates. Consequently, there may be no natural rate of interest.

Keywords: zero lower bound (ZLB), natural rate of interest, non-reproduced assets, stagnation, New Keynesianism, nominal rigidities.

JEL refs.: E0, E10, E12, E20, E40, E50.

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1. The search for an explanation of stagnation: the rise of ZLB economics

Having been surprised by the financial crisis of 2008 and the Great Recession, mainstream economics was further surprised by the onset of stagnation after the Great Recession. The initial expectation was that the economy would experience a V-shaped recovery in response to massive monetary and fiscal stimulus, as reflected in former Federal Reserve Chairman Ben Bernanke's March 2009 claim about "green shoots" of recovery.[1] That expectation then gave way to an expectation of a U-shaped recovery, which in turn morphed into an L-shaped recovery that was christened as "stagnation" by Larry Summers in a speech at the IMF on November 8, 2013.

The unexpected emergence of stagnation has prompted mainstream economists to search

[1] Bernanke first referred to green shoots in a March 15, 2009 television interview on *CBS Sixty Minutes*. Subsequently, he referred to them again in a commencement speech to the Boston College School of Law on May 22, 2009.

for a theoretical explanation. That search has now converged on the zero lower bound (ZLB) to nominal interest rates, which is claimed to obstruct clearing of the loanable funds market for full employment saving and investment. As a result, ZLB economics has become the new orthodoxy that saves "new Keynesian" economics. It does so by introducing yet another nominal rigidity, this time regarding nominal interest rates.

This paper explores the ZLB new orthodoxy.[2] It begins by exploring the economic logic of ZLB economics, and shows that the ZLB explanation of stagnation links directly to classical macroeconomics with its concept of the natural rate of interest (NRI). Put simply, the ZLB prevents the economy from obtaining the NRI needed to ensure goods market clearing at full employment.

Thereafter, the paper develops a Keynesian critique of the ZLB explanation of stagnation. The argument is that even absent a ZLB, the economy still might not reach full employment. The proposed Keynesian critique is therefore a double critique. First, it is a critique of the ZLB explanation of stagnation. Second, it is a critique of the classical doctrine of the NRI, in that there may be no rate of interest that delivers full employment goods market clearing given existing conditions. Furthermore, in such a world, negative nominal interest rates may even aggravate the problem of aggregate demand (AD) shortage.

2. A preliminary exposition of the Keynesian critique

The Keynesian theoretical critique is that negative nominal interest rates may fail to solve demand shortage owing to the existence of non-reproduced assets (NRAs), which include money but are not restricted to money. The reason is lower interest rates may result in bidding up the price of those assets rather than increasing investment.

[2] Literally speaking, ZLB economics has been disproved by the fact that several central banks have experimented with negative nominal interest rates, showing that negative nominal interest rates are technically feasible. However, despite that literal disproof, ZLB economics still raises important theoretical concerns that deserve attention.

That possibility was identified by Keynes (1936, p. 225 – 236) in a cryptic section on commodity rates of interest in Chapter 17 of *The General Theory*. Keynes concludes that section as follows:

> "Our conclusion can be stated in the most general form (taking the propensity to consume as given) as follows. No further increase in the rate of investment is possible when the greatest among the own-rates of own-interest of all available assets is equal to the greatest amongst the marginal efficiencies of all assets, measured in terms of the asset whose own-rate of own-interest is greatest.
>
> In a position of full employment this condition is necessarily satisfied. But it may be satisfied before full employment is reached, if there exists some asset, having zero (or relatively small) elasticities of production and substitution, whose rate of interest declines more slowly as output increases, than the marginal efficiencies of capital-assets measured in terms of it (Keynes, 1936, p.236)."

The essential problem is the existence of NRAs whose rates of return dominate that on investment. Consequently, even if the nominal interest rate were pushed below zero, marginal portfolio allocations would be directed toward accumulation of NRAs assets rather than investment, leaving AD unchanged.

It is not fiat money that is the core problem, but rather NRAs with higher rates of return than investment. Here too, Keynes is clear:

> "We could not get out of our difficulties (as some have supposed) merely by decreeing that wheat or houses shall be the standard of value instead of gold or sterling. For, it now appears that the same difficulties will ensue if their continues to exist any asset of which the own-rate of interest is reluctant to decrease as output increases. It may be, for example, that gold will continue to fill this role in a country which has gone over to an inconvertible paper standard (Keynes, 1936, p.229)."

Unfortunately, economists have missed the generality of Keynes' argument and conflated it with money. That is because money is the only NRA in economists' theoretical models. In the real world, NRAs are an array that includes fiat money, precious metals and minerals, land, rent streams from firms with market power, and intellectual property such as patents and copyrights.

That calls for distinguishing the roles of NRAs and money. NRAs are the primary problem. Money, which is also a NRA, causes the secondary problem of the ZLB. The important implication is that even if nominal interest rates can be lowered below zero, that still might not solve the problem of demand shortage owing to the existence of NRAs whose rates of return dominate that on investment.

To be clear, the Keynesian critique in this paper is not that nominal interest rate rigidities can never be a cause of demand shortage. Indeed, Keynes (1936, p.144) argued nominal interest rate rigidities sometimes could, though he emphasized the problem posed by costs of intermediation between borrowers and lenders. Instead, the critique is the underlying theoretical assumption in ZLB economics that lowering the real interest rate via negative nominal interest rates can always restore full employment. The Keynesian critique explains why unemployment may persist even if the nominal interest rate is negative. It also shows that in a zero or negative nominal interest rate environment, firms are likely to engage in debt-financed equity buy-backs. That provides an explanation of the increase in debt-financed buy-backs which has been observed over the past several years.

3. Classical macroeconomics as the foundation of ZLB economics: deconstructing the New Keynesian story

The ZLB explanation of stagnation was pioneered by Krugman (1998) who originally developed it to explain Japan's stagnation after the collapse of its asset price bubble in 1991. Eggertsson and Krugman (2012) then elaborated that story to explain the stagnation which followed the US financial crisis of 2008. Their elaboration is part of the New Keynesian research paradigm, which takes the classical macro model and add frictions that prevent the economy from equilibrating at full employment. Viewed in that light, the ZLB constitutes the most recent addition to the family of

frictions.

