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# DEPARTMENT OF ECONOMICS

## Working Paper

### Increasing inequality and financial instability

By

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AMHERST**

# Increasing inequality and financial instability\*

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## Abstract

Rising inequality affects the composition of asset demands as well as aggregate demand. The poor have few financial assets and their portfolio is skewed towards fixed-income assets. The rich, by contrast, hold a large proportion of their wealth in stocks. Thus, an increase in inequality tends to raise the demand for stocks. This generates capital gains, and these gains can fuel a bubble, as desired portfolios shift further towards stocks.

JEL codes: E11, E21

Key words: earnings inequality, portfolio composition, financial instability

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# 1 Introduction

Most if not all strands of heterodox macroeconomics view the share of profits as an important determinant of aggregate demand and economic performance. The details differ, but the centrality of income distribution is common ground. This emphasis on distribution is surely warranted but it may be a mistake to focus narrowly on the functional distribution. In the US the ‘great compression’ in the 1940s saw earnings inequality plummet, but starting in the late 1970s inequality has risen and is now at levels comparable to those in the 1920s: the income share of the top ten percent fell from about 45 percent in the 1930s to about 32 percent in the period from the late 1940s to the early 1970s, and then rose to above 45 percent in 2008.<sup>1</sup>

The sources of the changes in distribution are hotly debated.<sup>2</sup> This paper, however, focuses on some macroeconomic implications of increasing inequality, and for present purposes the precise reasons for the increase do not matter.

Heterodox models routinely assume different saving rates out of wages and profits, but rising earnings inequality can reduce aggregate demand, even if the functional distribution is unaffected. The stagnationist tendencies can be offset – at least temporarily – by asset market bubbles, and central banks have little incentive to burst the bubbles if demand is weak. In this sense increasing inequality may be said to permit the development of bubbles. In fact, a rise in inequality may also contribute to the initial creation of a bubble if policy makers reduce interest rates in response to a weakening of aggregate demand. Important as the policy-related connections may be, my argument here is different: the size distribution of income may have direct effects on financial markets.

The Survey of Consumer Finances shows that low and middle income groups have few financial assets.<sup>3</sup> Their wealth-income ratio is lower than that of the rich, and the composition of their portfolio is different. Housing makes up a larger fraction, and their holdings of financial assets are skewed towards fixed income assets. The rich, by contrast, hold a large proportion of their wealth in stocks. Thus, in 2001 stockholding households had average net worth that was 3-4 times higher than that of non-stockholding households, and the mean and median share of stocks in financial assets was 9.2 and 0.0, respectively, for households with a head of household aged between 55 and 64 and net worth

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<sup>1</sup>See Alvaredo et al. (2011). This database also shows that a great compression can be observed in other countries and that the recent increase in inequality is widespread.

<sup>2</sup>Mainstream explanations of the rise in inequality give a lot of weight to ‘skill-biased technological change’. But even if technological change has played a role, the critical feature may have been ‘power biases’, rather than skill biases (Skott and Guy 2007, Guy and Skott 2008).

The literature on neoliberalism and financialization has emphasized pressures on the wage share (e.g. Crotty (2005), Palley (2007), Hein (2008) and Epstein and Jayadev (2007)). Outsourcing and the threat of outsourcing, for instance, may have raised firms’ bargaining power. Workers have also been weakened by the institutional changes in the labor market, including a decline of unions and a falling minimum wage. The fall in the minimum wage, moreover, may have hurt low-wage workers in terms of employment as well as wages (Slonimczyk and Skott 2010).

<sup>3</sup>Bucks et al. (2009) present an overview of the findings.

between \$10,000 and \$100,000, but 31.5 and 30.5 percent for households with net worth above \$1 million ((Curcuro et al. (2005, Tables 4 and 6)).

These patterns are what one would expect. Essentially, the poor have few financial assets and their portfolio is skewed towards fixed income assets. The rich, by contrast, hold a large proportion of their wealth in stocks. An increase in inequality therefore tends to raise the demand for stocks and with a given supply, the result is a rising stock market. Boosted by capital gains, the return on equity now rises. The desired portfolio compositions react to the change in relative returns, and this can fuel a bubble as the portfolios now shift further towards stocks. Although intuitively straightforward, the interactions are quite complex and a formalization is useful to examine the argument in greater detail.

