

## The Great Moderation and "Falling Off a Cliff": Neo-Kaldorian Dynamics.

January 21, 2010

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Abstract. Following the broad outlines of Kaldor's 1940 model, we develop a simple non-convex macroeconomic model of the Keynesian sort with two stable short-run equilibria. In reference to empirical data, it explains the phenomenon of "falling off a cliff" (such as that perhaps seen during 2007-9) as a leap between equilibrium points, changing both expectations and behavior. Central to the origin of such jumps are endogenous declines in the demand/debt ratio that occur after persistent periods of high employment (cf. Minsky, 1982; Kalecki, 1933) which alter the short-run equilibria. Expectations adjustment allows short-run equilibration, based on a synthesis of the rational and adaptive theories of expectation determination. In addition, bringing in other macroeconomic analysis, the model suggests the likely need for exogenous shocks ("pump-priming") engineered by policy-makers to allow recovery after a steep and sudden recession. The model also allows for milder business fluctuations. But underlying such fluctuations is an asymmetry which implies that it is easier to fall off a cliff than to climb back up afterward.

Keywords: Macroeconomics; Business Cycles; Economic Fluctuations; Catastrophe Theory; Policy; Depression.

JEL Codes: E00, E03, E10, E12, E32, E60.

# The Great Moderation and "Falling Off a Cliff": Neo-Kaldorian Dynamics.<sup>1</sup>

by James G. Devine

"It's fallen off a cliff," [Warren] Buffett said ... "Not only has the economy slowed down a lot, but people have really changed their habits like I haven't seen." (AP, March 9, 2009)

Some economists (e.g., Bernanke, 2004) have dubbed the period of mild business cycles in the United States from 1985 to 2006 the "Great Moderation."<sup>2</sup> This period (the GM) caused macroeconomists to become increasingly complacent about fluctuations and to embrace the Linnaean dictum that "nature makes no sudden leaps" (*Natura non facit saltum*) as applying to a real-world economy. That gradualist theoretical prior was belied when the U.S. and world economies "fell off a cliff" during 2008. Suddenly relevant were cases where nature does make leaps, e.g., punctuated equilibrium in evolution, quantum collapses in physics, earthquakes in geology, and phase changes in chemistry.

Also pertinent is catastrophe theory. Long before that name was coined, Nicholas Kaldor (1940) applied this theory informally. His model described two-way interaction between two variables, implying two stable local equilibria and one unstable one.<sup>3</sup> Dynamics could involve leaps between the equilibrium points driven by endogenous forces.

To help understand the macroeconomics of "falling off a cliff," we adapt his model, while heeding later literature (Chang and Smyth, 1971; Kaldor, 1971; Varian, 1979; and Devine, 1980: 146-59). To temper our model's extreme abstractness, we link it to recent U.S. macroeconomic history making it more relevant. Part of this involves adding shift factors to the model to make it more realistic and complete. One conclusion is that the GM may have created the conditions that caused the Big Fall of 2007-9.

Figure 1 shows the key graph in our model. In simple terms, a Big Fall is represented by a leap from high-employment equilibrium (*H*) to low-employment equilibrium (*L*). As in Buffett's statement above, this Fall involves rapid changes in both behavior and expectations; in the real world, habits would also change drastically.

Such a Fall can arise from *endogenous shocks* due to the accumulation of imbalances during periods of persistent high employment, as during the GM. This process is suggested by the theories of Minsky (1992) and Kalecki (1933). In Aristotelian terms, we see many of the events blamed for the 2008-9 melt-down as only *efficient* causes (straws breaking the camel's back), while seeing the GM as the *material* cause of collapse: the camel's back must have been strained beforehand if a mere straw could break it.<sup>4</sup> That is, the U.S. economy was near collapse before Lehman Brothers tumbled in late 2008.

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<sup>1</sup> Presented at the Loyola Marymount University economics seminar, Nov. 10, 2009. Thanks to Jamie Galbraith, Andy Healey, Dorothea Herreiner, James Konow, Michael Reich, and especially Tom Michl for their comments. Of course, we deserve the blame for what remains.

<sup>2</sup> The name was coined by Harvard's James Stock.

<sup>3</sup> More equilibria may exist, but (like Kaldor) we assume that there are at most three. Because of its multiple equilibria, our model might be called post-Walrasian (Colander, 2006).

<sup>4</sup> The model itself describes Aristotle's *formal* cause. We reject his "final cause" (teleology)..

Not only can collapses be endogenously generated, but given the abruptness and depth of a collapse, the complete model suggests that exogenous shocks (government pump-priming) may be *required* to cause recovery afterwards. A key element is the economy's asymmetrical behavior, i.e., the difficulty of recovery after a Big Fall. The model also helps us understand all phases of "normal" fluctuations: most recessions should be not understood as "falling of a cliff."

As with Kaldor's original paper, we use the model in an informal way, emphasizing the graphical apparatus over math. The aim is more to understand the *mechanisms* causing fluctuations than to predict the economy's actual path. This is partly because our goals are more modest than those that Chang and Smyth (1971) attribute to Kaldor: no claims are made that the model undergoes self-sustaining cycles. In fact, asymmetry suggests that regular cycles cannot happen unless they consistently avoid a catastrophic fall.

Our dynamics are "neo" because the theory behind our model is not the same as Kaldor's, despite a strong family resemblance. We replace his Keynesian saving-investment model without rejecting Keynesianism itself: unlike Walrasian-style "new Classical" and "new Keynesian" models, ours involves quantity adjustment and positive feed-back (rather than price adjustment and equilibration alone).

In the graphs, our *DD* (demand) curve incorporates and replaces Kaldor's similarly-shaped investment function (1940: 81). Its sigmoid shape implies multiple equilibria. Our *AA* line (reflecting the role of the financial system) plays a formal role similar to Varian's linear saving function (1979: 21f). Like Varian's saving function, our *AA* line can rotate clockwise, causing a depression as distinct from a typical cyclical recession. Unlike in Varian (1979), this swing can occur due to endogenous mechanisms.