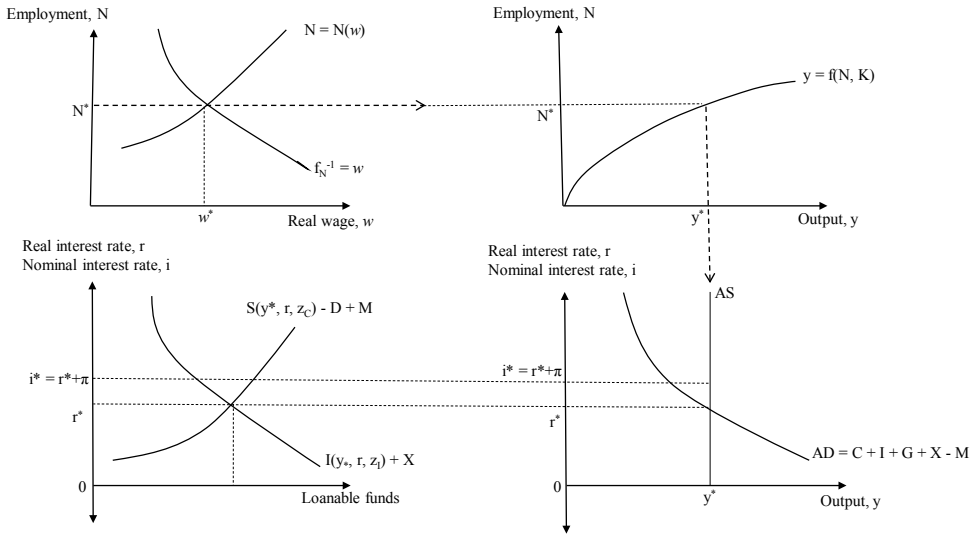
The New Keynesian approach to ZLB economics is framed within dynamic stochastic general equilibrium (DSGE) models. In such models, households and firms maximize utility and profits over an infinite horizon. The inter-temporal paths of consumption, employment, and capital accumulation are then governed by the Euler equations generated by the first-order conditions, subject to endpoint transversality conditions. However, the essential logic of New Keynesian ZLB economics can be captured and illustrated within the canonical classical macroeconomic model. Doing so has two benefits. First, it makes crystal clear the underlying economic argument behind the ZLB explanation of stagnation. Second, it makes clear the link between New Keynesian economics and classical macroeconomics.

The appendix contains a formal description of the simple classical model, the economic logic of which is as follows. Agents form rational expectations of the model's implied equilibrium solutions and equilibrium price level. Thereafter, given the expected price level, firms and workers set a nominal wage that yields the expected equilibrium real wage. Firms then employ the profit-maximizing number of workers consistent with that real wage, thereby determining the level of output. The loanable funds market determines the real interest rate to ensure aggregate saving (the supply of loanable funds) equals aggregate desired investment (the demand for loanable funds), which ensures AD equals aggregate supply (AS). Lastly, the price level adjusts to bring real money supply into equilibrium with real money demand, and determination of the price level determines the nominal interest rate and inflation. This accords with the classical and monetarist traditions in which monetary forces determine the price level.

The model is illustrated in Figure 1. The top left hand panel describes the labor market in which the real wage (w) and employment (N) are determined on the basis of the expected price

level. The top right hand panel shows the aggregate production function (f(.)) which determines the level of output (y) given the level of employment. The lower right panel shows the goods market in which the real interest rate (r) adjusts to bring AD into alignment with AS. The lower left panel shows the market for loanable funds in which the real interest rate equilibrates the demand for loanable funds (I) and the supply of loanable funds. The supply of loanable funds is equal to private sector saving (S) minus the budget deficit (D) plus imports (M) minus exports (X). The loanable funds market is the economic mechanism that coordinates saving and planned investment, thereby ensuring goods market equilibrium consistent with full employment output. The real interest rate that clears the loanable funds market is the Wicksellian "natural" rate of interest (NRI).[3]

Figure 1. The classical macro model



The ZLB becomes relevant if the nominal interest rate cannot adjust to deliver the full employment equilibrium real interest rate (i.e. the NRI) needed to clear the goods and loanable

[3] Note, the NRI is not exogenously fixed. Instead, it depends on current conditions and their impact on the demand for and supply of loanable funds.

funds markets. In that case, the model is under-determined as there is no mechanism for closing the goods market. ZLB economics solves the under-determination problem by adding the following auxiliary assumptions regarding interest rate and output determination:

(1) $i = Max[\ 0, r + \pi]$

(2) $y = Min[y^*, AD(y, -\pi)]$ $\quad AD_1 > 0, AD_2 < 0$

Equation (1) is the ZLB condition which says the nominal interest rate cannot go below zero. The standard reason given is the existence of money which has a zero nominal yield that sets the floor for nominal interest rates. Equation (2) is a Keynesian short-side output determination condition. When the goods market is in excess supply (i.e. AD is less than full employment output) and the real interest rate cannot adjust downward to clear the market because of the ZLB constraint, the level of output adjusts to equilibrate with AD. Given the ZLB constraint, the actual real interest rate equals the negative of the expected inflation rate ($r = -\pi$).

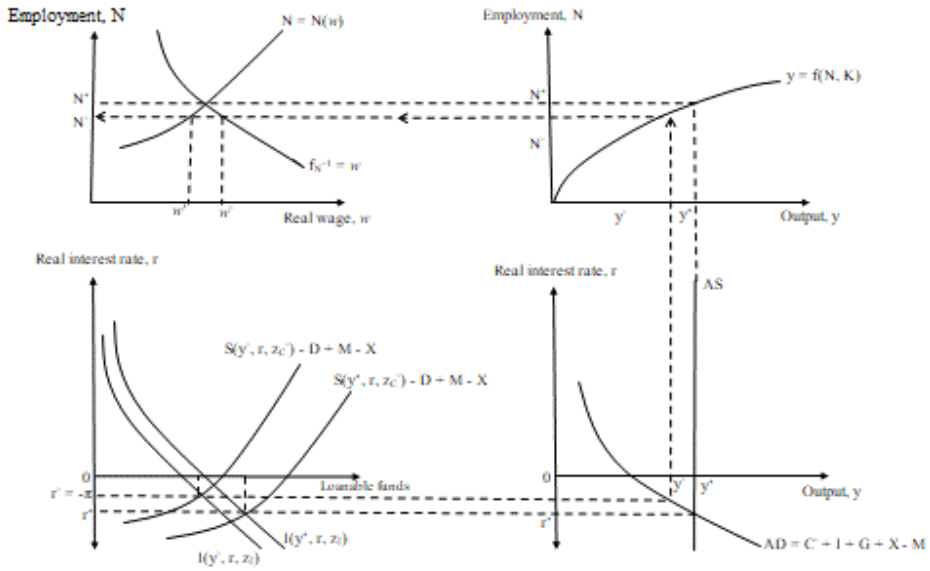
Figure 2 illustrates the effects of a negative autonomous consumption shock ($z_C' < z_C$) which pushes the economy to the ZLB.[4] The shock shifts the loanable funds supply function to the right, generating a NRI of $r^* < 0$. Given the nominal interest rate is constrained by the ZLB so that $i = 0$, the real interest rate is stuck at $r' = -\pi > r^*$. Consequently, both the goods market and loanable funds market are in excess supply at this real interest rate (even though it is negative). That triggers the ZLB short-side output determination condition, whereby output contracts in the goods market (lower right-hand panel) owing to insufficient demand at the real interest rate (r'). That adjustment is represented by a leftward movement up along the AD schedule and a reduction of output to y'.[5]

[4] In New Keynesian DSGE models, such consumption shocks are commonly identified with changes in household expectations about future income.