Section 2 presents the formal model and Section 3 examines its implications. Section 4 contains a few concluding comments.

## 2 Model

The purpose of the model is quite limited: the focus is on the effects of changes in earnings inequality on asset demands and asset prices. To keep things simple, I assume that aggregate demand follows a steady growth path – through policy or good luck – and that aggregate income grows at the constant rate  $g$ .

There are two distinct groups of households, rich and poor. In both groups consumption is determined by income and wealth, but the rich have a lower consumption propensity out of income,

$$C_P = aY_P + bW_P \quad (1)$$

$$C_R = \gamma aY_R + bW_R \quad (2)$$

where  $C, Y$  and  $W$  denote consumption, income and wealth, respectively, and subscripts  $P$  and  $R$  refer to poor and rich; the parameters  $a, b$  and  $\gamma$  satisfy the inequalities  $0 < a < 1, b > 0, 0 < \gamma < 1$ .

There are two financial assets, bank deposits ( $M$ ) and stocks ( $N$ ), as in Skott (1989). For simplicity, the real rate of return on deposits is zero while the return on stocks comes in the form of a combination of dividends and capital gains. The portfolio composition differs across households, and as an extreme version of the stylized pattern, it is assumed that poor households have only bank deposits while rich households own both deposits and stocks. Thus,

$$M_P = W_P \quad (3)$$

$$M_R = (1 - \alpha)W_R \quad (4)$$

$$vN_R = \alpha W_R \quad (5)$$

$$M = M_P + M_R \quad (6)$$

$$W = W_P + W_R = M + vN \quad (7)$$

where  $v$  is the price of shares and  $N_R$  the number of shares owned by the rich. The portfolio composition of the rich (the value of  $\alpha$ ) is predetermined at any

moment, but a change in the expected rate of return on equity will lead to adjustments in  $\alpha$ .

Households' budget constraints are given by

$$C_P + \dot{M}_P = Y_P \quad (8)$$

$$C_R + \dot{M}_R + v\dot{N} = Y_R \quad (9)$$

Using (1), (3) and (8) the wealth dynamics for the poor is determined by

$$\dot{W}_P = (1 - a) \frac{Y_P}{W_P} - b = (1 - a) \frac{1}{q_P} - b \quad (10)$$

where  $q_P$  is the ratio of wealth to income.

Turning to the rich, we have (using (2), (4)-(5) and (9))

$$\dot{W}_R = (1 - \gamma a) \frac{1}{q_R} - b + \frac{\dot{v}N}{W_R} \quad (11)$$

The term  $\dot{v}N$  represents capital gains on equity holdings, and these capital gains are determined endogenously. The equilibrium condition for the equity market is given by

$$N_R = N \quad (12)$$

where  $N$  is the number of outstanding shares. The rate of (net) new issues in the US is typically low, often negative, and for simplicity,  $N$  is taken as constant. With this assumption, we have

$$\begin{aligned} \dot{v}N &= \dot{\alpha}W_R + \alpha\dot{W}_R \\ &= \dot{\alpha}W_R + \alpha[(1 - \gamma a)Y_R - bW_R + \dot{v}N] \end{aligned} \quad (13)$$

Hence,

$$\frac{\dot{v}N}{W_R} = \frac{\dot{\alpha}}{1 - \alpha} + \frac{\alpha}{1 - \alpha}(1 - \gamma a) \frac{1}{q_R} - \frac{\alpha}{1 - \alpha} b \quad (14)$$

Using (11) and (14) It follows that

$$\dot{W}_R = \frac{\dot{\alpha}}{1 - \alpha} + \frac{1}{1 - \alpha}(1 - \gamma a) \frac{1}{q_R} - \frac{1}{1 - \alpha} b \quad (15)$$