Responding to Chang and Smyth (1971), Kaldor (1971) noted that we must assume that equilibrium points are attained faster than the curves shift. Thus, an additional equation is needed. Here, this is short-run *expectations determination*, involving a simple synthesis of the rational and adaptive theories of expectations. This is clarified by our division of Kaldor's model into short- and medium-run processes.

The first section presents the model, starting with the time frames used and identification of "fast" and "slow" variables. The main equations and short-run equilibria are then presented. The model is applied in §2, describing medium-run dynamics in a moderate cycle and those that prevail after that cycle is "short-circuited" by a GM. Some endogenous and exogenous causes of the GM are sketched, setting the stage for analysis of the possibilities of recovery after a Fall. Policy conclusions are limned in §3.

## 1. The *DD-AA* Model.

Our model attains equilibrium in the short run, but medium-run processes disturb these equilibria, causing movements of and between them. The aforementioned "endogenous shocks" are endogenous in the medium run but exogenous from a short-run perspective.

### 1.1. Time Frames.

Unlike most models, ours nears having a realistic conception of time: in the real world, fluctuations occur in historical (calendar) time rather than in merely logical (model) time in which processes are easily reversible (cf. Robinson, 1974). Instead of trying to reduce

the former to the latter, we move toward reconciling the two. But the model is far from deterministic: *how long* (in calendar time) it takes for processes to occur is unspecified.

In the short run, aggregate demand ( $\mathbf{D}$ ) at time  $t$  is determined by two variables:

$$\mathbf{D}_t = \mathbf{S}_t + \mathbf{F}_t \quad (1)$$

As usual, the *short run* is defined analytically, not by a calendar: this “run” is defined by constancy of the shift factor ( $\mathbf{S}_t$ ), representing the role of “slow” variables (in catastrophe theory jargon).  $\mathbf{F}_t$  represents the combined effect of “fast” variables that change during short-run equilibration, such as short-run expectations. The time index ( $t$ ) refers to calendar time.

*Medium-run* processes are analyzed using logical time, dropping the index. In this run, all variables held constant in the short run change: these include longer-run expectations and the inflation rate, which can vary either endogenously (due to persistence of a short-run equilibrium) or exogenously.

To focus on fluctuations, we ignore long-run trends: assume the growth rate of potential output ( $\mathbf{Z}$ ) to be zero: both labor productivity and the supply of labor-power are constant when potential is attained. Changing  $\mathbf{D}_t$  thus implies varying labor employment rates up to the limit set by  $\mathbf{Z}$ . In the medium run, industrial capacity ( $\mathbf{K}_t$ ) can exceed  $\mathbf{Z}$ , but the labor constraint prevents capacity from being fully used.

## 1.2. Fast vs. Slow Variables.

Our focus is on the behavior of the non-financial business sector. The model’s financial system is rudimentary: all business assets are tangible and correspond to industrial capacity ( $\mathbf{K}_t$ ), while all business liabilities are purely financial and equal net nominal private-sector debt ( $\mathbf{B}_t$ ).<sup>5</sup> Both are assumed positive, and in line with the Keynesian definition, constant in the short run; their variations change  $\mathbf{S}_t$  but not  $\mathbf{F}_t$ . Business net worth is  $\mathbf{q}_t \cdot \mathbf{K}_t - \mathbf{B}_t$ , where  $\mathbf{q}_t$  is the financial-market valuation of industrial capacity (akin to Tobin’s  $Q$ ). This ratio’s determination and role are left out of the model but appear in the informal discussion, varying with expectations.

Short-run expectations are measured by the expected demand/debt ratio ( $\mathbf{e}_t$ ), which determines both  $\mathbf{F}_t$  and  $\mathbf{q}_t$ . Longer-run expectations are given in the short run.

The aggregate price level is assumed constant in the short run. Thus, real private debt and industrial capacity are constant in this run, while  $\mathbf{D}_t$  refers to real output.

If people have fully adjusted to past experience of constant inflation rates, nominal debt and wages are rising in step with prices. So an economy behaves in much the same way as our model in the short run: any medium-run price rise is like a real-world inflationary impulse (accelerated inflation) and any medium-run decrease in prices is like inflationary deceleration (disinflation). Here, elide the distinction between real-world behavior and the model, i.e., between changing prices and changing inflation rates.

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<sup>5</sup> Liquid assets (money) are ignored. Measurement of the capital stock by full-capacity real GDP gets us beyond familiar aggregation problems for estimating the real capital stock.

Major demand variables also split between fast and slow. Much of private fixed investment reflects longer-run expectations and is part of  $S_t$ , but much is part of  $F_t$ .<sup>6</sup> Part of private consumer demand is part of  $F_t$ , following the multiplier effects of changing fixed investment and short-run expectational and financial changes (wealth effects). The other part is included in  $S_t$ , determined by longer-run expectations, habits, community standards, the availability of consumer credit, and the like.

For government demand, discretionary federal fiscal policy is treated as part of  $S_t$ . The budget's "automatic stabilizers" affect  $F_t$ , moderating its changes. State and local budgets largely impact  $F_t$ , reinforcing changes much the same way that "fast" consumption does.

Finally, the short-run effect of monetary policy is assumed to be nil, and so only affect  $S_t$ . If journalistic folklore is correct that monetary policy only affects aggregate demand after a year, our "short run" is less than a year.

The model totally ignores the roles of foreign trade and domestic income distribution. But these play a role in our informal empirical interpretation.

### 1.3. Key Equations.

$F_t$  is driven by fixed investment and other spending that rises with  $e_t$  but is limited by supply constraints. This variable determines the demand/debt ratio ( $a_t$ ), short-run demand ( $D_t$ ), and  $e_t$  itself, allowing the attainment of equilibrium.

1.3.1. The Demand/Debt Ratio. The *actual* demand/debt ratio equals the ratio of the capacity utilization rate ( $\rho_t = D_t/K_t$ ) and the debt/capacity or leverage ratio ( $\lambda_t = B_t/K_t$ ).

$$a_t \equiv \rho_t/\lambda_t \equiv D_t/B_t \quad (2)$$

With constant  $B_t$ , this implies the *AA* line of figure 1 with the independent variable on the horizontal axis: going through the origin,  $a_t$  rises with  $D_t$ , with slope =  $1/B_t$ .

