Britain's Great Depression, 1920-1980: A General Equilibrium Approach

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Abstract

Numerous attempts have been made in the literature to link Britain's sluggish macroeconomic performance in the interwar and postwar period to trade union activity and monopolization. In this paper, we adopt a unifying perspective on the British macroeconomy performance between the depression of 1920 and the supply-side reforms of the 1980s. We calibrate a model of monopolistic competition and search frictions in labor markets, in which unions appropriate their share of monopoly profits through collective bargaining. We argue that pro-union reforms after World War I combined with monopolistic structures in the British economy to establish a new steady state, characterized by below-trend levels of income and employment. We find that this equilibrium essentially persisted throughout the postwar period until the 1970s, with the 1950s as a marked but temporary dip in union power in the 1950s. We also offer a new interpretation of the supply side reforms of the 1980s, arguing that privatization and competition policy were key in reducing monopoly rents and thus the incentives for workers to unionize.

Keywords: Trade unions, collective bargaining, Great Depression, Britain

JEL codes: E24, E27, J51, J64, N12, N22

I. Introduction

Britain's macroeconomic record of the interwar and postwar period stands out for its low but fairly constant growth rates, accompanied by the absence of major financial and monetary crises. Having been hit hard by the 1920/21 recession, the British economy rode out the international depression of the early 1930s remarkably well, albeit with persistent unemployment, which never declined below 9.5 % over the period 1921-1939. Real GDP fell by nearly 20 % in the immediate post-WWI years (between 1918 and 1920), and remained about 20% below trend throughout the interwar years. By contrast, the Great Depression after 1929 brought a cumulative loss of GDP of only 5%, followed by recovery to 1929 levels but not to trend. Yet throughout most of the interwar period, real wages increased, outpacing productivity growth. The wartime and postwar shocks of the 1940s were small compared to the U.S. or any of the other major belligerent countries. As a flipside, the post-World War II boom in Britain was remarkably weak, no Golden Age could be recorded in the 1960s or 1970s, productivity remained low and the forces of competition remained feeble. One of us still has vivid memories of a visit to London in the late 1970s, watching how businessmen in Bowler hats lined up in front of creaky wooden escalators at the major underground stations.

How come the British economy remained so depressed over such an extended period? And why were business fluctuations so muted? Contemporaries and later researchers observed that the British economy seemed to have settled on a new equilibrium since the end of World War I. Cole and Ohanian (2002) analyzed the persistence of British interwar unemployment in a neoclassical model. They found that beginning in the early

1920s, Britain, experienced a persistent downward deviation of productivity from historical trends.

The idea that Britain's trajectory was not so much a business cycle phenomenon but rather a stable equilibrium has also been common in earlier work. Benjamin and Kochin (1979) famously and controversially argued that the generous increases and extensions of unemployment benefits introduced in 1920 by the Unemployment Insurance Act were instrumental in generating high rates of unemployment in the 1920s and 1930s. Cole and Ohanian (2002) argued these effects were aggravated by the sectoral and regional concentration of unemployment, themselves the consequence of a lack of regional mobility induced by Britain's housing policies. Historians instead emphasized the effects of mandatory collective wage bargaining, which was introduced at the same time (Broadberry, 1986a, 1986b; Broadberry/Crafts 1992)[1]. The accelerated unionization of the British economy in the early interwar period also attracted the attention of economists working on insider-outsider models of the labor market. Layard and Nickell (1986) applied this framework to the interwar period, as did Dimsdale (1984), Dimsdale, Nickell and Horsewood (1989), and Dimsdale and Horsewood (1992). The common basic idea of this work was to identify shifts in long-run equilibrium unemployment separately from the effects of monetary policy. A common theme of this earlier research was that monetary shocks

[1] One prominent contemporary observer, Jacques Rueff (1925, 1931), did argue that increased unionization rates and union bargaining power were key factors in explaining Britain's economic malaise of the 1920s and 1930s. Rueff claimed that increases in collective action led to higher wages and hence to higher rates of unemployment. Rueff, however, was attacked and his arguments discredited by contemporaries.

did well in explaining short-term macroeconomic responses but were unable to explain the persistence of high unemployment

For the postwar period, work abounds that links Britain's disappointing growth record to its labor market setup. While fast growth in Continental Europe was seen as a possible consequence of strategic wage moderations on the part of trade unions, labor and capital in the British case seemed deadlocked in the investment hold-up problem that comes with collective wage bargaining. Nationalization of mining and heavy industry under the Attlee government of 1946 did little to promote industrial dynamics and a more efficient allocation of capital. As pointed out by Broadberry (1996) and Broadberry and Crafts (2003), these policies essentially persisted under the subsequent Tory governments, which found it politically inopportune to withdraw from the consensus underlying Labour's postwar policy.