[5] There are also some background additional monetary dynamics not visible in Figure 2. The fall in output (y) increases the price level (p) to clear the money market. That further worsens the demand shortage by reducing real money balances, giving rise to an adverse Pigou effect on AD. Consequently, in the canonical classical model with a ZLB, price flexibility and the Pigou effect aggravate unemployment.

In the loanable funds market (lower left-hand panel) the adjustment is characterized by a leftward shift of both the supply of and demand for loanable funds. These twin shifts are brought about by reduction of output which reduces private sector saving and investment.[6] Note, the assumption is that the supply of loanable funds falls by more than the demand so that the prevailing real interest rate rises even though it is still negative ($0 > r' > r^*$).[7] Stagnation persists as long as the prevailing real interest rate is greater than the NRI.[8]

Figure 2. The classical macro model with a ZLB constraint owing to a negative consumption shock ($z_C' < z_C$).



[6] Having investment depend on the level of output assumes the existence of Keynesian accelerator effects. In a strictly neoclassical model the marginal efficiency of investment is determined by purely technical conditions and is independent of the level of output. In such a model, the demand for loanable fund (planned investment spending) would not shift in response to the reduction in output and the interest rate would rise further.

[7] This accords with the Keynesian multiplier stability condition whereby saving is more sensitive than investment to changes in income.

[8] In the above model fiscal policy is effective at the ZLB. A bond-financed increase in government spending (G directly adds to AD, which increases output but has no effect on the loanable funds real interest rate as long as the economy is at the ZLB. In the goods market, the AD schedule shifts right. In the loanable funds market, the saving schedule shifts left and the investment schedule shifts right (due to the effect of higher induced income). If bonds are net wealth there is an additional positive effect on AD and an additional negative effect on saving. If the budget deficit is money financed, the money supply increases. If the fiscal stimulus is large enough, the economy can escape the ZLB zone.

A similar story can be told for a negative autonomous investment shock ($z_I' < z_I$) which shifts the loanable funds demand function to the left, also generating a NRI of $r^* < 0$. In New Keynesian DSGE models, such shocks to investment are identified with changes in expectations about the future productivity of capital.

The above classical macro model with a ZLB illuminates the essential macroeconomics of the New Keynesian ZLB explanation of stagnation. It shows how the NRI is at the core of New Keynesian economics, being the mechanism that clears the goods market. It also shows the role of the ZLB, which prevents the interest rate from adjusting to the NRI.

Lastly, it should also be noted that New Keynesian economics adds an additional twist to the canonical classical macro model. That twist is a central bank which engages in interest rate targeting,[9] and the twist adds a layer of complexity which camouflages the similarity of economic logic between the Classical and New Keynesian macroeconomic models. Thus, whereas the Classical model has the loanable funds market set the interest rate, the New Keynesian model has the central bank take over the interest rate setting function. The central bank targets the nominal interest rate via a four step procedure. First, it announces an inflation target (which must be credible). Second, it estimates the full employment real interest rate (i.e. the NRI).[10] Third, it announces a nominal interest rate target that is equal to the inflation target plus the estimated NRI. Fourth, it adjusts money market conditions to hit the nominal interest rate target.[11] The central bank therefore plays the role of a "pseudo-loanable funds market". It implicitly targets the NRI, which is possible as long as the central bank can adjust the nominal interest rate. However,

[9] New Keynesian models also include sluggish price level adjustment, which adds another potential source of distortion to output and employment. Sluggish price adjustment means the economy takes time to gravitate to full employment, but in the absence of further shocks the economy would eventually reach full employment. If there are inside debt effects, price and nominal wage adjustment may be unable to restore full employment (Tobin, 1980; Palley, 2008). However, debt - deflation effects and the ZLB are distinct separate analytical issues. Unfortunately, they are easily conflated when inside debt is included in the model.

[10] Central banks sometimes refer to the NRI as R-star.

[11] The way in which the central bank adjusts money market conditions depends on the bank's operating procedure.

problems arise for the central bank if the NRI is negative, the nominal interest rate is at the ZLB, and the NRI is less than the negative of expected inflation ($r^* < -\pi$). In that case, the ZLB prevents lowering the nominal interest rate to hit the negative NRI.[12]

4. A Keynesian critique of ZLB economics

The previous section described the classical nature of the macroeconomic theory behind ZLB economics. This section provides a Keynesian critique of ZLB economics. The critique comes in two parts. The first part shows how ZLB economics persists with framing the macroeconomic problem as one of rigidities. The second part is a theoretical critique that shows a negative nominal interest rate may not deliver full employment even in the absence of a ZLB. Consequently, if a negative nominal interest rate will not deliver full employment, that implies the ZLB is not the cause of Keynesian unemployment and stagnation.

(4.1) Rigidity macroeconomics: the ZLB as the new nominal rigidity.

ZLB economics is part of the New Keynesian consensus. New Keynesianism views the macro economy as a full employment system that only fails to settle on full employment due to rigidities and market imperfections. The main rigidities concern prices and nominal wages. ZLB economics adds the nominal interest rate to the list of rigidities. In this vein, Krugman writes that there are two obstacles to full employment:

> "First is the zero lower bound on the interest rate: after a sufficiently large shock, the Taylor rule may say you should keep cutting rates, but you can't. Second is downward nominal rigidity… (Krugman, 2013)"

The net result is that after a large negative shock the central bank cannot lower nominal interest

[12] According to new Keynesians, a solution to the ZLB problem is to raise the expected future price level, thereby increasing expected inflation and lowering the real interest rate. However, after many years of quantitative easing policy that has increased the money supply, central banks have been unable to raise inflation expectations. Defenders of new Keynesian economics say that central bankers have not tried hard enough. Critics would argue that not only is the ZLB a flawed explanation of stagnation, this policy experience suggests there is also something wrong with the New Keynesian theory of inflation which is essentially monetarist.

rates to stimulate demand, while downward nominal rigidity prevents the economy from benefitting from a lower price level that would generate a positive Pigou real balance effect that would supposedly stimulate consumption spending and aggregate demand.

ZLB economics has been sold as Keynesian economics, but it is not. First, the new Keynesian view of the causes of unemployment is fundamentally at odds with Keynes' (1936, Chapter 19) view as expressed in his *General Theory*. For Keynes, nominal rigidities are not the cause of unemployment and some rigidities actually help stabilize the economy. That means New Keynesian economics should really be termed "New Pigouvian" economics (Palley, 2009) because it adopts Pigou's (1933) market frictions approach to explaining unemployment. ZLB economics continues with that line of reasoning, and it is fully consistent with the theoretical line initiated by Modigliani (1944) which recast Keynesian macroeconomics as a special case of classical macroeconomics with nominal rigidities. Viewed in that light, ZLB economics is the newest rigidity aimed at saving the classical model from Keynes' (1936) critique.