The demand/debt ratio *expected* to prevail at time  $t$  is  $e_t = a_t^{\text{ex}}$ , where "ex" refers to short-run expectations. As with equation (2), this directly reflects short-run expected capacity utilization ( $\rho_t^{\text{ex}} = D_t^{\text{ex}}/K_t$ ) and the actual leverage ratio ( $\lambda_t$ ). Turn next to the model's two behavioral equations.

1.3.2. Demand. Based on equation (1), the role of expectations in driving fast spending, and supply constraints, the second equation determines the short-run level of demand.

$$D_t = DD(e_t, S_t); \quad DD_1 \geq 0; \quad DD_2 \geq 0. \quad (3)$$

For this *DD* curve, all short-run changes are due to  $e_t$ , measured along the vertical axis. *DD* is not a simple demand curve: it combines effects of rising  $e_t$  on desired demand with decreasing ability to realize it as  $Z$  is neared. See the appendix for a formal explanation.

Rising  $e_t$  increases  $D_t$ . With constant  $\lambda_t$ , demand for new private-sector fixed investment rises with  $\rho^{\text{ex}}$ , as in a flexible accelerator model of fixed investment. This is reinforced by the association of rising capacity use with other factors spurring fixed investment, including improved short-run profitability, cash flow, valuation of industrial capacity

<sup>6</sup> The amount of investment that fits into each category depends on the (calendar) length of the "run."

( $q_t$ ), and investment opportunities (due to faster implementation of technical innovations at high demand). Second, with  $\rho^{ex}$  constant, both  $e_t$  and  $D_t$  rise as  $\lambda_t$  falls. With interest rates constant, higher  $\lambda_t$  increases interest costs, raising the likelihood of cash-flow problems and bankruptcy which discourage new fixed investment.

This discussion suggests a monotonic or even a linear relationship. But when we bring in the effects of economic depression and supply constraints,  $DD$  becomes sigmoid, as in figure 1.<sup>7</sup> This can be seen by examining this curve's main segments as  $e_t$  rises.

At *extremely low*  $e_t$ ,  $DD_1 = 0$  and  $DD$  is vertical due to demand constraints. Here, a rising expected demand/debt ratio does not have a significant impact: because firms expect such a low  $a_t$  in the near future, they shun accumulating new debt and new capacity. Any net investment is rejected as increasing idle capacity, while new debt is seen as being impossible to service. Note, however, that  $D_t > 0$  because  $S_t > 0$  in the short run.

At *medium*  $e_t$ ,  $DD_1 > 0$  and  $DD$  slopes upward because the problem of expected excess capacity relative to debt is seen as increasingly less important as  $e_t$  rises. With more hope that expanded output can be sold, firms see increases in expected demand more positively and so become more willing to borrow and to build new fixed capacity.

At *low-medium*  $e_t$ , firms become increasingly sensitive to  $e_t$  increases as issues of extreme depression become increasingly less important:  $DD$  flattens ( $DD_{11} > 0$ ). At *high-medium* levels, firms become less responsive to changes in  $e_t$ , as supply barriers (discussed next) begin to be encountered ( $DD_{11} < 0$ ).

At *very high*  $e_t$ ,  $DD$  becomes vertical again, now due to supply constraints. Moving east, all factors of production become increasingly utilized, attaining and even exceeding full utilization. Firms may *want* to raise their real spending, but the increasingly general prevalence of *bottlenecks* prevents them from putting desires into action: the production of new capital goods and their delivery is slowed, as are the anticipated times for both installing and making new capital goods useful (testing, tweaking, etc.).<sup>8</sup> This limits the rise of realized demand (actual output).

"Bottlenecks" are constraints imposed by supplies of either fixed capital goods or labor-power. For an individual firm, after being flat with idle capacity, both marginal and average variable cost curves soar with output as full capacity is encountered (Kalecki, 1939).<sup>9</sup> Second, as aggregate demand rises, increasing numbers of the many heterogeneous firms hit full capacity. Third, those firms which hit full capacity use and produce intermediate goods impose higher costs on those using those products as inputs. Initially, these problems hit only a few sectors. At  $Z$ , bottlenecks become general: even if idle industrial capacity exists, firms are unable to use it due to the labor constraint.

Rising demand also implies pressure for higher real wages and higher real raw-material prices, squeezing profits if the inflation rate is constant (or stimulating inflation, if not). If profit squeezes occur, demand falls, all else constant.

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<sup>7</sup> This clarifies Kaldor's (1940: 81) discussion of his investment curve.

<sup>8</sup> This problem is familiar to business: deliveries are slow and contractors take too much time to fulfill commitments, due to shortages of key raw materials and skilled labor-power.

<sup>9</sup> The utilization of both labor-power and fixed capital generally move in step, so that textbook diminishing marginal returns (due to the fixity of inputs) do not occur until full capacity is attained.

1.3.3. To understand expectations determination, review the debate between the adaptive expectations (AE) and rational expectations (RE) theories. Pure AE involves learning in increments:  $\Delta \mathbf{e}_t$  is proportional to the expectations gap ( $\mathbf{g}_t = \mathbf{a}_t - \mathbf{e}_{t-1}$ ). The problem is that under pure AE, approach to expectational equilibrium ( $\Delta \mathbf{e}_t = 0$ ) is like the mythical Achilles trying to catch up with the tortoise: changes split the distance between them during each calendar time-period – but never totally close the gap.

Among others, this problem led to many rejecting of AE in favor of RE (Muth, 1961). Under RE, people know the model's equilibrium (on average), with random error due to incomplete information. If people are able and willing to act on their expectations, this implies a temporary equilibrium, during a shorter period than our short run. Because temporary equilibria change due to the error, any short-run equilibrium point would be at the center of a cloud of constantly-varying temporary equilibria.

The AE model's non-equilibration is a problem if we want to reduce the historical time of AE to the logical (mythical) time of pure equilibrium models. New Classical macroeconomists thus “solve” the Achilles problem by jettisoning historical time altogether, treating the economy as identical to the model. However, the pure RE story cannot be consistent with our model: it can only apply if the equilibrium is unique.

