Trinity College
HARTFORD CONNECTICUT

Department of Economics
Trinity College
Hartford, CT
06106 USA

<http://www.trincoll.edu/depts/econ/>

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**Consumer and Corporate Debt:
A Neo-Kaleckian Synthesis**

Alan G. Isaac and Yun K. Kim

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Abstract

Models of the macrodynamic impact of private debt tend to emphasize the role of corporate debt. Corporate leverage affects macroeconomic outcomes and can contribute to financial fragility. We show that consumer debt is also important. We include consumer as well as corporate debt in a stock-flow consistent neo-Kaleckian growth model and explore the macrodynamic ramifications. We find that consumer credit conditions influence effective demand, the profit rate, and economic growth.

The inclusion of consumer debt as well as corporate debt in our model substantially alters the model's dynamics. We compare our short-run, transition, and long-run results to models containing a single type of debt. Some of our results confirm the results of simpler models. For example, we find that a surge in animal spirits is good for steady-state growth. We show that consumer borrowing can also help to sustain aggregate demand, that looser consumer credit conditions have a steady-state growth effect, and that demand augmenting changes can enhance system stability. In this sense, looser consumer credit conditions are good for macroeconomic stability.

J.E.L. Codes: E12, E44, O41

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1 Introduction

Economists have long recognized that investment-finance behavior can affect macroeconomic performance. For example, Minsky’s financial instability hypothesis proposes that debt dynamics contribute to macroeconomic instability (Minsky, 1980, 1986, 1992, 1995). The financial underpinnings of the Great Recession have generated renewed interest in finance-driven macrodynamics.

Models of the macrodynamic impact of private debt tend to emphasize the role of corporate debt (Taylor and O’Connell, 1985; Skott, 1994; Lavoie, 1995; Foley, 2003; Hein, 2006; Lima and Meirelles, 2006, 2007; Charles, 2008a,b). Particularly relevant to our work is that of Hein (2006) and of Charles (2008a,b). Hein builds upon the work of Lavoie (1995) to incorporate interest payments on corporate debt into a neo-Kaleckian growth model. He finds that interest-rate changes affect long-run economic growth. Charles explores the emergence of financial instability in neo-Kaleckian growth models with corporate debt.¹ He argues that high interest rates are a likely precondition to financial instability. We extend this literature by developing a tractable model that encompasses the core of these earlier efforts while simultaneously introducing a macrodynamic role for consumer debt.

Naturally we are not seeking to overturn the stylized fact that investment is more volatile than GDP and consumption, nor the central role of investment in economic fluctuations. Rather, this paper explores the additional contribution of consumer debt dynamics to the evolution of consumption expenditures and thus to macroeconomic outcomes. Certain stylized facts suggest this contribution may be growing in importance.

From the 1980s to the mid-2000s, the US experienced consumption expansion accompanied by significant household debt accumulation. For example, the ratio of personal outlays to disposable personal income increased from about 88 percent in the early 1980s to nearly 100 percent in 2007. Additionally, household debt outstanding as a share of GDP increased from about 45 percent in 1975 to nearly 100 percent in 2006, falling slightly since then.² Onaran et al. (2011) note that the rentier share of income in the US has been growing at the

expense of both the wage share and the non-rentier profit share. The magnitude of these shifts is startling and calls for new theoretical and empirical research on their implications.

Cynamon and Fazzari (2008) provide an informal but informative discussion of these trends from a Minskyan perspective. They suggest that social factors, such as changes in consumption and borrowing norms, have had important effects on the level of household debt in the US. They argue that increased borrowing provided a substantial macroeconomic stimulus, but that debt accumulation eventually reached untenable levels, planting the seeds for financial instability and a severe economic downturn. Indeed, these facts have been broadly implicated in the “Great Recession” of 2007–2009 and its aftermath.

Minsky himself suggested that household debt could contribute to business-cycle dynamics (Minsky, 1992). Yet the Minskyan emphasis was on the role of the firm, and household borrowing played little role in his work (Papadimitriou and Wray, 1999). Most subsequent research on macroeconomic debt dynamics has also largely neglected household debt. Yet recent events suggest that the willingness of workers to borrow may be an important determinant of macroeconomic outcomes.

In this context, Palley (1994) and Dutt (2006) are exceptional in that they formally investigate the macrodynamic effects of consumer debt. Palley develops a multiplier-accelerator model of the cyclical aspects of consumer debt over the business cycle. A rise in consumer borrowing initially increases consumption and thereby promotes growth. Eventually the accumulation of debt becomes excessive: the debt-service burden constrains consumption, which reduces output. Dutt finds somewhat different results in a neo-Kaleckian model: an expansion of worker borrowing raises the growth rate in the short run, but the long-run effect is ambiguous. In any model that acknowledges the relatively high propensity to consume of workers, we may see such differences between short-run and long-run outcomes. Higher worker debt implies contractionary income-distribution effects: interest on the debt shifts income from workers to rentiers, who have a higher propensity to save. Our model of worker borrowing includes such distributional effects of consumer debt, and we simultaneously con-

sider corporate debt dynamics.

Our paper is organized as follows. Section 2 presents the theoretical framework. We weave together disparate threads from the existing literature by developing a neo-Kaleckian growth model with both consumer and corporate debt. Section 3 analyzes the comparative statics of temporary equilibrium, while section 4 explores the model dynamics. Section 5 summarizes our results and offers some concluding comments.

2 Theoretical Framework

Neo-Kaleckian models of growth and distribution were initiated by Asimakopulos (1975) and Del Monte (1975). Key early contributions include Rowthorn (1982), Dutt (1984), Taylor (1985), and Bhaduri and Marglin (1990). Blecker (2002) provides a critical survey of later extensions. Key features of these models include demand-driven output and growth, a role for profitability in the accumulation process, and the importance of income distribution for macroeconomic outcomes.

A few recent contributions to this literature have examined the role of corporate debt or, to a lesser extent, consumer debt (Dutt, 2005, 2006; Hein, 2006; Charles, 2008a,b). These studies provide natural reference points and building blocks for our formal model. We incorporate the dynamics of *both* corporate debt and consumer debt in an analytically tractable model. The resulting model extends the neo-Kaleckian literature on debt dynamics. In this section we lay out our accounting framework and present our basic model structure.