Aggregate income is made up of three components, distributed incomes to the rich, distributed income to the poor and firms' retained earnings. Assuming a constant profit share ( $\pi$ ) and a constant retention rate out of profits ( $s_f$ ), we have

$$Y_R = (1 - s)xY \quad (16)$$

$$Y_P = (1 - s)(1 - x)Y \quad (17)$$

where  $s = s_f\pi$ ,  $Y$  is aggregate income and  $x = \frac{Y_R}{Y_R + Y_P}$  is the share of the rich in distributed income. By assumption aggregate output grows at the rate  $g$ , and it follows that

$$\hat{Y}_R = g + \hat{x} \quad (18)$$

$$\hat{Y}_P = g - \frac{x}{1 - x} \hat{x} \quad (19)$$

Combining (10), (15) and (18)-(19), finally, we get expressions for the growth rates of the two wealth-income ratios,

$$\hat{q}_R = \frac{1-\gamma a}{1-\alpha} \frac{1}{q_R} - \frac{1}{1-\alpha} b + \frac{\dot{\alpha}}{1-\alpha} - g - \hat{x} \quad (20)$$

$$\hat{q}_P = (1-a) \frac{1}{q_P} - b - g + \frac{x}{1-x} \hat{x} \quad (21)$$

### 3 Implications

#### 3.1 Constant $\alpha$

The dynamics of the system (20)-(21) is simple if both  $\alpha$  and  $x$  are constant. In this case equations (20) and (21) constitute two independent first order differential equations. They are both stable and  $q_P$  and  $q_R$  converge monotonically towards the stationary solutions,

$$q_P \rightarrow q_P^* = \frac{1-a}{b+g} \quad (22)$$

$$q_R \rightarrow q_R^* = \frac{1-\gamma a}{b+(1-\alpha)g} \quad (23)$$

The wealth income ratio of the rich exceeds that of the poor for two separate reasons: their consumption rate is lower ( $\gamma < 1$ ) which increases the numerator and they hold part of their wealth in equity ( $\alpha > 0$ ) which reduces the denominator. The first effect is straightforward and the second also has an intuitive explanation. Rising incomes and a constant portfolio composition mean that the rich want to increase the value of both deposits and equity holdings. The increase in deposits requires saving out of current income but since the number of shares is given, the rich as a group cannot buy additional shares. Instead, the desired increase in equity holdings is achieved through capital gains: equity prices are being bid up as the rich try to raise their equity holdings, and this process does not come to halt until the value of their holdings is at the desired level. The induced capital gains reduce the saving rate that is required for wealth to grow at the rate  $g$ .<sup>4</sup>

Note finally, that the steady-state value of the aggregate wealth-income ratio ( $q$ ) is increasing in both  $x$  and  $\alpha$ . This follows directly from the definition of the  $q$  as the weighted average of  $q_P$  and  $q_R$ ,

$$\frac{W}{Y} = q = (1-s)(xq_R + (1-x)q_P) \quad (24)$$

Since output grows at a constant rate, the steady-state increase in  $W/Y$  following a rise in  $x$  must imply a transitory process of increasing wealth and (above steady-state) capital gains to share holders.<sup>5</sup>

<sup>4</sup>This mechanism is at the heart of Kaldor's 'neo-Pasinetti theorem'; Kaldor (1966), Skott (1981).

<sup>5</sup>This can be seen formally from equation (14): an increase in  $x$  implies a drop in  $q_R$  (for given  $W_R$ ), and  $\dot{v}N/W_R$  is decreasing in  $q_R$ .

### 3.2 Endogenous changes in $\alpha$

The desired portfolio composition depends on the expected returns, but the adjustment is unlikely to be instantaneous.<sup>6</sup> Thus, I assume that the change in  $\alpha$  is determined by

$$\dot{\alpha} = \mu(\alpha^*(r^e) - \alpha); \quad \alpha^{*'} > 0, \mu > 0 \quad (25)$$

where  $\alpha^*$  is the desired share of equity and  $r^e$  is the expected rate of return on equity (the return on deposits – the other asset – is taken to be constant at zero).