Thus, our model uses *locally rational expectations* (LRE) to complement AE, allowing equilibration. This theory says that if the model persists near a local demand/debt equilibrium (where **AA** and **DD** intersect), firm's decision-makers use their knowledge of what they currently perceive to be the normal workings of the economy (their model of it) to supplement adaptive learning. Thus, as a local equilibrium is neared, its existence becomes more certain, so decision-makers take it more into account.

Represent LRE as saying that adaptation of  $\mathbf{e}_t$  speeds up as it nears  $\mathbf{a}_t$ , i.e., as the model approaches a local demand/debt equilibrium. Becoming more excited by the chance of achieving his goal, Achilles runs faster as he gets closer to the tortoise. Our AE/LRE function is thus as follows:

$$\Delta \mathbf{e}_t = \text{sign}(\mathbf{g}_t) \cdot E(|\mathbf{g}_t|); \quad E(0) = 0; \quad 1 \geq E_1 > 0; \quad E_{11} < 0. \quad (4)$$

$E$  is the positive adaptation function:  $\mathbf{e}_t$  changes with the magnitude of the gap. The final inequality says that a smaller magnitude implies faster adjustment, while the sign of the gap determines adjustment's direction. This allows equilibration: in the figures, expectations adjustment and equilibration are represented by arrows between curves.

Some might add extra terms to (4) to represent longer-term expectations or short-run incomplete information. The first includes not only extrapolation but Keynesian “animal spirits,” the spontaneous optimism and even *hubris* allowing people to cope with real-world uncertainty. But the effect of these expectations on  $\mathbf{e}_t$  is not additive: instead they change decision-makers' *interpretation* of, and response to, short-term expectations. They are thus included as part of  $\mathbf{S}_t$  and shift **DD** for any given value of  $\mathbf{e}_t$ .

Second, adding a stochastic term to represent information problems again implies that a short-term equilibrium is the center of a cloud of temporary equilibria. Since we make no pretensions that the model corresponds directly to real world, focus on the centers alone, leaving the random term implicit. But assume that it has small variance: the model does

not jump randomly between short-run equilibria. This implicit term also allows “wobbles” away from a short-run equilibrium, testing its stability.

#### 1.4. Short-Run Equilibria.

Turn to the nature and stability of short-run equilibria. *Overall equilibrium* has  $\mathbf{a}_t = \mathbf{a}^* = \mathbf{e}_t = \mathbf{e}_{t-1}$ , as at points  $H$ ,  $M$ , and  $L$  in figure 1. There,  $\mathbf{a}$ ,  $\mathbf{e}$ , and the corresponding  $\mathbf{D}$  have  $H$ ,  $M$ , and  $L$  subscripts. Otherwise, equilibrium values are indicated by an asterisk.

Overall equilibrium combines two kinds of equilibria which imply each other. First, in *expectational equilibrium*,  $\Delta \mathbf{e}_t = 0$ . This can occur only in *demand/debt equilibrium*, where  $\mathbf{a}$  is determined by intersection of  $AA$  and  $DD$ : its actual value ( $\mathbf{a}^*$ ) is determined by the current level of demand ( $\mathbf{D}^*$ ), following the  $AA$  line, which equals the expected level of this ratio ( $\mathbf{e}^*$ ) that caused that level of demand to be attained (following  $DD$ ).

Only two of three equilibria (the circled ones) are stable;  $M$  is unstable. Stability is seen by examining points for a given value of demand,  $\mathbf{D}'$ .  $\mathbf{D}'$  implies an actual demand/debt ratio  $\mathbf{a}'$  at point  $Q$  (by  $AA$ ). To have  $\mathbf{D}'$  prevail initially, the expected ratio must be  $\mathbf{e}'$ , at point  $R$  (by  $DD$ ). Thus, at  $\mathbf{D}'$  a positive expectations gap must prevail. So  $\mathbf{e}_t$  rises, following (4). So  $\mathbf{D}_t$  rises (by  $DD$ ), which leads to rising  $\mathbf{a}_t$  (by  $AA$ ). The two demand/debt ratios  $\mathbf{e}_t$  and  $\mathbf{a}_t$  converge, attaining equilibrium at  $H$ .

Thus,  $\mathbf{e}_t$  rises where  $DD$  is below  $AA$  (and *vice-versa*). An equilibrium is stable only if  $AA$  cuts  $DD$  “from above” as at  $L$  and  $H$ , i.e., where  $AA$  is flatter than  $DD$ .

## 2. Applying the Model.

As the GM persisted, most macroeconomists assumed that it was normal and even “natural” – absent exogenous shocks or grossly incompetent policy. This view both mirrored and spurred the “there’s no place to go but up” attitude among non-economists, promoting high demand in the late 1990s and mid-2000s. Our model suggests, however, that such a long-term period of high employment can create the basis for a serious Fall.

### 2.1. Endogenous Shocks.

The consensus ignored the way in which persistent high employment can create economic imbalances:  $\mathbf{a}$  falls, rotating  $AA$  clockwise. Recall equation (2) and start with rising  $\lambda$ : Minsky (1982) found a tendency toward increased leverage and *financial fragility* due to sustained prosperity, moving from “hedge” to “speculative” to “Ponzi” (“Madoff”) finance. With a cycle where recessions are not deep or long enough to purge financial imbalances and fading memories of the Depression, firms raise  $\lambda$ .

This tendency might have been weaker without specific institutions: in recent decades, it was allowed or even encouraged by mutually-reinforcing processes of financial deregulation and innovation. So Minsky’s trend may have played a smaller role and had a lesser impact when finance was more regulated, as before 1980. Also encouraging this drift is the moral hazard problem, i.e., the implicit or explicit promise that the over-leveraged will be bailed out by the government or the Fed (especially if “too big to fail”). However, these trends to a large extent arose endogenously from the political power of

financiers. Thus, the rise of *laissez-faire* financial policy is partly due to the same Minskyan process that caused rising leverage. Palley (2009) summarizes this history.