2.1 Social Accounting Matrices

We begin laying out the model by providing a basic accounting framework, which closely follows Lavoie and Godley (2002). We distinguish four types of agents in this model: workers, rentiers, banks, and non-financial firms. To focus our discussion on the role of consumption and investment behaviors, we model a closed economy with no government contribution to

aggregate demand.

Table 1 is the balance sheet matrix for our model economy. It shows the asset and liability allocations across our four types of agent. We consider three fundamental classes of assets: physical capital (K), net loans to households and firms (D_W and D_F), and the net bank deposits of rentiers ($D_W + D_F$). A column sum for a class of agent produces its net worth, while a row sum (across workers, rentiers, banks, and firms) produces the net value of a class of assets. Note that we do not assume that the measured net worth of firms is zero.

[Table 1 about here.]

Associated with this balance sheet matrix is the transaction flow matrix in table 2. Household real wage income ($W_r L$) can be supplemented by new borrowing ($\dot{D}_W$) to finance the sum of consumption (C_W) and interest on past borrowing (iD_W). Rentiers earn income on their net deposits ($iD_W + iD_F$), which they use for consumption (C_R) or to make new deposits ($\dot{D}_W + \dot{D}_F$). In the case of firms, we distinguish between capital and current transactions. Firms can finance investment (I) with new borrowing ($\dot{D}_F$) or retained earnings (Π_F). As in Hein (2006), there is no publicly held equity; in this sense, capitalists are identical to firms. Related to this, firms retain all earnings net of debt service. For simplicity, a common interest rate (i) applies to consumer and corporate debt, and we do not distinguish between the borrowing rate and the lending rate. For the transaction matrix, we note that the sums across the rows must equal zero as a consistency condition. The columns also sum to zero, reflecting budget constraints.

[Table 2 about here.]

2.2 Banks and Firms

Our specification of banking sector follows Lavoie and Godley (2002), similarly distinguishing the capital and current accounts. We refer to financial intermediaries as “banks” and non-financial businesses as “firms”. All lending is intermediated by the banking sector. Banks are pure intermediaries that do not generate profits: deposit and loan rates are identical. Rentiers hold saving deposits with banks, on which they receive intermediated interest payments. Firms and workers may receive these bank deposits as bank loans, with which they can finance investment or consumption.

Firms are characterized by their investment demand behavior and markup pricing behavior. We treat the pricing behavior of firms in standard neo-Kaleckian fashion: price is a markup over unit labor costs, reflecting an oligopolistic market structure (Harris, 1974; Asimakopulos, 1975).

$$P = (1 + \tau)W_n L/Y \quad (1)$$

Here $P > 0$ is the price level, $W_n > 0$ is the nominal wage, $\tau > 0$ is the constant markup rate (which represents Kalecki’s degree of monopoly), and $L/Y > 0$ is the labor-output ratio (i.e., the inverse of the average product of labor). Such markup pricing behavior implies a standard expression for the gross profit share ($\pi = \Pi/Y$):

$$\pi = \frac{\tau}{1 + \tau} \quad (2)$$

Since the profit share is directly determined by the markup, our exposition below will often treat π as a model parameter. Recalling the discussion in section 2.1, we see that gross profit (Π) is split between retained earnings (Π_F) and debt service (iD_F).

$$\Pi = \Pi_F + iD_F \quad (3)$$

Let $r = \Pi/K$ denote the gross profit rate, $r_F = \Pi_F/K$ denote the retained earnings rate, and

$d_F = D_F/K$ denote the leverage ratio (corporate debt/capital). Then we can decompose the gross profit rate into the sum of the retained earnings rate and the average cost of capital.

$$r = r_F + id_F \quad (4)$$

The retained earnings rate plays a central role in our characterization of investment demand. Many empirical studies find retained earnings or “cash flow” to be an important determinant of investment (Fazzari and Mott, 1986-1987; Fazzari et al., 1988; Chirinko and Schaller, 1995; Ndikumana, 1999; Chirinko et al., 1999). As in Jarsulic (1996) and Charles (2008a), our desired investment rate ($g_K = I/K$) therefore responds to the retained earnings rate (r_F).

$$g_K = \kappa_0 + \kappa_r r_F \quad (5)$$

Here κ_0 captures “animal spirits” (the state of business confidence), and κ_r captures the sensitivity of desired investment to retained earnings. The parameters are positive, and we will make the standard assumption that $\kappa_r < 1$.³

Note that the gross profit rate can be simply expressed in terms of the capacity utilization rate ($u = Y/K$). This allows us to reduce the expression for the retained earnings rate and thereby for the accumulation rate.

$$r = \pi u \quad (6)$$

$$r_F = \pi u - id_F \quad (7)$$

$$g_K = \kappa_0 + \kappa_r(\pi u - id_F) \quad (8)$$

2.3 Workers and Rentiers

As indicated by the social accounting matrix in table 2, workers can borrow to raise their consumption above their current income. Correspondingly, workers must pay interest on any outstanding consumer debt. As Dutt (2006) emphasizes, the traditional neo-Kaleckian

consumption function—in which workers consume all their wage income each period—does not allow for these considerations. To allow for debt financed consumption, we incorporate two modifications of the aggregate consumption function: we explicitly account for the payment of interest on consumer debt, and we include a term that captures the influence of aggregate credit conditions on consumer spending.⁴

$$C_W = W_r L - iD_W + \theta(\overline{D_W} - D_W) \quad (9)$$

The term $W_r L - iD_W$ is after-interest disposable income. Here $\theta > 0$ is an adjustment coefficient, and the “aggregate credit target” $\overline{D_W}$ summarizes current consumer-credit conditions in the macroeconomy. Our formulation of the consumption behavior of workers encompasses models that constrain it to equal current wages (with $D_W, \theta = 0$).

When accumulated consumer borrowing is below the credit target, the average consumer can borrow, allowing the aggregate consumption of workers to exceed their after-interest disposable income.⁵ When there is an increase in $\overline{D_W}$, consumption spending increases. Note that $\overline{D_W}$ regulates credit flows but not the outstanding stock of credit, which is determined historically.