Yet at the same time, Britain's unemployment rates were low, and remained low up until the early 1970s. As emphasized by Broadberry (1994) and Crafts (1995), this poses a problem for an explanation of British labor history across World War II. Given the further tightening of labor market regulation of the late 1940s, the bargaining approach would predict a further increase in unemployment in the postwar period, not a decrease to historical lows as it actually happened. One hypothesis explored by several authors is that nationalization itself weakened unions during the 1950s and temporarily reduced their bargaining power. Union activity indeed went through a lull in the 1950s but crept up again in the late 1960s, as did unemployment.

Britain's output and productivity record remained below historical trends until the reforms of the late 1970s and early 1980s. A near-unanimous consensus attributes the decline in unemployment rates to labor market deregulation in this era, see e.g. Layard and Nickell (1985) and Crafts (1993). At the same time, however, Britain's accession to the European Community contributed to product market deregulation, an avenue that has been left largely unexplored.

The present paper aims to present a coherent theoretical framework within which to examine the relative contributions of increases in unionization rates and increases in unemployment benefits. The model is an otherwise standard neoclassical growth model, which allows for monopolistic competition in goods markets, equilibrium unemployment microfounded by search frictions in the labor market and two wage bargaining regimes, individual and collective. We use the model to evaluate three sources of variation in the levels of output, unemployment, and wages. These are, in turn, the relative contributions of increases in the fraction of workers engaged in collective bargaining, changes in unemployment benefits, and changes in the degree of monopoly power in product markets.

II. History

Britain's low productivity and growth performance during much of the 20th century has been noticed by historians and economists alike. In a sectoral analysis, Broadberry/Crafts (1992, 2003) highlighted the persistence of Britain's productivity gap vis-a-vis the international productivity leaders. Cole/Ohanian (2002) found that even compared to Britain's low 1.4% average growth rate in pre-war GDP, Britain maintained a persistent output gap throughout the interwar period. Data underlying Figure 1 suggest that their finding holds

more generally and applies also to the postwar period: only in the late 1980s did British per-capita GDP catch up to its extrapolated 1.4% pre-1913 trend.

(Figure 1 about here)

The evidence also shows that cyclical fluctuations were minor. The two major effects that stand out are the two postwar recessions of 1920 and 1946/7, both of which pushed output per capita to less than 20% of trend. By comparison, the Great Depression of post-1929, while still clearly visible, is a second-order effect

Levels of output below trend were accompanied by very low rates of private investment. During the interwar and much of the postwar period, private fixed investment remained at well below 10% of GDP. Beginning in the late 1950s, private investment started to creep up but still remained low compared to the high levels recorded elsewhere at the time.

(Figure 2 about here)

Low private investment was also accompanied by low profits. Profits in the private non-farm economy were very low in the 1920s when compared to 1913 levels. A recovery occurred in the rearmament years beginning in 1936. After World War II, private profits eroded again. This is all the more remarkable as nationalization in the late 1940s had arguably bailed out several industries affected by conversion to a peacetime economy, which would bias observed private profit shares upwards.

(Figure 3 about here)

Despite this bias, by the late 1950s private profits had slipped back to the share they had commanded in the mid-1930s before rearmament took off in earnest.

Unemployment was high overall in the interwar period, with a sharp cyclical peak in 1933 and subsequent recovery to the levels of the 1920s. Full employment was not reached until 1941.

(Figure 4 about here)

In line with the international evidence, postwar British unemployment remained very low until the late 1960s and increased markedly in the 1970s. What set Britain apart from the European evidence was a return to high employment in the 1990s, which lasted to 2008.

Both labor and product markets were shaped by cartel arrangements and regulations that limited competition during extended subperiods, which were too long to be easily explained by cyclical factors. Unemployment relief had been introduced in 1911 but was raised to sizeable amounts in 1920. Consensus estimates agree that the replacement ratio between benefits and wages increased from 15% before World War I to around 35% in the mid-1920s. Eligibility for unemployment benefits was generous during the 1920s but restrictions were put into place in 1932, notably affecting young workers. On the other hand, the replacement ratio during the 1930s climbed to new heights, exceeding 50% according to some estimates. In the early postwar period, the replacement ratio was cut back again, stabilizing below 40% but arguably still exceeding the levels of the 1920s. The expansion of the welfare state in the late 1960s and early 1970s saw a rernewed increasde in replacement ratios, until the radical steps undertaken in the context of the Thatcher reforms of the early 1980s.

Unionization and collective wage bargaining were not uncommon in Britain before World War I but were made mandatory only in 1920. As a consequence, unionization and labor activity surged, leading to two major strikes in 1921 and 1926 that had strong repercussions on British politics and were seen as enhancing the power of the Labour party. Union power continued to remain legally protected until the advent of World War II, which brought about cozy arrangements to minimize labor stoppages in war production.