A standard mainstream assumption of rational expectations makes little sense in a world of profound uncertainty. Instead, real-world expectations seem to have a strong adaptive or conventional element. If returns have been high for a long time, there is a tendency to think that this will continue.<sup>7</sup> Using a simple adaptive specification, I assume that

$$\dot{r}^e = \lambda(r - r^e) \quad (26)$$

where  $r$  is the current rate of return on equity. From the definitions  $s = s_f \pi$ ,  $x = Y_R/(R+Y_P)$  and equations (5), (14) and (16), it follows that the current return can be written

$$\begin{aligned} r &= \frac{(1 - s_f)\pi Y}{vN} + \hat{v} \\ &= (1 - s_f)\pi \frac{Y}{Y_R + Y_P} \frac{Y_R + Y_P}{Y_R} \frac{Y_R}{W_R} \frac{W_R}{vN} + \frac{\hat{v}N}{W_R} \frac{W_R}{vN} \\ &= \left[ \frac{\pi - s}{1 - s} \frac{1}{x} \frac{1}{\alpha} + \frac{1 - \gamma a}{1 - \alpha} \right] \frac{1}{q_R} + \frac{1}{1 - \alpha} (\hat{\alpha} - b) \end{aligned} \quad (27)$$

Equation (27) gives  $r$  as a function of  $\alpha$ ,  $q_R$  and  $\hat{\alpha}$ . Hence, substituting (27) into (26), equations (20), (25) and (26) constitute a three dimensional system of differential equations in  $r^e$ ,  $\alpha$ ,  $q_R$ .<sup>8</sup> The system has a unique stationary solution with  $\alpha > 0$ , and the Routh-Hurwitz conditions for local stability are satisfied if the portfolios respond slowly to changes in current returns. This response is determined by  $\lambda$ ,  $\mu$  and  $\alpha^{*'}$ , and given any two of these, local stability can be achieved by reducing the third sufficiently (see Appendix A). These results are not surprising. If  $\lambda = 0$ , the system becomes two dimensional and this new 2D system is recursive: for a given  $r^e$  equation (25) is a stable one-dimensional equation in  $\alpha$ , and for a given  $\alpha$  equation (20) is a stable equation in  $q_R$ . From the Routh-Hurwitz conditions for the original 3D system it can also be seen, however, that stability can easily be lost for high values of  $\lambda$ ,  $\mu$  or  $\alpha^{*'}$ .

<sup>6</sup>The adjustment may be gradual partly because households do not keep continuous track of their own financial wealth (Kennickell and Starr-McCluer, 1997).

<sup>7</sup>Conventional elements in a slightly different form are central to Minsky's financial instability hypothesis, and the specifications in this section have similarities with Ryoo's (2010) model of a Minskian long wave.

<sup>8</sup>For simplicity, I consider the effects of a change in the level of  $x$ . A change in  $\hat{x}$  would complicate the analysis since the system fails to be autonomous if  $\hat{x} \neq 0$ .