The rigidities perspective is fundamentally at odds with Keynes' view of the economy. ZLB economics derives its Keynesian flavor via the addition of a short-side production rule (see equation (2) above). That yields a Keynesian-style output response when the actual real interest rate (r) is above the full employment real interest rate ($r > r^*$) – which classical economists termed the "natural" rate of interest and Keynes (1936, p. 183) termed the "neutral" rate of interest. The output rule creates a discrete switching regime which is either classical or Keynesian.[13] However, that switching regime is inconsistent with Keynes' (1936) principle of effective demand determined output, which he believed held at all times in a capitalist economy except at full

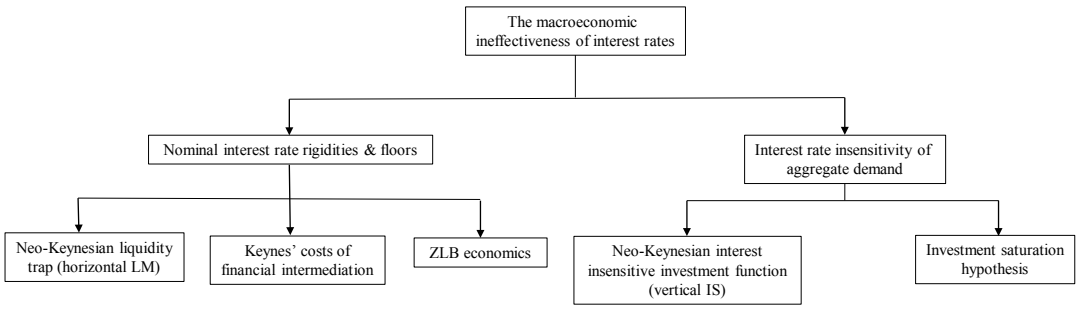
[13] Taylor (2014) describes this mix as "neither beast nor fish nor fowl".

employment – a position Keynes (1936, p.303) defined to be where an increase in aggregate demand yielded no increase in employment.[14]

(4.2) Theoretical critique: investment saturation owing to non-produced stores of value.

ZLB economics is part of a family of arguments regarding the macroeconomic ineffectiveness of interest rates. As shown in Figure 3, those arguments can be divided. One set of arguments concerns interest rate rigidities and floors which prevent interest rate adjustments that would restore full employment. The other set concerns the interest rate insensitivity of AD.

Figure 3. The debate over the macroeconomic ineffectiveness of interest rates.



The interest rate floors approach can be sub-divided into the neo-Keynesian liquidity trap, historically associated with a horizontal LM schedule; Keynes' (1936, p.208) costs of financial

[14] Parenthetically, in the presence of nominal interest rate targeting, Eggertsson and Krugman's (2012) real interest rate based short-side output rule implicitly makes central banks responsible for unemployment. That is because unemployment occurs whenever the nominal interest rate is too high so that $r > r^*$. Ironically, that connects ZLB economics with Milton Friedman. Friedman argued central banks were responsible for unemployment because of their erratic management of the money supply. ZLB economics implicitly makes central banks responsible, albeit through their interest rate policy.

intermediation and lender's risk; and the ZLB.[15] On the other side, the interest insensitivity of AD has historically been associated with the interest insensitivity of investment, as captured by a vertical IS schedule. The standard argument for that insensitivity is constructed in terms of production function technology being Leontief fixed proportions whereby input choice is independent of the interest rate.

However, there is another argument that has gone unrecognized, which can be termed the investment saturation hypothesis. It rests on the existence of NRAs, which include money. According to that argument, even if the central bank were to make the nominal cost of finance negative, firms might still refuse to invest sufficiently and prefer to acquire additional NRAs. Thus, even absent a ZLB, demand shortage could persist.

The investment saturation argument is illustrated by the following model of investment and asset allocation by firms. On the asset side, firms have an initial capital stock which they can increase via new investment, and they can also hold money and NRAs. On the liabilities side, firms are financed by a mix of equity and loans. Each asset has its own pattern of diminishing marginal returns, and there is a positively sloped supply of each type of finance.

The balance sheet of the representative firm is given by:

(2) $K_0 + I + L + G = E + B$

K_0 = initial capital stock, I = investment (i.e. addition to the capital stock), L = money holdings, G = non-reproduced asset (NRA), E = equity, B = Loans. All variables are in real terms and are

[15] Early Keynesians identified the case of an interest rate floor in the ISLM model with the liquidity trap. Keynes preferred to identify the floor as due to costs of intermediation, which he wrote about as follows: "There is, finally, the difficulty discussed in section IV of Chapter 11, p.144, in the way of bringing the effective rate of interest below a certain figure, which may prove important in an era of low interest rates; namely, the intermediate costs of bringing the borrower and the ultimate lender together, and the allowance for risk, especially moral risk, which the lender requires over and above the pure rate of interest. As the pure rate of interest declines it does not follow that the allowances for expense and risk decline *pari passu*. Thus the rate of interest which the typical borrower has to pay may decline more slowly than the pure rate of interest, and may be incapable of being bought, by the methods of the existing banking and financial organization, below a certain minimum figure (Keynes, 1936, p.208)". This argument is one where Keynesian and Pigouvian economics overlap.

deflated by the general price level.

Nominal rates of asset returns and the costs of finance are given by:

(3) $R_I = R(K_0) - \kappa(I) - \delta + \pi$ $\quad R(K_0) \geq 0, R_K < 0, \kappa_I > 0, \kappa_{II} > 0, \kappa(0) = 0, \delta > 0$

(4) $R_G = \psi(G) + \pi$ $\quad \psi(G) \geq 0, \psi_G < 0, \psi_{GG} < 0$

(5) $R_E = \xi(E) + \pi$ $\quad \xi(E) > 0, \xi_E > 0, \xi_{EE} > 0$

(6) $R_L = i_L + \varphi(L)$ $\quad \varphi(L) \geq 0, \varphi_L < 0, \varphi_{LL} < 0$

(7) $R_B = i_H + \rho + \lambda(B)$ $\quad \rho > 0, \lambda(B) \geq 0, \lambda_B > 0, \lambda_{BB} > 0$