The rise of *purely* financial fragility (e.g., credit default swaps built on collateralized debt obligations built on simple securitized mortgages) does not raise  $\lambda$  for nonfinancial firms (our concern). However, the financial sector's increased leverage arises from the same processes that Minsky pointed to, while reinforcing the negative effects of falling  $\mathbf{a}$ . Thus, these two trends will be merged in our informal discussion.

Next, all else constant, persistently high  $\mathbf{D}$  goes with sustained high investment. Kalecki (1933) pointed to the eventual positive impact on the capacity to produce (partly reflecting vintage effects, as new capital goods replace the old). Unrelenting high demand also protects much existing obsolete capacity from being purged by "shake out." Either effect boosts full-capacity output ( $\mathbf{K}$ ), lowering  $\rho$  for any given  $\mathbf{D}$ . If  $\mathbf{D} = \mathbf{Z}$ , this problem cannot be mitigated by higher demand. This trend implies *real-sector* fragility.

There is collective action problem here: individual firms may not want to incur excessive debt or unused capacity, but competition encourages these in the aggregate: each firm hopes that others suffer from their effects or can be induced to do so by competition.

Combining these,  $\mathbf{a}$  falls. It does not matter whether the fall is primarily due to  $\lambda$  or  $\rho$ . Recent history suggests that Minsky's tendency dominated.<sup>10</sup> Even so, Kalecki's story played a role, discouraging rises in  $\rho$  that could have counteracted the rising  $\lambda$ . Figure 2 shows data illustrating the combined trend. During the GM, the demand/debt ratio for nonfinancial corporations trended downward, an average annual fall of about 1.3%.<sup>11</sup>

## 2.2. The Typical Cycle.

Figure 1 indicates that  $\mathbf{a}$  also fell before and during recessions (the shaded areas). Then, the ratio temporarily reverses its downward trend. This suggests a story of typical fluctuations: the trend of falling  $\mathbf{a}$  does not persist if it quickly causes a recession, as with rotation from  $AA_0$  to  $AA_1$  in figure 3, lowering  $\mathbf{D}$  once the sloped part of  $DD$  is achieved (with  $DD$  not shifting). Both private debt accumulation and investment slow, so that  $\mathbf{a}$  rises, rotating  $AA$  back toward high employment, back toward  $AA_0$ . This story implies oscillations in which a modest boom is followed by a tame recession and a new tepid boom. This would reinforce the effects of the inventory cycle (ignored here).

Nothing in the math implies an actual cycle. In the literature, cycles are due to adjustment lags. Thus, our lag-less model might imply a medium-term equilibrium, in which trend fall of  $\mathbf{a}$  is prevented by persistently incomplete use of capacity. However, real-world shocks, lags, and policies make it unlikely that this equilibrium persists.

<sup>10</sup> Which dominates depends on how capacity is measured: using a geometric average of historical and current market valuation of fixed capital to estimate  $\mathbf{K}$ , rising  $\lambda$  dominated over the entire GM while falling  $\rho$  was more important during 1998-2006.

<sup>11</sup> From the third quarter of 1983 to the end of 2007, the coefficient for the quarterly time index  $\approx -0.0032$ , with a t-stat  $\approx -11.07$ . Debt = nonfarm nonfinancial corporate business credit market instruments liability (Flow of Funds Accts, series LA104104005.Q). Demand = Gross value added of nonfinancial corporate business (Bureau of Economic Analysis, NIPA table 1.14). Both were seasonally adjusted.

Could the GM have represented as a cycle around this notional equilibrium? In our model, this implies that a trendless  $\mathbf{a}$ . But the data of figure 2 contradict that prediction.

### 2.3. Falling off a Cliff.

The difference between empirical reality and a medium-term equilibrium likely arose because luck and policy persistently short-circuited the usual purging process (which raises  $\mathbf{a}$ ) by increases in demand, so that imbalances accumulated (lowering  $\mathbf{a}$ ).

For given  $DD$ , falling  $\mathbf{a}$  means that demand steadily decreases once the sloped part is attained. Therefore, this trend implies that persistence of high  $\mathbf{D}$  requires rightward or downward shifts of  $DD$  to prevent a slide toward  $\mathbf{H}_1$ . A rightward shift of  $DD$  means higher  $\mathbf{D}$  for each  $\mathbf{e}$ . If the economy starts at  $\mathbf{Z}$  (as in figure 3),  $DD$  cannot shift right. The  $DD$  curve's movement must thus be downward, i.e. solely due to demand increases.

A downward shift (the "new  $DD$ " in figure 3) makes the vertical part of  $DD$  nearer to the abscissa at  $\mathbf{Z}$ : high output coexists with lower demand/debt ratios than before. The shift makes the economy *increasingly tolerant* of increased debt and unused capacity.

As with an addiction, tolerance encourages further abuse: the longer the economy stays at high employment, the more  $\mathbf{a}$  falls. Thus, more downward  $DD$  shifts are required. Eventually, as discussed below, the possibilities of such shifts occurring – or their effectiveness – evaporates: the private economy faces a limit, unknown ahead of time, on how low  $\mathbf{a}$  can go. When it is hit,  $DD$  shifts upward and/or leftward.

To represent the case where  $DD$  first shifts down (to maintain high  $\mathbf{D}$ ) and then up (due to limits just mentioned), assume that the curve does not shift at all, as in figure 4. Thus, we are discussing the impact of falling  $\mathbf{a}$  that is hidden from view by fluctuations of  $DD$ .

As  $AA$  rotates from  $AA_0$  to  $AA_2$ ,  $\mathbf{H}$  and  $\mathbf{M}$  approach each other – until they coincide. Convergence creates equilibrium point  $HM$ . This is *unstable*: both to the right and left,  $\mathbf{a}_t$  is lower than expected. While downward wobbles away from this equilibrium cannot be ruled out, AE says they imply falling  $\mathbf{e}_t$ . This spurs a Big Fall to depression point  $\mathbf{L}$ .