Recall that the workers’ budget constraint from Table 2 requires that $\dot{D}_W = C_W + iD_W - W_r L$. Therefore (9) implies a simple adjustment process for consumer indebtedness, similar to the continuous time formation of Dutt (2005) and the discrete time formulation of Palley (1994).

$$\dot{D}_W = \theta(\overline{D_W} - D_W). \quad (10)$$

From (2) we know the share of real wages in income is $1 - \pi = 1/(1 + \tau)$, so we can rewrite the worker’s consumption function (9) as

$$C_W = (1 - \pi)Y - iD_W + \theta(\overline{D_W} - D_W) \quad (11)$$

In our model, rentiers are the recipients of interest income. In contrast with workers, rentiers simply consume a fraction of their interest income.

$$C_R = (1 - s_R)(iD_F + iD_W) \quad (12)$$

Here s_R is the saving rate of rentiers. From a portfolio perspective the model has effectively one asset; rentiers treat consumer debt and corporate debt as perfect substitutes. Recalling that the rentiers' budget constraint in Table 2 requires $C_R = i(D_F + D_W) - (\dot{D}_F + \dot{D}_W)$, we find that (12) implies the following stock/flow linkage:

$$\dot{D}_F + \dot{D}_W = s_R i(D_F + D_W) \quad (13)$$

It follows that the saving behavior of rentiers is a key determinant of the growth rate of gross indebtedness in the economy.

3 Temporary Equilibrium

Commodity market equilibrium in this model has a standard representation:

$$Y = C_W + C_R + I \quad (14)$$

As usual, we restrict our analysis to economically meaningful conditions by assuming aggregate demand is positive. Substituting from the consumption equations (11) and (12) and normalizing all variables by the capital stock produces our preferred representation of commodity market equilibrium.

$$u = (1 - \pi)u - id_W + \theta(\overline{d_W} - d_W) + (1 - s_R)i(d_W + d_F) + g_K \quad (15)$$

Recall that $u = Y/K$ denotes capacity utilization. Here $d_W = D_W/K$ denotes the normalized indebtedness of workers and $\overline{d_W} = \overline{D_W}/K$ denotes the exogenous consumer credit target. (Exogeneity of $\overline{d_W}$ implies that $\overline{D_W}$ is scaled to the size of the economy.) After substituting from the investment demand equation (8) and solving for u , we find a reduced form expression for capacity utilization. (We follow Hein (2006) and Charles (2008a) in treating i as an exogenous policy variable.)

$$u = \frac{1}{\pi(1 - \kappa_r)} [\theta(\overline{d_W} - d_W) - s_R i d_W + (1 - s_R - \kappa_r) i d_F + \kappa_0] \quad (16)$$

Substituting (16) into (6), (7), and (8), we produce reduced forms for the profit rate, the retained earnings rate, and the accumulation rate.

$$r = \frac{1}{1 - \kappa_r} [\theta(\overline{d_W} - d_W) - s_R i d_W + (1 - s_R - \kappa_r) i d_F + \kappa_0] \quad (17)$$

$$r_F = \frac{1}{1 - \kappa_r} [\theta(\overline{d_W} - d_W) - s_R i (d_W + d_F) + \kappa_0] \quad (18)$$

$$g_K = \frac{1}{1 - \kappa_r} [\kappa_0 + \kappa_r \theta(\overline{d_W} - d_W) - \kappa_r s_R i (d_W + d_F)] \quad (19)$$

3.1 Comparative Statics

This section presents the comparative static analysis of temporary equilibrium. When possible, we sign the response of u , r , and g_K to changes in the model parameters. Table 3 summarizes the results.⁶

[Table 3 about here.]

It is straightforward to sign most of the comparative statics. The interest rate proves most ambiguous. Consider first the effect of an increase in i . This affects the economy through a consumer debt channel and a corporate debt channel.

Consider first the consumer debt channel. For any positive level of consumer debt, a higher interest rate increases rentiers' income and correspondingly reduces workers' after-interest disposable income. The net effect is lower effective demand, since workers have a higher marginal propensity to consume than rentiers.

Consider next the corporate debt channel. An increase in the interest rate causes a reduction in retained earnings for any positive level of corporate debt, and hence a fall in investment demand. On the other hand, there is a corresponding increase in rentiers' consumption, since they are now collecting more interest income from firms.

Generally, the net effect is ambiguous, as indicated in Table 3. Looking at equation (16), we see that this ambiguity arises from the term $(1 - s_R - \kappa_r)$. Although both κ_r and s_R are less than one, their sum may well exceed 1. At issue is whether increased corporate debt payments reduce investment more than they raise rentier consumption. (See Onaran et al. (2011) for a recent discussion.) A key assumption of Charles (2008a) is that they do: $(1 - s_R - \kappa_r) < 0$. (This also corresponds to the “normal case” of Hein (2006).) For ease of reference, we will refer to this as the “rentier-saving assumption”. For $d_F > 0$, this assumption ensures a negative impact of interest rate through the corporate debt channel. If we also have $d_W > 0$, this further ensures a negative overall affect on u and r . For reasons explained in the next section, it is also interesting to note that if $d_W = -d_F > 0$ then the effect is definitely negative.⁷

Related but simpler considerations apply to the impact effect of change in corporate debt. Higher corporate debt results in higher interest payment for firms, cutting retained earnings and reducing accumulation. At the same time, it also results in higher interest income for rentiers, leading to higher consumption. The overall impact on u and r is therefore ambiguous. Taylor (2004) suggests distinguishing between debt-led and debt-burdened effective demand, which depends on the relative magnitudes of these effects. Here we find it necessary to draw a slightly finer distinction. In general, higher corporate debt has an ambiguous effect on effective demand. Under the rentier-saving assumption, however, the ef-

fect is definitely negative. Furthermore, even without the rentier-saving assumption, greater corporate debt suppresses growth by suppressing the accumulation rate. In this sense growth is definitely debt-burdened.

The effects of consumer indebtedness are somewhat easier to trace. An increase in the credit target $\overline{d_W}$ allows workers to increase their consumption spending. The resulting increase in effective demand increases capacity utilization, which in turn increases the profit rate and thereby the rate of accumulation. (Dutt (2006) obtains a similar result in a model of consumer debt.) Unsurprisingly then, an increase in the level of consumer indebtedness (d_W) has the opposite effects. Higher consumer debt implies higher interest payments for workers and more income for rentiers. Since workers have the higher propensity to consume, this reduces total consumption. The result is lower capacity utilization, retained earnings, and investment.