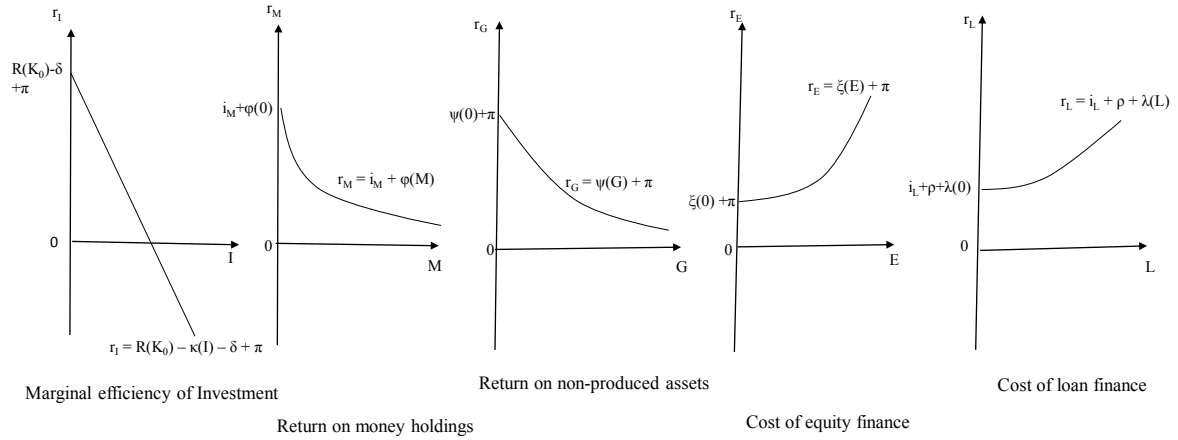
(8) $i_L = i_H - c$ $\quad c > 0,$

R_I = nominal marginal efficiency of investment, $R(K_0)$ = marginal efficiency of capital, $\kappa(I)$ = capital stock adjustment cost, δ = depreciation, π = inflation, R_L = total return on money (including liquidity return), i_L = deposit interest rate, $\varphi(L)$ = own liquidity return on money, R_G = nominal return on NRAs, i_H = nominal money market rate set by the central bank, R_E = nominal cost of equity finance, R_B = nominal loan rate to firms, ρ = loan administration cost per dollar loaned, $\lambda(B)$ = default risk premium, c = deposit administration cost per dollar deposited.

Rates of return are subject to diminishing marginal returns. The nominal returns on investment (R_I) and NRAs (R_G) are augmented by inflation because the value of these assets rises with inflation. Likewise, the nominal return to shareholders (R_E) also rises with inflation since equity holders benefit from the increased value of the firm's underlying assets. The total return to money (R_L) is the nominal return plus the liquidity service yield ($\varphi(L)$). The nominal cost of loan capital (R_B) is the nominal cost charged by the bank, which is the cost of finance (i_H) to the bank plus associated lending costs. The loan finance interest rate increases with volume owing to rising default probability.The deposit rate is the money market interest rate less the deposit administration cost.

Figure 4 shows the pattern of rates of return on different assets and the interest rate assoociated with different sources of finance. The marginal efficiency of investment eventually becomes negative owing to diminishing marginal productivity of capital and rising marginal costs of adjusting the existing capital stock.[16] These adjustment costs reflect the fact that adding capital to the existing capital stock imposes disruption costs associated with integrating new capital into the existing organization.[17]

Figure 4. Nominal rates of asset returns and costs of finance



In a manner of speaking, firms are real sector multi-input multi-output financial intermediaries. They take finance from different sources and use that finance to hold different types of assets that produce different returns. In equilibrium, firms equalize the marginal costs of

[16] For neo-Keynesians, the investment function (MEI) is derived from the neoclassical production function. The MEI is declining (i.e. downward sloping) because of diminishing returns to adding capital, and because of rising adjustment costs to adding capital. Keynesians have a different explanation of the investment function, whereby it is downward sloping because of the diminishing profitability of the marginal investment project.

[17] The supply of non-produced assets is fixed at g. The total real value of such assets is G = qg/p where q = price of non-produced assets, p = general price level. Given g and p are fixed, an increase in G implies an increase in q. As q increases, the expected return on non-produced assets falls.

sources of funds with marginal benefits from application of funds so that marginal rates of return and cost are equalized. This implies the condition

(9) $R_I = R_L = R_G = R_E = R_B$

The solution to the firm's capital allocation and financing decision is illustrated in Figure 5. The total demand for assets is obtained by summing horizontally the different asset return schedules, and the total supply of finance is obtained by summing horizontally the different finance supply schedules. The intersection of the asset demand and finance supply schedules determines the equilibrium marginal return on assets and marginal cost of finance. The composition of the representative firms' asset holdings and financing is then determined by horizontally decomposing asset holdings and finance at the equilibrium interest rate.

Figure 5. Equilibrium financing, investment and asset holdings of firms in normal times ($i_F > 0$).
$r_I = r_M = r_G = r_E = r_L$

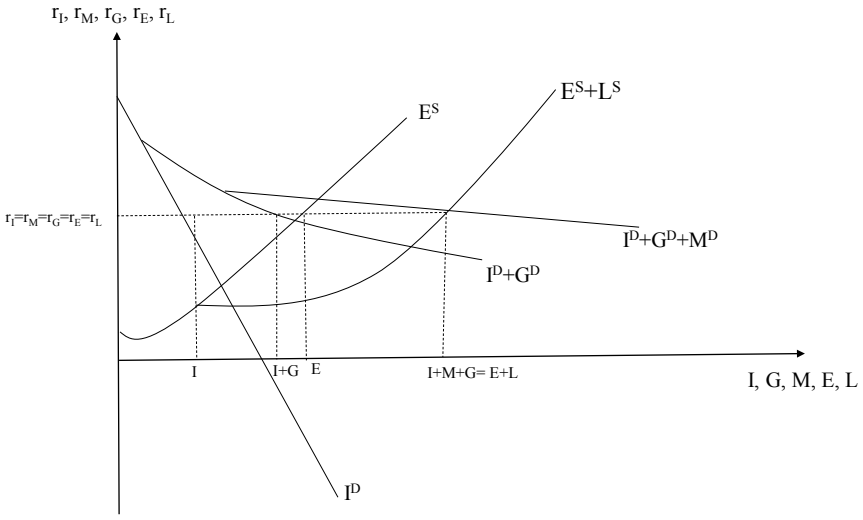


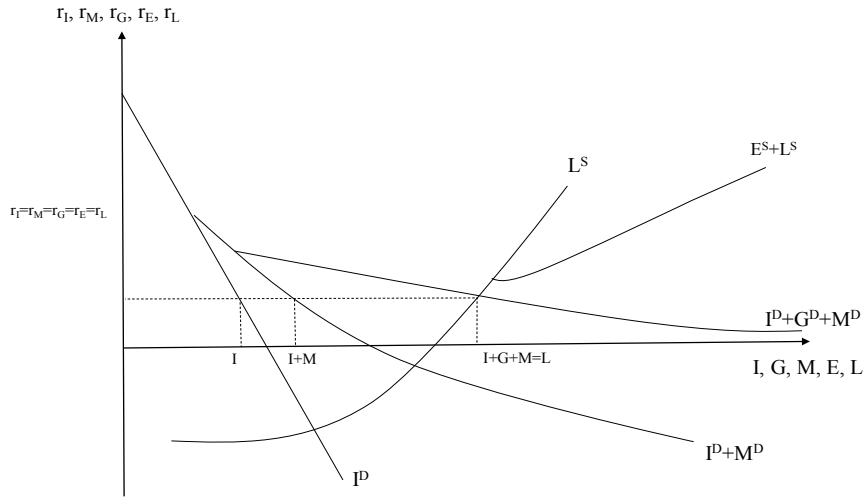
Figure 5 can be used to understand the effects of monetary policy which works by lowering the money market risk free interest rate. That lowers the cost of loan finance and shifts down the loan supply function. It also lowers the return on money holdings function by lowering the deposit rate. The total finance supply and money portion of the asset return function shift down by an equal