However, movement southwest from  $HM$  due to pure AE may be blocked by rational attraction toward this equilibrium due to LRE. To the extent that such an attraction occurs, it allows  $AA$  to continue rotating. This makes point  $HM$  disappear altogether, implying a *true* fall off the cliff, rather than simply a slide down the slippery slope of  $DD$ . Both expectations and demand fall drastically, each reinforcing the other's changes.

### 2.4. Origins of a GM.

In §C, sustained prosperity was assumed, based on historical experience. To see how a typical cycle becomes a GM, examine forces that can cause long-lasting prosperity. Some result from prosperity itself while others arise from exogenous factors. Also important are limits on these forces, so that  $DD$  eventually shifts left or up, ending a GM. These are all demand-driven shifts, since  $\mathbf{D}$  cannot exceed  $\mathbf{Z}$ .

2.4.1. Endogenous Forces. First, inflation arises if high employment persists due to government or private demand.<sup>12</sup> This lowers expected real interest rates and encourages firms to accumulate nominal debt (which loses value due to inflation) and real capacity (which does not), as seen in the experience with fixed investment during the inflationary 1970s, despite two serious recessions and slumping profitability (cf. Lally, *et al*, 2008).<sup>13</sup> This means that demand increases for any given **e**, so that **DD** shifts right and/or down, preventing any declining **a** from causing a Fall and allowing the fall of **a** to continue.

Continued fall of **a** means that *accelerating* inflation is required to maintain prosperity. But this spurs events such as the Federal Reserve's early-1980s war against inflation. Indeed, rising inflation seems a politically incorrect way to maintain high spending, especially since it hurts powerful financial interests. Because of the self-limiting nature of the inflationary stimulus to prosperity and (more importantly) the mild inflation of recent decades, this phenomenon likely did not cause the real-world GM.

Second, a sustained boom induces optimistic longer-term expectations (and a medium-run rise in **q**). This boosts fixed both investment and consumer spending, shifting the **DD** curve right and/or down. This boom can create a self-feeding circle: it promotes persistent or increased optimism, which encouraging high employment. This meshes well with the role of competitive profit-seeking in pushing a capitalist economy forward.

As before, this process delays a Big Fall. As before, it allows the continued fall of **a**. The ratio's fall requires that longer-run expectations become *increasingly* optimistic to maintain prosperity. But there must be limits to how optimistic longer-run expectations can be. This is especially true since sustained increases in debt, increasing capacity to produce, and even sustained prosperity itself encourage rising skepticism.

Accelerating inflation and increasing optimism are unlikely to persist together, since the former undermines the latter. The limits on both suggest that in order to have a GM, exogenous forces are required.

2.4.2. Exogenous Forces. Political forces may have encouraged the GM. Because monetary and fiscal policies are resultants of a variety of political vectors, they are very hard to see as endogenous: any explanation of them is necessarily *ex post facto*.

First, expansionary monetary policy raises spending by lowering interest rates. Cutting rates also reduces cost pressure from interest payments on profits, as firms refinance, reducing the impact of **λ** on demand. This policy might also cause inflation and longer-term optimism, which boost demand. Unfortunately, it leads to further private debt accumulation and the expansion of fixed capacity so that **a** falls steadily, requiring increasingly expansionary monetary policy to maintain high demand.

Despite increasing imbalances, easy money is spurred by a triumphalist attitude of monetary authorities (as under Alan Greenspan), fears of deflation (as in the early 2000s), the wish to help friendly incumbent politicians with reelection (perhaps as in 2004), and

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<sup>12</sup> Inflation can also hit exogenously, as with oil crises. But to be sustained enough to promote fixed investment spending, it must be accompanied by the persistently high demand.

<sup>13</sup> The ratios of both fixed nonresidential investment and total fixed investment to GDP soared from the 1960s and the 1970s.

fears of any negative effects due to “popping” bubbles (later in the decade). This can also involve denial of bubbles’ existence or helplessness about what to do about them.

Second, expansionary fiscal policy can help sustain prosperity, by directly energizing demand, stimulating longer-term optimism, raising  $q$ , and/or encouraging inflation. This also raises government debt, which does not imply the same fears of bankruptcy that private debt does (at least for a rich country such as the U.S.) But, if it successfully spurs prosperity it also raises private debt and lower  $a$ . This implies that expansionary fiscal policy becomes increasingly required in order to maintain a GM.

Fiscal policy does not explain the prosperity of the 1990s, since during that period, budget deficits fell and became surpluses. Instead, it was abundant inflow of foreign funds that financed the bubble *qua* boom. Expansionary fiscal policy better fit the mid-2000s, which saw tax cuts, a military build-up, and other fiscal stimuli.

Expansionary policy may be a direct response to increased financial fragility and idle capacity. Monetary policy is more likely to be used, due to the Fed’s generally-accepted dominant role in macro-policy (until 2009) and the greater influence of financial interests (which face the direct results of increased fragility) on the central bank. In any event, expansionary policy allows continued increases in fragility and/or capacity, and falling  $a$ . This policy simply promotes the problem it aims to attenuate.

Any inflation encourages the end to expansionary policy. If inflationary acceleration does not occur, perhaps due to a high dollar exchange rate putting a lid on inflation, policy can maintain a GM longer. Of course, during recent decades, the high dollar also depressed net exports, making policy more necessary to preserve a GM.

A third exogenous factor may help explain the GM. Despite generally stagnant wage and salary incomes (except for top earners) after the 1970s, consumer demand rose significantly, from roughly 60% to 70% of GDP. In fact, the mid-2000s prosperity is often dubbed “consumption-led.” To some extent, this occurred due to consumption by the rich and rising labor-force participation. But in the 2000s, the contrast was most likely due to expanding consumer credit. Rising consumer debt occurred due to efforts to maintain living standards, financial innovation, weaker regulations of consumer borrowing (the famous sub-prime loans), and bubble-based increases in the value of consumer wealth (especially housing). Palley (2009) presents one sketch of this process.

Rising consumer indebtedness does not raise the leverage ratio ( $\lambda$ ) but has complementary effects. Increasing consumer debt ratios stimulate aggregate demand, private fixed investment, and  $DD$ , allowing the prosperity’s persistence despite falling  $a$ . These increases also make consumer spending more fragile (prone to fall), as in 2007-09. This limited continued downward movements of  $DD$ .