Finally, an increase in the profit share (π) redistributes income away from workers, reducing consumption demand. This decline in effective demand reduces capacity utilization in proportion. As in Charles (2008a), our neo-Kaleckian model of debt dynamics is wage-led or “stagnationist” (Bhaduri and Marglin, 1990; Blecker, 2002).

4 Dynamics

In this section we analyze the debt-dynamics implied by our model. The debt accumulation of firms, $\dot{d}_F$, is determined by the transactions flows in Table 2. We see that when investment spending exceeds retained earnings, firms must engage in debt finance. We therefore have

$$\dot{d}_F = g_K - r_F - g_K d_F \tag{20}$$

Although (20) is simple and intuitive, when we combine it with the behavior of consumer debt, the dynamics become somewhat complex. We will therefore first consider a special case: the model in the absence of consumer debt. This will serve two purposes. First, the

model without consumer debt is more easily compared to the extant neo-Kaleckian literature on debt dynamics, most of which focuses on the role of corporate debt (Lavoie, 1995; Hein, 2006; Charles, 2008a,b). Second, the special-case dynamics provide a point of comparison for the dynamics of the full model, which will illustrate how the addition of consumer debt alters the short-run and long-run predictions of the model.

4.1 The Case of $d_W = 0$

In the absence of consumer debt, the consumption functions for workers and rentiers simplify:

$$C_W = W_r L \quad (21)$$

$$C_R = (1 - s_R) i d_F \quad (22)$$

The rest of the structural model is unchanged. We can now simplify (16)–(19), the temporary-equilibrium solutions for capacity utilization (u), the profit rate (r), the retained earnings rate (r_F), and the investment rate (g_K).

$$u = \frac{1}{\pi(1 - \kappa_r)} [(1 - s_R - \kappa_r) i d_F + \kappa_0] \quad (23)$$

$$r = \frac{1}{(1 - \kappa_r)} [(1 - s_R - \kappa_r) i d_F + \kappa_0] \quad (24)$$

$$r_F = \frac{1}{1 - \kappa_r} (-s_R i d_F + \kappa_0) \quad (25)$$

$$g_K = \frac{1}{1 - \kappa_r} (\kappa_0 - \kappa_r s_R i d_F) \quad (26)$$

The comparative statistic results in Table 3 are preserved. The dynamics of this special-case model are summarized by the behavior of d_F . From (25) and (26) we see that $g_K - r_F = s_R i d_F$, which we combine with (20) to conclude that

$$\dot{d}_F = (s_R i - g_K) d_F \quad (27)$$

This suggests two steady states. The first (d_{F1}) involves the natural steady-state condition

$$s_R i = g_K \quad (28)$$

This just says that in a steady state, debt must grow at the same rate as the capital stock.

In the second steady state ($d_{F2} = 0$), investment is financed purely by internal funds.

Substituting from (26) into (28) and solving for d_F produces

$$d_{F1} = \frac{\kappa_0 - (1 - \kappa_r)s_R i}{\kappa_r s_R i} \quad (29)$$

Thus d_{F1} could be either positive or negative depending on the magnitude of κ_0 relative to $(1 - \kappa_r)s_R i$. Note that κ_r , s_R , and i are fractions, which makes the term $(1 - \kappa_r)s_R i$ very small. We therefore assume

$$\kappa_0 > (1 - \kappa_r)s_R i \quad (30)$$

This means that animal spirits are high enough to ensure $d_{F1} > 0$, and that the capital stock is partly debt financed at this steady state.

Next consider the stability of our steady states. Starting from (27) then substituting from (26) and (29), we can write

$$\frac{dd_F}{dF} = -\frac{\kappa_r s_R i}{(1 - \kappa_r)}(d_{F1} - 2d_F) \quad (31)$$

Since we know $d_{F1} > 0$, (31) implies d_{F2} is a stable steady-state. Correspondingly, d_{F1} is an unstable steady state. Figure 1 illustrates this in a univariate phase diagram.

It is easy to understand why the steady-state at d_{F1} is unstable. At this steady state, the saving of rentiers is just adequate to meet the demand to debt finance the capital stock. Consider a slight reduction in d_F , attributable to a decline in D_F . This reduces the debt-service payments of firms, which then have more internal funds available for investment. The capital stock grows more quickly in response, driving d_F lower yet.

[Figure 1 about here.]

Our special-case ($d_W = 0$) model bears a substantial resemblance to the model of Hein (2006). However our results differ. First of all, our comparative statics results do not show any possibility of a positive relationship between the interest rate and the accumulation rate (Hein’s “puzzling case”). This difference traces to the absence in our model of an explicit accelerator effect, which Hein includes in his investment function. There is also a difference in the steady state properties: our model cannot possess a stable steady state at a positive debt-capital ratio, while a stable steady state at a positive level is a possibility and a focal point of the analysis in Hein’s study.⁸

Our special-case model also bears comparison to Charles (2008a). Charles includes an endogenous retention ratio, but if we restrict the retention ratio to unity ($s_f = 1$), his model becomes essentially identical to our special-case model. Charles reports the existence of multiple equilibria, with the unstable equilibrium at higher levels of the corporate leverage and retention ratios. This result depends on the magnitude the exogenous interest rate. In our model, the magnitude of the interest rate is irrelevant to the existence of multiple equilibria. Nevertheless, a higher interest rate brings the stable and unstable equilibria closer together, as in Charles’s model.

4.2 Adding Consumer Debt

We have seen that even the special case with only corporate debt has multiple steady states. We now analyze the macrodynamics of the complete model, including both corporate and consumer debt.

Recall that we used the capital financing constraint ($\dot{D}_F = I - \Pi_F$, from the transaction flows matrix) to conclude in (20) that the leverage ratio grows when investment exceeds retained earnings: $\dot{d}_F = g_K - r_F - g_K d_F$. In the absence of consumer debt, we could simply equate rentier saving to the financing needs of firms: this immediately produced (27), from which we derived a reduced form for $\dot{d}_F$. But now rentier saving must finance two types of

loans. To see the implications of this, use the reduced forms for r_F and g_K , (18) and (19), to conclude that

$$g_K - r_F = s_R i(d_W + d_F) - \theta(\overline{d_W} - d_W) \quad (32)$$

Once again we have a natural interpretation: for capital accumulation to exceed the available internal funds, it must be financed by borrowing. The ability of banks to extend net new loans still depends on the saving of rentiers, but now rentier saving must finance consumption borrowing as well as corporate borrowing.