amount since the loan supply and return on money functions are equally impacted, which leaves the total size of the firms´balance sheet unchanged. However, there is a change in the composition of the firm´s balance sheet. First, firms switch from equity finance to loan finance because loan finance is cheaper. That means a lower policy interest rate induces firms to return equity to shareholders and adopt a more risky balance sheet financing structure. Second, firms reduce their money holdings because the return on money is lower, and they increase investment (capital accumulation) and holdings of NRAs.

In normal times, a lower policy interest rate stimulates investment. Just how much depends on several factors including the sensitivity of the MEI to investment spending (i.e. the steepness of the MEI function) and the sensitivity of the marginal return on NRAs. The relative steepness of the functions governing the MEI and the return on NRAs determines how new borrowing is allocated across investment and aqcuisition of NRAs.

Now, consider abnormal times when the monetary authority wants to increase investment and sets a negative money market interest rate (as the European Central Bank and Swiss National Bank have done). In this case, as shown in Figure 6, the loan supply shifts down and a portion of it is negative. The return on money function also shifts down and a portion of it also becomes negative. If the money market rate is sufficiently negative so that the loan rate is sufficiently low, firms will switch completely to loan finance. They do this via share buybacks and special dividends that return all equity to shareholders. Even though the deposit rate is negative, firms still hold some money balances because the "own liquidity return" to money increases as the firm´s money holdings fall.

Figure 6. Equilibrium financing, investment and asset holdings of firms in depressed times ($i_F < 0$).
$r_I = r_M = r_G = r_E = r_L$



The critical feature is that if the marginal return to NRAs is always greater than or equal to zero, there comes a point when the MEI hits zero and all extra loan finance from negative loan rates will be directed to increased holdings of NRAs rather than investment. Once the MEI has fallen to zero, firms will not invest for a negative return when they can do better by acquiring additional NRAs.

The ZLB is not the problem. Instead, as argued by Keynes (1936) in Chapter 17, it is the existence of NRAs such as cash, land, commodities like gold, assets like patents and copyrights, assets like knowhow and organizational capital embodied in existing firms, and streams of rents owned by firms with monopoly power. The price of those assets will be bid up by negative interest rates, but investment will not increase. Firms will borrow to return equity to shareholders and they will engage in bidding wars (e.g. take-overs) for existing assets, but they will not invest.

In Keynesian economics, interest rate insensitive investment spending is widely associated with a vertical IS schedule. Historically, this feature has been interpreted as a technical feature of

the investment function. However, the above analysis shows the interest inelasticity of investment spending is a product of the existence of NRAs and balance sheet re-engineering options. From that perspective, a vertical IS schedule is an intrinsically financial phenomenon rather than the product of the techinical characteristics of the marginal efficiency of investment.

Microeconomic forces can amplify the problem. For instance, if managers have a short-termist perspective because they are rewarded with unrestricted stock options, they will have a further personal incentive to engage in debt-financed equity buy-backs rather than undertake long-term profitable investment (Palley, 1997). In that regard, financialization has likely increased such behavior by encouraging and facilitating financial engineering aimed at raising the current share price.

(4.3) The effect of minimum required real returns on investment

If firms have a minimum required real return on investment (θ), the equilibrium condition given by equation (9) becomes

(10) $r_I - \theta = r_M = r_G = r_E = r_L$.

The impact of a minimum required return on investment is to shift the MEI down, which reduces investment spending. Such a minimum return covers against the possibility that an investment may turn sour because of fundamentally uncertain future developments such as technological or product innovation that renders the investment obsolete, new competitive entry that adversely impacts future cash flows from the investment, or future adverse macroeconomic developments that adversely impact the profitability of the investment.[18]

Required minimum returns on investment is another place where fundamental uncertainty

[18] In neoclassical microeconomic theory firms are viewed as an implicitly carrying out the wishes of shareholders. In that case, firms would require the same risk premium as shareholders. In post Keynesian theory firms (i.e. managers) and shareholders are distinct and separate agents so that the risk premium demanded by firms can differ from the risk premium demanded by shareholders in equity markets (Crotty, 1990; Palley, 2001). A minimum rate of return creates a wedge so that at any rate of interest the project must earn an additional θ.

and Keynes' (1936) notion of animal spirits become relevant. The minimum return on investment can also be endogenous and may rise in slumps if future conditions become perceived as even more uncertain. It may also be impacted by convention and the psychology of habit. For instance, during periods of prolonged boom and unusually high returns, firms may ratchet up their minimum target return on equity and those targets may be slow to come down in the slump. That would cause investment to fall by more during a slump, thereby deepening the slump. Such behavioral economics resonates with Keynes' *General Theory* which is full of references to conventions governing expectations.[19] It also resonates with the stagnation that set in after the Great Recession as firms may have been slow to lower their minimum expected returns after the bursting of the credit bubble which ran from 1981 to 2007.

(4.4) The adverse effect of lower interest rates on AD via saving

If lower interest rates cannot increase investment to solve the demand shortage problem, can they do so by lowering saving? As is well known, in pure consumption theory a lower real interest rate gives rise to both positive substitution and negative income effects. The substitution effect raises consumption and lowers saving, thereby increasing demand. The income effect lowers consumption and raises saving, thereby decreasing demand. Consequently, the effect of lower real interest rates on consumption is theoretically ambiguous – though new Keynesian loanable funds models always assume a lower interest rate raises consumption. The implication is consumption can fall and saving increase in response to a lower interest rate if the income effect dominates.[20]

Introducing money and negative nominal rates on money deposits may worsen the problem and make it more likely that the saving function is badly behaved and is a negative function of the

[19] Koutsobinas (2014/15) suggests Keynes is the first behavioral economist.

[20] For example, consider the case of a household which lives for two periods, has a zero discount rate, income of Y in period 1 and zero income in period 2. The real interest rate is r. The optimal consumption plan has equal consumption per period so that $C_1 = C_2 = Y[1 + r]/[2 + r]$ and period 1 saving is $S_1 = Y/[2 + r]$. A lower interest rate lowers period 1 consumption ($dC_1/dr > 0$) and increases period 1 saving ($dS_1/dr > 0$).

real interest rate. That is because a negative deposit rate is a form of tax on money that lowers real wealth, which lowers consumption and increases saving. If banks are charged negative rates on their central bank deposits they will pass those charges on to consumers in the form of fees and negative deposit rates, and possibly even raise loan rates to recoup their costs. Just as the Pigou real balance effect is viewed as increasing wealth and consumption, so too bank fees and a negative deposit rate will reduce wealth and consumption.