Whatever the explanation for the GM – and its later bankruptcy – it is beyond our scope to do more than to suggest possibilities. Likely, more than one of the factors discussed played a role, to different degrees. All hit the aforementioned limits on counteracting the falling  $a$  before a leftward  $DD$  are induced. So turn to a Fall’s *aftermath*.

## 2.5. Recovery or Stagnation?

Recent monetary and fiscal policy initiatives may mean that a true Big Fall did not (and will never) happen. But for analytical purposes, assume that we have fallen off the cliff: short-circuiting the typical rollercoaster ride caused the car to fly off the tracks.

Depression point  $L_3$  in figure 5 is a stable equilibrium. Demand is low because of excessive debt and idle capacity, partly caused by low demand. Any rightward demand wobble (with no curve shifts) creates a negative expectations gap and reversion to  $L_3$ .

Further, conflict between endogenous forces muddies the chances of recovery. This implies a positive role for policy. Start, however, with the endogenous forces promoting recovery. Then examine the endogenous depressive forces and policy responses.

2.5.1. Recovery. In the medium run, an endogenous force exists causing  $L$  to move toward recovery: persistent low demand causes  $a$  to rise, swinging  $AA$  counterclockwise (turning back the clock!): slowed debt accumulation and deleveraging coexist with the purging of excess capacity (via scrapping) and very low new investment. Debt accumulation can be negative due to waves of bankruptcy resulting from low demand while bad times lead to conservative finance and even a cut-off of loans (due to bad credit ratings, inadequate collateral, etc.) Rising  $a$  implies a new equilibrium such as  $L_4$ , closer to  $M_4$  than were  $L_3$  and  $M_3$ . Eventually, the two are identical, at  $ML$ . This is unstable, so the economy “jumps up the cliff,” a reversal of figure 4’s Big Fall. The economy recovers, as demand and expectations improve dramatically, soaring to high-employment equilibrium (not shown). Since the  $DD$  curve is vertical at  $Z$ , a high-employment equilibrium should exist.<sup>14</sup>

If this were the complete story, we might see a rough cycle, a more extreme version of the typical one sketched above. The economy would leap from high-employment equilibrium to depression and then back again. This might help explain the cycle seen before 1929, during which government played a small role (except during wars) and the economy went through much larger ebbs and flows than after 1950 (until 2007). Of course, the Great Depressions of 1873-96 and the 1930s deserve special attention in any empirical investigation.

2.5.2. Stagnation. The problem with this cyclical story is that the longer depression persists (which is more likely after a steep dive off a cliff), the more endogenous forces pull the economy downward. First, a sudden Fall followed by depression encourage serious declines in longer-term expectations: waves of bankruptcy, factory closings, hasty deleveraging, and rapid-onset despair cause wider and deeper pessimism and falling  $q$ . The spontaneous optimism and *hubris* that cause booms become gloom and shame. This hurts any spending that was immune to falling short-term expectations.

Second, a Big Fall and severe stagnation can turn business competition on its head. Instead of spending on investment, firms try to raise profits via wage cuts, eventually causing price cuts. With a persistent and/or deep recession, this combination can form a downward wage-price spiral. Such galloping deflation then boosts the real value of outstanding debt, promotes deflationary expectations and delayed spending, and raises

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<sup>14</sup> It may not be attained, of course, if policy-makers slow the economy to avoid inflation.

expected real interest rates.<sup>15</sup> This *debt-deflation depression* (Fisher, 1933) can justify the oft-criticized efforts in the early 1930s to prevent price and wage cuts.

These two forces can – and likely do – impact the economy simultaneously, reinforcing each others' effects. Mass bankruptcy hurt creditors and long-term expectations, while deepening pessimism spurs foreclosures and restricts new loaning. These forces shift **DD** left and upward. A leftward shift decreases **D**, while the upward shift stretches the vertical part of the curve: the same low spending occurs even if **e** is higher than where **DD** gained a positive slope. Absent rotation of **AA**, this deepens the depression.

2.5.3. Asymmetry. Conflict between forces for recovery and those for stagnation makes the story less clear than that of high employment. The economy could go either way. But the conflict makes it significantly easier to fall off a cliff than to climb back up it.

Asymmetry arises first from the difference between the kinds of constraints in the economy. While the movement up to and beyond full capacity has clear negative consequences (inflation), supply-side barriers to the upward movement do not change, except in the rare case of hyperinflation (which hurts the ability to produce). But a downward movement not only creates demand-side barriers (pessimistic expectations, excessive debt, and unused capacity) but can make them get worse over time.

The *impact* of the endogenous forces of inflation and longer-term expectations is also asymmetrical. In encouraging continued prosperity, both rising inflation and optimism have clear limits, while not coexisting with each other. But deflation and pessimism not only reinforce each other but in theory have no limit except where **D** = 0. Smithies (1957) argues correctly that floors exist limiting the economy's fall. But these are less absolute than the limits set by the supplies of factors of production.

What about the independent role of consumer demand? In a depression, consumer credit is severely curtailed, while the prices of consumers' potential collateral (housing, equities, etc.) are depressed. Given these limits, successful efforts to slash wages relative to labor productivity hurt mass consumer demand and make the situation worse, not better. In this *underconsumption trap* (Devine, 1980: 139-45), cutting wages actually reduces employers' profits, in a process akin to that of the paradox of thrift.

2.5.4. Policy. All of this suggests that to get the economy back to high employment, policy-makers must "prime the pump" by shifting **DD** rightward and/or downward.

In depression, monetary policy encounters the zero bound on nominal interest rates along with upward pressure on them by a fear-driven flight to money (Keynes' liquidity trap). Also, just as investment does not respond significantly to rising **e**, the effects of interest-rate cuts are blocked by extreme debt and idle capacity.<sup>16</sup> Thus, fiscal policy is dominant.