To produce the reduced form for $\dot{d}_F$, recall from (20) that $\dot{d}_F = (1 - d_F)g_K - r_F$, so we can again use (18) and (19) to conclude that

$$\dot{d}_F = \frac{(1 - \kappa_r + d_F \kappa_r)}{(1 - \kappa_r)} [s_R i(d_W + d_F) - \theta(\overline{d_W} - d_W)] - \frac{1}{1 - \kappa_r} \kappa_0 d_F \quad (33)$$

Next consider consumer debt. From the definition of d_W , we see that

$$\dot{d}_W = \theta(\overline{d_W} - d_W) - g_K d_W \quad (34)$$

So we can use (19), our reduced form for g_K , to determine the reduced form for $\dot{d}_W$.

$$\dot{d}_W = \frac{1}{(1 - \kappa_r)} [(1 - \kappa_r - \kappa_r d_W) \theta(\overline{d_W} - d_W) + \kappa_r s_R i d_W (d_W + d_F) - \kappa_0 d_W] \quad (35)$$

4.2.1 Steady States

Steady states lie at the intersection of the nullclines, $\dot{d}_F = 0$ and $\dot{d}_W = 0$, and so must satisfy the necessary condition $\dot{d}_F + \dot{d}_W = 0$. Combining our two equations of motion, (33) and (35), we find

$$\dot{d}_F + \dot{d}_W = (s_R i - g_K)(d_F + d_W) \quad (36)$$

Recalling our discussion of (27), this again suggests two different type of steady states: one type where $s_R i = g_K$, and one type where $d_F + d_W = 0$. In the first type of steady state,

debt must grow at the same rate as the steady-state capital stock. At the second type of steady state, we have a kind of “euthanasia of the rentier”. (The steady-state values of the variables d_W and d_F have the same magnitude but opposite signs, so net rentier income is zero.)

We now consider the individual nullclines in more detail. Equation (33) implies that along the $\dot{d}_F = 0$ nullcline we have

$$d_W|_{\dot{d}_F=0} = \frac{1}{s_R i + \theta} \left[\theta \bar{d}_W - s_R i d_F + \frac{\kappa_0 d_F}{1 - \kappa_r + \kappa_r d_F} \right] \quad (37)$$

That is, d_W is a nonlinear function of d_F along the nullcline. Similarly, along the $\dot{d}_W = 0$ nullcline we have

$$d_F|_{\dot{d}_W=0} = \frac{-1}{\kappa_r s_R i d_W} [(1 - \kappa_r - \kappa_r d_W) \theta (\bar{d}_W - d_W) - \kappa_0 d_W] - d_W \quad (38)$$

That is, d_F is a nonlinear function of d_W along this nullcline.

Due to the nonlinearities in the system, there are three steady state solutions. Recalling our discussion of (36), consider first a steady state characterized by the condition $g_K = s_R i$. This is particularly easy to find, because after setting $\dot{d}_W = 0$ in (34) we can use this condition to solve for d_W as

$$d_W^B = \frac{\theta}{s_R i + \theta} \bar{d}_W \quad (39)$$

Again using our condition $g_K = s_R i$ but now invoking (19), we find that (39) implies the corresponding steady state value of d_F .

$$d_F^B = \frac{1}{\kappa_r s_R i} [\kappa_0 - (1 - \kappa_r) s_R i] \quad (40)$$

The point (d_F^B, d_W^B) is represented by point B in Figure 2, which illustrates the phase diagram for this system. From (39) and (40) we see that at point B we have $d_W > 0$ and $d_F > 0$. (Recall (30), and see the upcoming discussion of stability for details.)

[Figure 2 about here.]

To find the other two steady states, we set $\dot{d}_F = 0$ and $\dot{d}_W = 0$ in (33) and (35), and we additionally impose the condition that $d_W + d_F = 0$. We find

$$d_F = -d_W = -\frac{\kappa_0 + \theta(1 - \kappa_r + \kappa_r \overline{d_W}) \pm \sqrt{\delta}}{2\kappa_r \theta} \quad (41)$$

where

$$\delta = [\kappa_0 + \theta(1 - \kappa_r + \kappa_r \overline{d_W})]^2 - 4\overline{d_W}(1 - \kappa_r)\kappa_r\theta^2 \quad (42)$$

These steady states are represented by points A and C in Figure 2, the phase diagram for the debt dynamics of our model. From (41) we know $d_F < 0$ and $d_W > 0$ at A and C.⁹ It also follows that $d_W^A < \overline{d_W}$ and $d_W^B > \overline{d_W}$. We might say that steady state C is characterized by excessive debt accumulation, in the sense that d_W exceeds the value targeted under the prevailing consumer credit conditions.

4.3 Stability

We conduct our stability analysis by considering linear approximations to our nonlinear system near the steady states. Characterize our system as

$$\dot{d}_F = \mathcal{F}(d_F, d_W, \dots) \quad \dot{d}_W = \mathcal{W}(d_F, d_W, \dots) \quad (43)$$

Stability of the system near a steady state is determined by the system Jacobian:

$$J(d_F, d_W) = \begin{bmatrix} \mathcal{F}_{d_F} & \mathcal{F}_{d_W} \\ \mathcal{W}_{d_F} & \mathcal{W}_{d_W} \end{bmatrix} \quad (44)$$

where

$$\begin{aligned}
\mathcal{F}_{d_F} &= \frac{1}{(1 - \kappa_r)} [-\kappa_0 - \kappa_r \theta (\overline{d_W} - d_W) + (1 - \kappa_r) s_R i + \kappa_r s_R i (d_W + 2d_F)] \\
\mathcal{F}_{d_W} &= \frac{(\theta + s_R i)}{(1 - \kappa_r)} (1 - \kappa_r + \kappa_r d_F) & \mathcal{W}_{d_F} &= \frac{d_W \kappa_r s_R i}{(1 - \kappa_r)} \\
\mathcal{W}_{d_W} &= \frac{1}{(1 - \kappa_r)} [(\kappa_r - 1) \theta - \kappa_0 - \kappa_r \theta (\overline{d_W} - 2d_W) + \kappa_r s_R i (2d_W + d_F)]
\end{aligned} \tag{45}$$