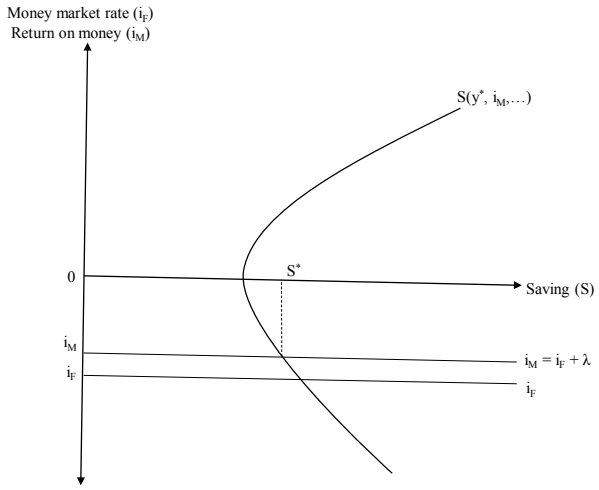
Behavioral economics may also matter here. A lower positive interest rate means less income: a negative interest rate imposes an additional loss of money wealth which is felt asymmetrically strongly via the endowment effect (Kahneman et al., 1990). That contributes to a larger compensating saving response.

Balanced against the negative Pigou effect, there will also be positive asset price wealth effects working in the other direction. The net impact on AD will depend then on the relative magnitudes of these effects. If households have different MPCs, it will also depend on the distribution of wealth and money holdings.

Figure 7 depicts a backward bending supply of saving in the presence of a negative money market rate. The saving function is drawn as backward bending at the ZLB.[21] Below the ZLB, full employment saving increases because of the dominance of the combined adverse income and money wealth effects. A negatively sloped saving function makes a lower interest rate counter-productive. However, all that is needed for the interest rate – saving channel not to work is that the saving function be vertical.

[21] For clarity of argument, Figure 8 depicts the saving function as becoming backward bending at the ZLB. However, the saving function may start to bend backward above the ZLB when interest rates are positive, or it could even be negatively sloped over the entirety of its range.

Figure 7. The supply of saving in depressed times with a negative money market rate ($i_F < 0$, $\pi = 0$).



(3.4) Further issues: negative nominal interest rates and the problem of financial instability[22]

The above analysis has shown why negative nominal interest rates may not increase AD because investment may not increase and saving may not fall. The implication is the fundamental problem is not the ZLB. Furthermore, in addition to not solving the AD shortage problem, lowering the nominal interest rate below the ZLB could create financial instability problems.

One problem already identified is it will promote risky balance sheet re-engineering by firms as they substitute debt for equity. A second problem is that it will tend to promote financial disintermediation. With a negative interest rate on deposits, agents will tend to exit money and look for other stores of value and media of exchange. That may show up in the form of precious metals inflation, commodity price inflation and land inflation.

A second related problem is that exit from money can produce asset price bubbles as agents chase both yield and alternative stores of value. Those asset bubbles introduce a time-consistent

[22] These issues are tackled in greater depth in Palley (2016).

policy contradiction.[23] Policy first pushes low and negative money market interest rates to increase AD. However, should policy be successful, that will necessitate raising interest rates which risks triggering a financial crisis by bursting any bubbles.

Third, ultra-low and negative interest rates jeopardize business models related to insurance and retirement income provision in jeopardy. That can cause financial disruption and disintermediation in these important financial sub-sectors. In sum, pushing money market rates below the ZLB may not only fail to solve the AD shortage problem, it may create significant financial instability.

5. A new explanation of IS schedule pathology and non-existence of the NRI

The arguments developed above can be understood and summarized in terms of a simple model of investment – saving (IS) goods market equilibrium. There are two pathological situations when interest rate adjustment cannot ensure full employment output. One case is when the interest rate is at its floor, while the other case is when investment is unresponsive to lower interest rates.

These two situations are illustrated Figures 8.a and 8.b.[24] Figure 8.a corresponds to the ZLB hypothesis, according to which output would expand if policymakers could lower the nominal interest rate. The reasoning is a lower nominal rate with unchanged inflation would stimulate investment and reduce saving, causing the economy to move down the IS to a higher equilibrium level of output.

[23] The generic problem of time consistency of policy was first addressed by Kydland and Prescott (1977).

[24] The figures are drawn under the simplifying assumption that the inflation rate is zero so that the nominal and real interest rates are identical. If the inflation rate is non-zero and positive there is need to add a shadow nominal IS schedule that lies above the IS schedule, with the gap between the two schedules equal to the inflation rate. The ZLB becomes binding when the shadow IS intersects the ZLB line.

Figures 8.a and 8.b. The ZLB versus pathological IS hypothesis.

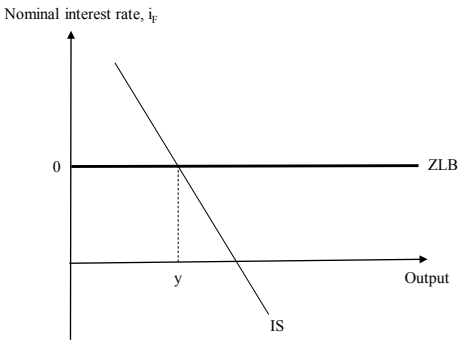


Figure 8.a. The ZLB hypothesis.

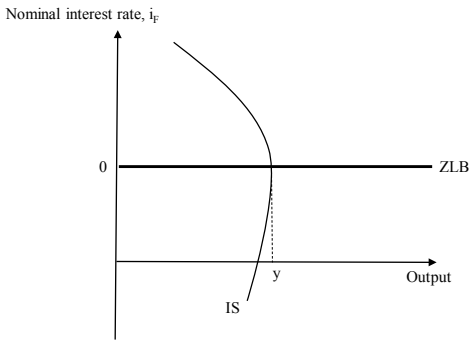


Figure 8.b. The pathological IS hypothesis.

Figure 8.b corresponds to the argument developed in this paper, whereby the IS schedule becomes vertical if the marginal efficiency of investment is zero or negative. In that event, a lower real interest rate encourages acquisition of NRAs with positive return rather than generating additional investment. That generates a new financial theory of the vertical IS resting on portfolio choice and investment saturation. Furthermore, if a lower real interest rate increases saving, the IS can become positively sloped.

The important implication is removing the ZLB, so that the real interest rate can fall, would not cause the economy to move closer toward full employment output. Indeed, if the IS schedule is positively sloped, a lower rate will lower output owing to increased saving. In that event, the ZLB is actually a stabilizing mechanism that puts a floor under the economy.