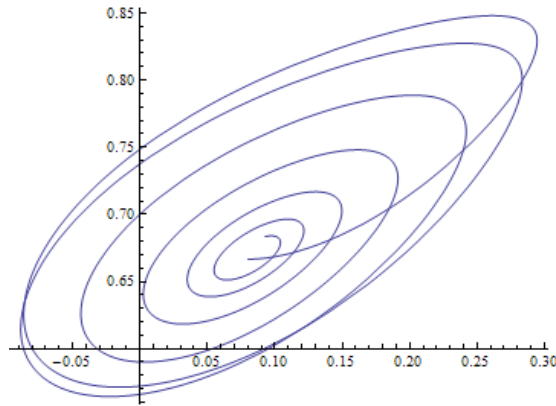


Figure 1a: Initial value  $q_R = 4.1$

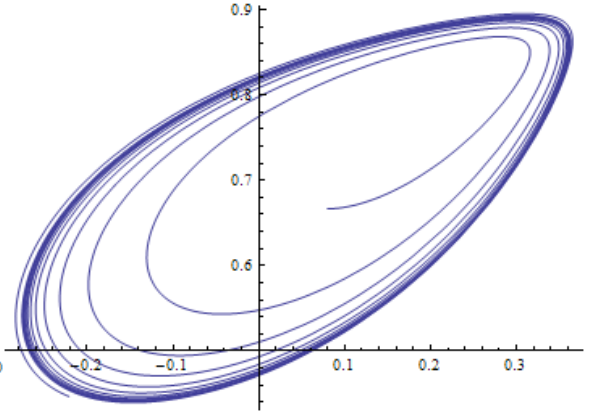


Figure 1b: Initial value  $q_R = 4.043060432395$

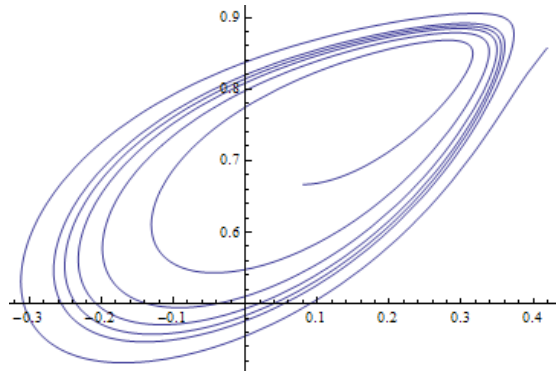


Figure 1c: Initial value  $q_R = 4.04305$

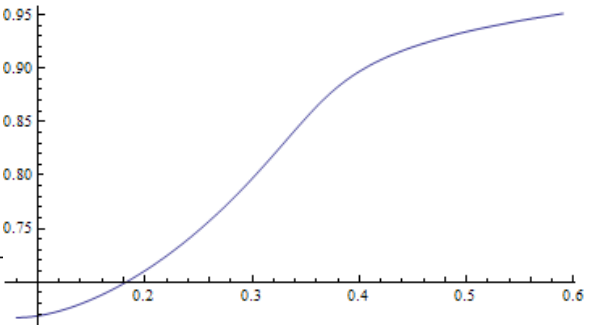


Figure 1d: Initial value  $q_R = 3.95$

The analysis is confirmed by the simulations. Interestingly, corridor stability can be observed for a range of parameter values. This is illustrated in figures 1a–1d which show the projection of the 3D system on the  $(r^e, \alpha)$ -plane.<sup>9</sup> The four figures use the same parameter values, and the initial disturbance – a fall in

<sup>9</sup>The simulations use the specification  $\alpha^*(r^e) = \rho_0 + \rho_1 r^e$ . The parameters and exogenous variables take the values  $\frac{\pi-s}{1-s} = 0.1, x = 0.5, \gamma a = 0.7, b = 0.04, \mu = 0.4, \lambda = 0.4, \rho_0 = 44/75, \rho_1 = 1$ .

With these values the stationary solution is given by  $r = r^e = 0.08, \alpha = 2/3, q_K = 6$ . The solution is locally stable. Gradual increases in  $\rho_1$  (or in  $\lambda$  or  $\mu$ ) would take the system through a subcritical Hopf bifurcation.

the wealth-income ratio  $q_R$  compared to the stationary solution – corresponds to the effect of a shock to the share of the rich in distributed income.<sup>10</sup> The shift in distribution produces higher returns to equity and as a result both  $r^e$  and  $\alpha$  start to rise in all four cases. The system is stable and returns to the stationary solution after the small shock in figure 1a; slightly larger shocks takes the system out of the stable corridor and leads to divergence (figures 1b-1c), and the divergence becomes monotonic if the size of the shock is increased even further (figure 1d).

## 4 Conclusions

The model in this paper highlights a particular mechanism that may have contributed to the stock market boom in the 1990s. The model has many limitations and it clearly provides – at best – one element for an understanding of financial instability. But it shows that the intuition behind inequality-induced bubbles is logically sound.

Variations in portfolio shares are central to the story (and portfolio shares do exhibit considerable variation over time), but inequality is not the only factor that influences the average portfolio composition. Indeed, the income-distribution argument relies on the more general observation that relative asset demands depend on the composition and conditions of households. Thus, the same type of reasoning suggests that other structural features will affect average portfolio decisions – demographic changes is an obvious source as are pension reforms or tax changes – and the destabilizing feedback effects from capital gains to portfolio shifts does not depend of the specific initial shock. An attempt to ‘test’ the empirical relevance of the mechanism therefore raises a host of issues and is well beyond this initial exploration.