Consider the steady state B in Figure 2, characterized by the condition $g_K = s_R i$. We evaluate the Jacobian at (d_F^B, d_W^B) , using the steady state values (39) and (40).

$$J^B = \frac{1}{1 - \kappa_r} \begin{bmatrix} \kappa_0 - (1 - \kappa_r) s_R i & \kappa_0 (1 + \theta / s_R i) \\ \overline{d_W} \kappa_r s_R i \theta / (s_R i + \theta) & \kappa_r \theta \overline{d_W} - (1 - \kappa_r) (s_R i + \theta) \end{bmatrix} \tag{46}$$

The determinant is

$$\det J^B = - \frac{(s_R i + \theta) [\kappa_0 - s_R i (1 - \kappa_r)] + \theta i s_R \kappa_r \overline{d_W}}{1 - \kappa_r} \tag{47}$$

Recalling (30), we see that the determinant is certainly negative. This means that the steady state at point B is a saddle point.

Next, consider the two steady states that are characterized by the condition $d_W + d_F = 0$. We find the trace of the Jacobian at point A to be

$$\text{tr} J^A = - \frac{\kappa_0 + 3\sqrt{\delta} - 2i(1 - \kappa_r) s_R - \theta(1 - \kappa_r - \kappa_r \overline{d_W})}{2(1 - \kappa_r)} \tag{48}$$

where δ is defined in (42). Since $\sqrt{\delta} > \kappa_0 + \theta(1 - \kappa_r(1 + \overline{d_W}))$ and since $\kappa_0 > s_R i(1 - \kappa_r)$, we see that the $\text{tr} J^A < 0$. We also find

$$\det J^A = \frac{\sqrt{\delta}(\kappa_0 + \sqrt{\delta} - 2s_R i(1 - \kappa_r) - \theta(1 - \kappa_r - \overline{d_W} \kappa_r))}{2(1 - \kappa_r)^2} \tag{49}$$

and the same considerations tell us $\det J^A > 0$. The negative trace and positive determinant

imply that point A is a stable steady state. Similar arguments tell us that at point C the trace and determinant are positive, so that point C is an unstable steady state.

As in the special-case ($d_W = 0$) model of section 4.1, the key determinant of dynamic stability is the investment financing behavior of the firms. An increase in d_F reduces the retained earning rate r_F , which reduces the investment rate but still induces the firm to borrow more. If investment remains high enough that the capital stock is increasing faster than corporate debt, the increase in the leverage ratio will be reversed. That is the case in a stable region, such as near point A in Figure 2. In an unstable region, however, the process is explosive: rising debt service payments create rising borrowing needs, in a process reminiscent of Minsky's "Ponzi state" of corporate finance.

4.4 Steady-State Responses

In this section we briefly present some steady-state comparative-statics results (sometimes referred to as "comparative dynamics"). Such experiments are sensible only near a stable steady state, so we concentrate our analysis on point A in Figure 2.

Begin by substituting $-d_W$ for d_F in (16)–(19) to obtain the following characterizations of u , r , r_F , and g_K at the steady state positions A and C.

$$u = \frac{1}{\pi(1 - \kappa_r)} \{ \kappa_0 + \theta \overline{d_W} - [\theta + i(1 - \kappa_r)] d_W \} \quad (50)$$

$$r = \frac{1}{(1 - \kappa_r)} \{ \kappa_0 + \theta \overline{d_W} - [\theta + i(1 - \kappa_r)] d_W \} \quad (51)$$

$$r_F = \frac{1}{(1 - \kappa_r)} [\kappa_0 + \theta(\overline{d_W} - d_W)] \quad (52)$$

$$g_K = \frac{1}{(1 - \kappa_r)} [\kappa_0 + \kappa_r \theta(\overline{d_W} - d_W)] \quad (53)$$

In order to calculate the implied steady-state responses, we must account for the long-run endogeneity of d_W . Recall our solution for d_F and d_W at point A, as given by (41). We immediately see that $\partial d_W^A / \partial i = \partial d_W^A / \partial s_R = 0$. Additionally we find

$$\begin{aligned}\frac{\partial d_W^A}{\partial \bar{d}_W} &= -\frac{\kappa_0 - \theta(1 - \kappa_r - \kappa_r \bar{d}_W) - \sqrt{\delta}}{2\sqrt{\delta}} \\ \frac{\partial d_W^A}{\partial \kappa_0} &= -\frac{\kappa_0 + \theta(1 - \kappa_r + \kappa_r \bar{d}_W) - \sqrt{\delta}}{\kappa_r \theta 2\sqrt{\delta}}\end{aligned}\tag{54}$$

(Reverse the signs to get the responses of d_F^A .) Examining (42), we find that we can re-express δ as

$$\delta = (\kappa_0 - \theta(1 - \kappa_r - \kappa_r \bar{d}_W))^2 + 4\kappa_0\theta(1 - \kappa_r)\tag{55}$$

This immediately implies that $1 > \partial d_W^A / \partial \bar{d}_W > 0$. Similarly, we can re-express δ as

$$\delta = (\kappa_0 + \theta(1 - \kappa_r + \kappa_r \bar{d}_W))^2 - 4\theta^2 \bar{d}_W \kappa_r (1 - \kappa_r)\tag{56}$$

which immediately implies that $\partial d_W^A / \partial \kappa_0 < 0$. With this information, we are able to produce the results in Table 4.

[Table 4 about here.]

An increase in the interest rate has a negative effect on the long-run values of capacity utilization and the profit rate, but has no effect on retained earnings and the growth rate. Keep in mind that at point A, firms are net lenders but workers are net borrowers. An increase in the interest rate reduces worker consumption by reducing after-interest disposable income, and the resulting fall in demand depresses capacity utilization. The fall in consumer demand offsets the extra interest income received by firms, so they do not increase investment. Contrast this with the results of Dutt (2006) and Hein (2006). In a model of consumer debt, Dutt finds a negative effect of a higher interest rate on long run growth, while Hein finds a positive effect in a model of corporate debt.¹⁰ Our model includes both consumer and corporate debt, and we find no effect on the steady state growth rate.