Fiscal expansion counteracts both longer-term pessimism and falling prices. It directly shifts **DD** rightward, encouraging attainment of a new stable **H** equilibrium point (helped by any counterclockwise **AA** rotation). This role goes far beyond the textbook Keynesian

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<sup>15</sup> Even a more moderate case of merely slowing inflation (disinflation) increases the real interest burden of already accumulated debt, putting pressure on profits.

<sup>16</sup> In the *lingua franca* of macroeconomics, **LM** is horizontal and **IS** vertical.

story about government deficits raising personal consumption or the use of interest rate cuts to energize private fixed investment. It also allows monetary policy to work.

### 3. Preliminary Conclusions about Policy.

Our model has two main elements. First, there are two short-run equilibria, at high and low employment. Second, there are medium-term dynamics: persistent high employment creates imbalances during the medium run that can convert boom times into recession. Similarly, endogenous medium-term purging of imbalances can convert stagnation into a boom. As in the metaphor above, it is a mistake for policymakers to speed up or even smooth a rollercoaster ride, because these can cause the car to hurtle off the traces.

This makes our model akin to the views of the “Austrian” school and many of the Marxian school (cf. Haberler, 1958). To the first, policy-makers *should not* stabilize the economy. Efforts to maintain high employment are “unnatural” and merely delay and intensify recessions. So “nature” should be allowed to take its course. Some Marxists have a similar message, with a different tone: the authorities *cannot* stabilize the economy forever: business cycles – including a fall off the cliff – are an inherent part of the system that cannot be abolished without ending the reign of capital. As for Austrians, avoiding recessions merely delays the problem, making the inevitable worse.

Both views fit our suggestion that the GM was the material cause of the Fall that started in 2007. But the current model points to a positive role for government: policy can moderate and/or end serious depressions. Policy-makers, who might be seen as “villains” causing a GM and thus a Great Fall, can become necessary “heroes” to clean up the mess afterwards. The problem of distinguishing a mild recessions that purges imbalances and a steep one that causes persistent stagnation is empirical and thus beyond the scope of this paper. It requires finesse, not our model’s high level of abstraction.

Our conclusion may fit a Marxian view because it indicates failure of decentralized capitalism and the need for the state as a helping hand.<sup>17</sup> But it contradicts the Austrian view that full employment is the rule unless the government intervenes in the wrong way.

Asymmetry explains our difference from not only these caricatures, but also from the textbooks’ new Classical and new Keynesian stories. Unlike these, our model posits asymmetry between situations of high demand and those of low demand. Second, depressionary forces can feed on themselves.

Our skepticism about the value of maintaining high aggregate demand over long periods is moderated if the constancy of  $Z$  is dropped. If policy raises private and public investment, that can raise the growth rate of  $Z$ . This might also occur endogenously, as when persistent high demand promotes labor productivity growth (via economies of scale and Verdoorn’s “law,” cf. McCombie, 1987) or raises the growth of the labor-force by reducing the amount of structural or frictional unemployment (cf. Hargreaves Heap, 1980). Of course, the moderation of our conclusion is itself moderated if there are diminishing marginal returns to these effects.

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<sup>17</sup> To Engels (1880, §3), one result of capitalist development was more explicit socialization of production.

## Appendix: Investment and the *DD* curve.

Adapting equation (1), demand is based on the partial-adjustment or flexible accelerator model of aggregate investment to reflect supply constraints:

$$\mathbf{D}_t = \theta(\mathbf{D}_t/\mathbf{Z}) \cdot [\mathbf{K}_t^D - \mathbf{K}_{t-1}] + \delta \cdot \mathbf{K}_{t-1} + \mathbf{S}_t; \quad \mathbf{K}_t^D \geq \mathbf{K}_{t-1} \quad (5)$$

If this equation describes a representative firm's behavior, it determines the demand for real GDP because of the generalized multiplier effects of fixed investment (including the short-term stimulus given to – and resulting from – asset price changes). (The multiplier effect is left implicit here.) Net investment plans depend on the gap between desired capacity ( $\mathbf{K}_t^D$ ) and capacity left over from the past; added to this is the effect of replacement investment, assumed proportional to capacity left from the past (using the positive depreciation rate  $\delta$ ). Medium-term factors ( $\mathbf{S}_t$ ) can also affect demand. The key difference from standard models is the nature of the adjustment coefficient ( $\theta$ ), which itself adjusts: assumed nonnegative, it falls with  $\mathbf{D}_t/\mathbf{Z}$ , the percentage of potential utilized, due to the increasing role of bottlenecks in preventing the realization of spending plans:

$$\theta(0) = 0; \quad 1 > \theta \geq 0; \quad \theta_1 < 0; \quad \theta \rightarrow 0 \text{ as } \mathbf{D}/\mathbf{Z} \rightarrow 1 \quad (6)$$

As in the text, desired capacity is mostly determined in the short run by the expected demand/debt ratio:

$$\mathbf{K}_t^D = f(\mathbf{e}_t, \dots); \quad f_1 > 0 \quad (7)$$

Assuming that spending decisions are made in light of bottlenecks expected to be encountered ( $\mathbf{D}_t^{\text{ex}}/\mathbf{Z}$ ) in the short run, assumed to equal  $\mathbf{e}_t$ , the demand function is:

$$\mathbf{D}^D = \theta(\mathbf{e}_t) \cdot [f(\mathbf{e}_t, \dots) - \mathbf{K}_{t-1}] + \delta \cdot \mathbf{K}_{t-1} + \mathbf{S}_t \quad (8)$$

In the short run,  $\mathbf{K}_{t-1}$  is fixed. Given this, we have a *DD* curve: the term in brackets implies the positive slope of most of the *DD* curve. The vertical part at low  $\mathbf{D}_t$  arises when  $\mathbf{K}_{t-1} \geq f(\mathbf{e}_t, \dots)$  due to low  $\mathbf{e}_t$ . (The floor on fixed investment might be even lower, i.e., where zero gross investment equals zero.) The fall of  $\theta$  to zero as  $\mathbf{e}_t$  rises makes the curve increasing steep as  $\mathbf{D}_t$  rises in the middle range, eventually becoming vertical.

In the medium run,  $\mathbf{K}$  rises due to positive net investment (and falls if net investment is negative). This shifts our *DD* curve.

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