Figures 8.a and 8.b make clear the analytical difference between ZLB economics and the Keynesian critique presented in this paper. ZLB economics focuses on interest rate rigidities. The Keynesian critique rests on a pathological IS schedule rooted in the behavior of investment and saving. The two arguments are easy to conflate as money plays a role in both. ZLB economics

argues money is the cause of the ZLB. The Keynesian critique emphasizes the role of NRAs, one of which is money, in making investment insensitive to negative interest rates.

Lastly, the pathological IS explanation of stagnation brings into question the existence of a NRI. Given, the position of the IS, there may be no interest rate that can deliver sufficient AD for full employment. Consequently, there is no NRI. However, if there were a large fiscal stimulus that shifted the IS schedule sufficiently far right, then there would be a natural rate – or what Keynes (1936, p.183) termed a "neutral rate". That makes the neutral rate an ephemeral contingent concept, which is why Keynes (1936, p.243) dismissed it as having nothing "useful or significant to contribute to our analysis."

5. Conclusion

This paper has provided a Keynesian critique of ZLB economics which has become the new orthodoxy for explaining stagnation. ZLB economics is an extension of classical macroeconomics and Pigouvian microeconomics, both of which attribute macroeconomic dysfunction to rigidities and market imperfections. The ZLB is the latest rigidity in that pre-Keynesian tradition.

The paper argued that negative nominal interest rates, even if feasible, may be unable to remedy demand shortage unemployment. That is because investment can become unresponsive to a lower interest rate if the return on investment is dominated by the returns on NRAs. Moreover, a lower interest rate may even aggravate demand shortage if saving increases in response to negative interest rates. The dominance of returns on NRAs explains why, in the current low interest rate environment, firms have engaged in mergers and debt-financed equity repurchases rather than increasing investment.

Appendix

The canonical classical macro model is given by the following sixteen equations:

(A.1) $y = f(N, K)$ $\quad f_N > 0\ f_{NN} < 0$
(A.2) $N = N(w)$ $\quad N_1 > 0$
(A.3) $w = w/p = f_N$
(A.4) $AD = y$
(A.5) $AD = C + I + G + X - M$
(A.6) $C = C(y - T, r, [H + B]/p, z_C)$ $\quad C_1 > 0, C_2 < 0, C_3 > 0, C_4 > 0$
(A.7) $I = I(y, r, z_I)$ $\quad I_1 > 0, I_2 < 0, I_3 > 0$
(A.8) $M = M(y - T, r, [H + B]/p, z_M)$ $\quad M_1 > 0, M_2 < 0, M_3 > 0, M_4 > 0$
(A.9) $D = G - T + iB_{-1}/p$
(A.10) $S = y - C - D + M - X$
(A.11) $L = L(y, [H + B]/p, i, \pi, z_L)$ $\quad L_1 > 0, L_2 < 0, L_3 < 0, L_4 > 0$
(A.12) $H/p = L$
(A.13) $H = H_{-1} + \gamma pD$
(A.14) $B = B_{-1} + [1-\gamma]pD$
(A.15) $i = r + \pi$
(A.16) $\pi = \{E[p_{+1}] - p\}/p$

y = real output, N = employment, K = capital stock, *w* = real wage, w = nominal wage, p = price level, AD = aggregate demand, C = aggregate consumption, I = aggregate investment, G = government purchases, X = exports, M = imports, T = lump sum tax, r = real interest rate, z_C = consumption shift factor, z_I = investment shift factor, z_L = real money demand shift factor, D = government budget deficit or surplus, S = aggregate saving, L = real money demand, i = nominal interest rate, H = nominal money supply, B = bond stock, γ = money financed share of the deficit, π = expected inflation, $E[p_{+1}]$ = expected next period price level. The exogenous variables are K, G, T, X, z_C, z_I, z_L, and $E[p_{+1}]$. The endogenous variables are y, N, w, p, C, I, L, M, D, S, H, B, r, and π.

Equation (A.1) is the aggregate production function in which real output (y) is a concave function of employment (N) and the capital stock (K). Equation (A.2) is the labor supply function in which labor supply (N) is a positive function labor of the real wage (*w* = w/p). Equation (A.3) has the real wage equal to the marginal product of labor (f_N). Equation (A.4) is the goods market clearing condition requiring AD equal output. Equation (A.5) is the definition of AD which is equal to the sum of real consumption spending (C), planned investment spending (I), government spending (G) and exports (X) minus imports (M).

Equation (A.6) determines aggregate consumption. It is a positive function of disposable income, a negative function of the real interest rate, a positive function of real money balances and real bond wealth, and a positive function of a shock/shift term. Equation (A.7) determines aggregate investment. It is a positive function of aggregate income, a negative function of the real interest rate, and a positive function of a shock/shift term. Equation (A.8) determines import spending which is a positive function of disposable income, a negative function of the real interest rate, a positive function of real money balances and real bond wealth, and a positive function of a

shock/shift term. Issues regarding the real exchange rate are abstracted from for purposes of simplicity. Equation (A.9) defines the government deficit, which is equal to outlays minus tax revenues. Equation (A.10) defines aggregate saving. Equation (A.11) determines real money demand. It is a positive function of aggregate income, money and bond real wealth, a negative function of the nominal interest rate, a negative function of expected inflation, and a positive function of a shock/shift term. Equation (A.12) is the money market equilibrium condition and has real money demand equal to real money supply. The real money supply is endogenous and depends negatively on the price level. Equation (A.13) determines the evolution of the nominal money supply which depends on the share of the budget deficit that is money financed. Equation (A.14) determines the evolution of the bond stock which depends on the share of the budget deficit that is bond financed. Equation (A.15) defines the real interest rate, and equation (A.16) defines expected inflation.

AD is assumed to be a positive function of real money balances and bond wealth, reflecting the Pigou effect. That implies the impact of real money balances on consumption dominates the impact on import demand ($C_3 > M_3$). If the budget is balanced so that government outlays equal taxes ($G + iB_{-1}/p = T$), the deficit is zero ($D = 0$) and both the nominal money supply ($H = H_{-1}$) and nominal bond stock are fixed ($B = B_{-1}$).

The above specification of the classical macro model is block recursive as the labor market, the goods market and the money market interact in a one-way direction. Equations (A.1) – (A.3) determine supply-side equilibrium. Given those solutions, equations (A.4) – (A.9) determine demand-side equilibrium. Thereafter, equations (A.10) – (A.12) determine money market equilibrium. The solution process therefore flows recursively down in a one-way direction. Metzler (1951) added a Pigou real balance effect to consumption which results in the real money supply impacting AD. That change complicates the classical model and undoes it three segment block recursive structure by making the equilibrium solution for the goods and money markets simultaneous.

Given the non-stochastic nature of the simple above model, and assuming approximate model linearity, implies $E[p] = p$.

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