In a model of corporate debt with a variable retention ratio, Charles (2008a) finds that positive interest-rate shocks can induce additional equilibria at positive levels of corporate debt. That is not the case in our model. Nevertheless, we do observe an interesting effect on macroeconomic stability. As illustrated in Figure 3, an increase in the interest rate shifts B to B'. This reduces the size of the stable region in the first quadrant. For example, consider an economy initially at point E. Before the illustrated interest-rate shock, the economy is on a stable trajectory. After the shock, the economy is on an unstable trajectory. In this sense, interest-rate shocks can destabilize the macroeconomy.

[Figure 3 about here.]

The most prominent results of Table 4 involve the effect of aggregate demand on long-run growth. For example, more ebullient “animal spirits” are represented by an increase in κ_0 . In a neo-Kaleckian macromodel, we expect to find that increased optimism stimulates growth. And indeed, here we find that an increase in κ_0 increases r_F and therefore g_K . The effect on output outweighs the effect on the capital stock, so capacity utilization and the profit rate also increase. These are conventional results from a demand-driven growth model.

[Figure 4 about here.]

Figure 4 illustrates this increase in what Keynes (1936) also called “spontaneous optimism”. This shifts the saddle point from point B to B'. Greater optimism also produces a larger stable region. For example, consider an economy initially at point B, where economic growth just offsets the growth in consumer and corporate debt. A surge in confidence will increase the accumulation rate, driving down d_F and d_W . Conversely a decrease in the state of confidence can shrink the stable region. An economy on a stable macroeconomic trajectory (for example, at point E) can be destabilized by a sizable decrease in confidence.

A final experiment is of particular interest in our model. An increase in the consumer credit target is another possible source of increased demand. The additional demand raises

the retained earnings rate and stimulates growth: g_K definitely increases, even in the long-run. That is, the model predicts that looser consumer credit conditions increase long-run growth. Since both output and the capital stock increase, there is an ambiguous effect on steady-state capacity utilization (and therefore on the profit rate).

Although increased borrowing by workers implies higher consumption, it leads to a shift in income from workers to rentiers, who are higher saving agents. Indeed, in a model of consumer debt dynamics, Dutt (2006, p.355) argues that this mechanism underpins an ambiguity in the impact of looser credit conditions on long-run economic growth. We find that the effect on growth is positive, but we do see an ambiguity in the effect on capacity utilization. Related to this, one might reasonably wonder if whether the resulting increase in d_W might eventually exceed the increase in $\overline{d_W}$, putting additional downward pressure on demand and growth. However we know from (54) that this cannot happen.

[Figure 5 about here.]

Figure 5 illustrates the effect of looser consumer credit conditions. As with an increase in “animal spirits”, we see that an increase in the consumer credit target enlarges the stable region of the economy. For example, consider an economy initially at point B. At that point, the economic growth rate of the economy just offsets increases in consumer and corporate debt. The increase in demand will augment retained earnings and increase investment, reducing the magnitude of d_F and d_W . Similarly, an economy initially at point E is on an unstable macroeconomic trajectory. An increase in the consumer credit target can enlarge the stable region enough to encompass this point. In this sense, looser consumer credit conditions *promote* macroeconomic stability.

In sum, our results suggest that interest rate increases can be destabilizing while increases in autonomous demand can promote system stability (in the sense of increasing the size of the stable region). We explored two sources of increased aggregate demand: a surge in animal spirits, and looser consumer credit conditions. In the context of the present paper, the

second experiment is particularly interesting. Looser consumer credit conditions contribute to macroeconomic stability and long-run growth.

5 Concluding Remarks

Researchers have demonstrated that corporate borrowing behavior is an important determinant of macrodynamic outcomes. The few macroeconomic models that explicitly consider consumer debt find that the willingness of workers to borrow also matters. Related to this, household borrowing has been broadly implicated in the Great Recession of 2007–2009. We therefore weave together threads from the two literatures, developing and analyzing a neo-Kaleckian growth model with consumer as well as corporate debt.

In order to allow ready comparisons to the literature, we initially analyze a restricted version of our model: the special case of no consumer debt. We show that this special-case model has substantial overlap with the existing neo-Kaleckian literature on corporate-debt dynamics, including the existence of multiple steady states.

Despite the apparent complexity of our full model, which considers both consumer and corporate debt, the dynamic analysis eventually proves tractable. We find important similarities to our special-case model. For example, the stable equilibrium is characterized by a kind of “euthanasia of the rentier”.

We also find that some predictions of our model differ from the predictions of existing models. For example, the Dutt (2006) model of consumer debt predicts that higher interest rates reduce long run growth, while Hein (2006) presents a model of corporate debt and predicts a positive effect. In our model of consumer and corporate debt dynamics, we find no interest-rate effect on steady state growth. (However, higher interest rates do reduce capacity utilization and the profit rate, and they can contribute to macroeconomic instability.)

Our analysis suggests that the distinction between consumer and corporate debt is important. Incorporating both into a single model is a substantial extension of the neo-Kaleckian

literature on debt dynamics. In line with the results of simpler models, we find that a surge in animal spirits is good for steady-state growth. Naturally consumer borrowing can also help to sustain aggregate demand, so we suspect and confirm that looser consumer credit conditions have a similar steady-state effect. We also show that such demand augmenting changes enhance the stability of the system, in that they enlarge the stable region. However, a surge in animal spirits must increase long-run capacity utilization and the profit rate, while looser credit conditions may not.

Our model remains tractable despite the presence of both indebted consumers and leveraged firms. Further extensions to the model may push the bounds of analytical tractability. Nevertheless, we close by mentioning a few useful extensions of the model that we would like to pursue. Most important, we would like to include a mechanism to enforce firm solvency outside the steady state. This extension can be expected to introduce substantial additional non-linearity into the model and may require the use of simulation techniques. Related to this, we would like to add portfolio considerations to the behavior of lenders. Highly leveraged firms should face credit rationing unless they have exceptional growth rates. As a final extension of this line of thought, we would like to consider (in Minsky's terms) both borrowers' and lenders' risks. This remains a critical and inadequately recognized limitation of efforts to incorporate Minskyan financial instability in Kaleckian macromodels (Lavoie, 1995; Hein, 2006; Charles, 2008a,b).