## 5 Appendix A

### 5.1 Existence of a stationary solution

Substituting  $\dot{\alpha} = 0$  in (20) and setting the left hand side equal to zero we get

$$q_R = \frac{1 - \gamma a}{b + (1 - \alpha)g} \quad (28)$$

Using (27)-(28), the value of  $r$  at a stationary solution must satisfy

$$\begin{aligned} r &= \left[ \frac{\pi - s}{1 - s} \frac{1}{x} \frac{1}{\alpha} + \frac{1 - \gamma a}{1 - \alpha} \right] \frac{b + (1 - \alpha)g}{1 - \gamma a} - \frac{1}{1 - \alpha} b \\ &= \frac{\pi - s}{1 - s} \frac{1}{x} \frac{1}{\alpha} \frac{b + (1 - \alpha)g}{1 - \gamma a} + g \end{aligned} \quad (29)$$

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<sup>10</sup> A shock to  $x$  is associated with a shock to the wealth-income ratio  $q_R = W_R/((1-s)xY)$ , but has no direct impact on the other two state variables,  $r^e$  and  $\alpha$ .

This expression for  $r$  is decreasing in  $\alpha$ , and since  $\alpha^*$  is increasing in  $r^e$  it follows that multiple solutions with  $\alpha > 0$  are ruled out. The existence of a solution follows from the observation that  $r \rightarrow \infty$  for  $\alpha \rightarrow 0$  and  $r \rightarrow r_0 < g$  for  $\alpha \rightarrow \infty$ . Thus, a solution exists as long as  $\alpha^*(g) < \infty$ , a condition that is clearly met.

## 5.2 Local stability properties

The local stability properties of the stationary solution are determined by the Jacobian which, evaluated at the stationary solution, takes the form

$$J(r^e, \alpha, q_R) = \begin{pmatrix} \lambda(\frac{1}{1-\alpha} \frac{1}{\alpha} \mu \alpha^{*'} - 1) & \lambda(-\frac{\pi-s}{1-s} \frac{1}{x} \frac{1}{\alpha^2 q_R} + \frac{g}{(1-\alpha)^2} - \frac{1}{\alpha(1-\alpha)} \mu) & -\lambda(\frac{\pi-s}{1-s} \frac{1}{x} \frac{1}{\alpha q_R^2} + \frac{1}{q_R^2} \frac{1-\gamma a}{1-\alpha}) \\ \mu \alpha^{*'} & -\mu & 0 \\ \frac{1}{1-\alpha} \mu \alpha^{*'} & \frac{1}{1-\alpha} (g - \mu) & -\frac{1}{1-\alpha} \frac{1-\gamma a}{q_R^2} \end{pmatrix} \quad (30)$$

The necessary and sufficient Routh-Hurwitz conditions for local stability of the linearized system are that

1.  $Tr(J) = \lambda A - \mu - \frac{1}{1-\alpha} \frac{1-\gamma a}{q_R^2} < 0$
2.  $Det(J_1) + Det(J_2) + Det(J_3) = \lambda \mu \alpha^{*'} B + \lambda(\mu + \frac{1}{1-\alpha} \frac{1-\gamma a}{q_R^2}) + \mu \frac{1}{1-\alpha} \frac{1-\gamma a}{q_R^2} > 0$
3.  $Det(J) = \lambda \mu (\alpha^{*'} C - \frac{1}{1-\alpha} \frac{1-\gamma a}{q_R^2}) < 0$
4.  $-Tr(J)[Det(J_1) + Det(J_2) + Det(J_3)] + Det(J) > 0$

where

$$\begin{aligned} A &= \frac{1}{1-\alpha} \frac{1}{\alpha} \mu \alpha^{*'} - 1 \\ B &= \frac{\pi-s}{1-s} \frac{1}{x} \frac{1}{\alpha q_R} [\frac{1}{\alpha} + \frac{1}{(1-\alpha)q_R}] - \frac{1}{(1-\alpha)} [\frac{1}{\alpha} \frac{1-\gamma a}{q_R^2} + g] \\ C &= -\frac{\pi-s}{1-s} \frac{1}{x} \frac{1}{\alpha q_R^2} \frac{1}{1-\alpha} [g + \frac{1-\gamma a}{\alpha q_R}] < 0 \end{aligned}$$

Condition 3 is satisfied. Conditions 1,2 and 4, however, will not be met unless  $\lambda, \mu$  and  $\alpha^{*'}$  are sufficiently small.

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