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Notes

¹Charles (2008a) endogenizes the retention ratio of the firm. Charles (2008b) links financial structure (as defined by Minsky) to capital accumulation.

²As of the first quarter of 2011, household debt outstanding as a share of GDP is about 89 percent, and the ratio of personal outlays to disposable personal income is about 94 percent. Personal outlays, disposable personal income, and GDP data are available from Bureau of Economic Analysis. Household debt data is available from the Flow of Funds accounts of the United States, published by the Federal Reserve.

³ Such a restriction on the marginal propensity to spend is standard in Neo-Kaleckian macromodels. It is usually justified in terms of an implicit short run stability condition. To see why, let very short term output adjustment ($\dot{u}$) depend positively on excess demand $ed = (C + I - Y)/K$. Examining $d\dot{u}/du$ near an equilibrium, we obtain $\kappa_r < 1$ as a stability condition. This condition ensures that investment responds less strongly than aggregate saving to an increase in capacity utilization. Ceteris paribus, an additional unit of income will generate $(1 - \pi)$ units of consumption and π units of retained earnings, of which $\kappa_r\pi$ will be used for new investment. If we were to have $\kappa_r > 1$, a rise in income would *increase* excess demand.

⁴Our use of the term “credit conditions” is rather broad: it is intended to summarize the financial practices of both lenders and borrowers, as influenced by institutional and cultural norms. (Thus it plays a similar role to the “desired level of borrowing” of Dutt (2006).) Our formulation is a tractable but ad hoc representation of such influences, and a natural extension would be to allow $\overline{D_W}$ to respond to changes in economic conditions. Note that $\overline{D_W}$ is appropriately scaled to the size of the economy, as described in section 3.

⁵Although our aggregate credit target is not the same as a credit limit at the micro level,

we are inclined to find some support for our macroeconomic story in the microeconomic empirical evidence of Gross and Souleles (2002). Using US data on a panel of thousands of individual credit card accounts, they found that consumers increased their credit card debt following increases in their credit limits.

⁶Recall $\kappa_r < 1$. (For a discussion, see footnote 3.)

⁷ With positive net debt, in contrast to Hein’s model, our model does not suggest any possibility of a positive response of the accumulation rate to an increase in the interest rate. (This is the “puzzling” case of Lavoie (1995).) To produce that, we could add an accelerator effect to our investment function (i.e., a positive response of the accumulation rate to u). Hein also includes a positive response of the markup to the interest rate, but we consider the evidence to speak against that assumption (Nekarda and Ramey, 2010).

⁸ Comparison with the reported results of Hein (2006) is complicated by lacunae in his discussion. Hein’s model could have a steady state at a negative leverage ratio. He gives little attention to this possibility, and he ignores a steady state at zero leverage level. Related to this, his discussion of stability of equilibrium depends on an implicit assumption that the equilibrium leverage ratio must be positive. (That is, in his notation, he requires $d\hat{\lambda}/d\lambda < 0$ rather than $d\dot{\lambda}/d\lambda < 0$.) Comparing his equation (22) to our equation (31) by setting his $\beta = 0$, we see that his stability analysis is problematic. In this sense, our explication of our special-case model provides a partial correction of Hein’s analysis.

⁹This follows from $[\kappa_0 + \theta(1 - \kappa_r + \kappa_r \overline{d_W})] > \sqrt{\delta} > 0$. To see that $\delta > 0$, expand δ and then regroup to get $\delta = [\kappa_0 + \theta(1 - \kappa_r(1 + \overline{d_W}))]^2 + 4\kappa_0\theta\kappa_r\overline{d_W}$, which is positive since all parameters are positive.

¹⁰However, recall our discussion in footnote 8.

A Tables and Figures

A.1 Tables

Table 1: Balance Sheet Matrix

	Workers	Rentiers	Firms	Banks	Sum
Capital	0	0	K	0	K
Deposits	0	$D_W + D_F$	0	$-(D_W + D_F)$	0
Loans	$-D_W$	0	$-D_F$	$D_W + D_F$	0
Net worth	$-D_W$	$D_W + D_F$	$K - D_F$	0	K

Table 2: Transaction Flow Matrix

	Workers	Rentiers	Firms		Banks	
			Current	Capital	Current	Capital
Consumption	$-C_W$	$-C_R$	$C_W + C_R$	0	0	0
Investment	0	0	I	$-I$	0	0
Wages	$W_r L$	0	$-W_r L$	0	0	0
Firms' profits	0	0	$-\Pi_F$	Π_F	0	0
Deposit interest	0	$i(D_W + D_F)$	0	0	$-i(D_W + D_F)$	0
Loan interest	$-iD_W$	0	$-iD_F$	0	$i(D_W + D_F)$	0
Deposit flows	0	$-(\dot{D}_W + \dot{D}_F)$	0	0	0	$(\dot{D}_W + \dot{D}_F)$
Loan flows	$\dot{D}_W$	0	0	$\dot{D}_F$	0	$-(\dot{D}_W + \dot{D}_F)$

Table 3: Short-Run Comparative Statics

	κ_0	π	i	d_F	d_W	$\overline{d_W}$	s_R
u	+	-	?	$\text{sgn}(1 - \kappa_r - s_R)$	-	+	$-\text{sgn}(d_F + d_W)$
r	+	0	?	$\text{sgn}(1 - \kappa_r - s_R)$	-	+	$-\text{sgn}(d_F + d_W)$
r_F	+	0	$-\text{sgn}(d_F + d_W)$	-	-	+	$-\text{sgn}(d_F + d_W)$
g_K	+	0	$-\text{sgn}(d_F + d_W)$	-	-	+	$-\text{sgn}(d_F + d_W)$

Table 4: Steady-State Responses

	κ_0	π	i	$\overline{d_W}$	s_R
u	+	−	−	?	0
r	+	0	−	?	0
r_F	+	0	0	+	0
g_K	+	0	0	+	0

A.2 Figures

Figure 1: Univariate Dynamics of Corporate Debt

Figure 2: Two-Dimensional Debt Dynamics

Figure 3: Interest Rate Increase

Figure 4: More Ebullient Animal Spirits

Figure 5: Looser Credit Conditions