Union were formally restored after the end of the war but limited de facto by sweeping nationalization of core industries. During some time this changed the nature of the wage bargain. On the one hand, the state as an employer could now credibly commit to overcoming the investment holdup problem implicit in collective wage bargaining. As a consequence, unions offered wage restraint in exchange for expanded investment in the state-controlled industries. From the viewpoint of policy makers, this arrangement was seen as advantageous as it would produce high employment levels. On the other hand, state officials could credibly threaten to respond to higher wage demands with changes in Britain's income tax code, which combined wide tax exemptions for low incomes near-with confiscatory taxes on high incomes. Confronted with a choice between employing their wage bargaining power to the full and public policy running highly redistributive income policies, unions opted for the latter.

Wage moderation deals ended in the 1960s. At the same time, the unions' grip on the wage bargain increased with progressive legal tightening of the closed shop system. Strike waves in the early 1970s succeeded in shifting the power balance further towards unions, creating the political climate that finally brought forth Thatcherism.

Product market competition in the UK has generally been seen as feeble. In a legal environment that allowed cartels both internationally and domestically, competitive pressure was generally low, keeping margins high. During the 1930s, monopoly power grew further. Foreshadowing a point made for the U.S. by Cole and Ohanian (2005), Broadberry and Crafts (1992) argued that attempts by the British Treasury to reflate the economy consisted in allowing the degree of collusion to increase, thus trading off further deflation against the limitation of output inherent in cartel arrangements.[2]

Competition policy in the postwar period was ambiguous. Although legislation against cartels was passed in 1956 and subsequently strengthened, the presence of large national-

[2] Eggertsson (2011) provides the counter-argument, arguing again for beneficial effects of stopping deflation through increased wedges between price and marginal cost. A counter-criticism is Wieland (2013).

ized sectors of the economy limited its effects. Britain's gradual accession to the European Communities increased competitive pressure in product markets, as did the sweeping privatizations that started in the Thatcher era.

III. Model of monopolistic competition and labor search frictions

In order to address the interplay between monopoly power and organized labor theoretically, two model elements are crucial. First, the goods market must allow for monopolistic competition. Second, there must be wage bargaining, allowing for two bargaining regimes: collective bargaining (organized labor) and individual bargaining. These model elements are integrated into an otherwise standard neoclassical growth model with capital. We assume that regime changes are unexpected.

A. Labor Search

The first key element of the model is the explicit assumption of a labor market which allows for two types of wage formation: collective and individual bargaining. Wage bargaining is underpinned by Mortensen-Pissarides search frictions in the labor market, which create rents. In particular, unemployed workers *U* and vacancies *V* are transformed into job matches by a constant returns to scale matching function

$$m(U,V) = sU^{\eta}V^{1-\eta}$$

where η is the elasticity of the matching function with respect to unemployment and *s* is a scaling factor.. Job matches are separated at the exogenous rate χ. Key variables are the aggregate labor market tightness, defined as $\theta = \frac{V}{U}$, the rate at which firms fill vacancies $q(\theta) = \frac{m(U,V)}{V} = s\theta^{-\eta}$, and the rate at which workers find jobs $f(\theta) = \frac{m(U,V)}{U} = s\theta^{1-\eta}$.[3]

The intuition is that the greater the number of vacancies relative to unemployed workers

[3] Choosing the scaling factor *s* appropriately ensures that both matching rates lie between *0* and *1*.

(i.e. the higher is tightness), the easier it is for firms to fill vacancies, and the more difficult it is for workers to find jobs. In the steady- state, the flow of workers into and out of unemployment must be equal, leading to a Beveridge curve relating equilibrium unemployment to tightness:

$$U \cdot f(\theta) = (1-U)\chi \Rightarrow U = \frac{\chi}{\chi + f(\theta)}$$

There is a continuum of risk-averse workers on the unit interval.[4] Value functions for unemployed and employed workers are defined as follows:

$$V_{E,k} = w_k + \beta'\left[(1-\chi)V_{E,k}' + \chi V_U'\right] \quad (2)$$

$$V_U = b + \beta'\left[\left(1 - f(\theta_k)\right)V_U' + f(\theta_k)V_{E,k}'\right] \quad (3)$$

where β' is the agent's discount factor satisfying $\beta' = \tilde{\beta}\frac{u_c'}{u_c}$. The value of employment under bargaining regime *k* is the period real wage w_k, plus the expected continuation value of current employment. In calculating the expected continuation value, workers take into account that they will lose their jobs with probability χ[5]. Similarly, the value of unemployment is the real flow value to unemployment *b* (which includes the value of home production and of any unemployment benefits or charitable assistance), plus the continuation value of unemployment. This continuation value takes into account the possibility of finding a job, which occurs with probability $f(\theta_k)$.

From the worker's value functions, we can derive the steady-state worker's surplus $V_{W,k}$ for each bargaining regime *k* as the difference between the values of employment and unemployment.

[4] Risk-aversion is only necessary to ensure that the problem is convex in the presence of capital. All qualitative results go through in a setting with risk-neutrality and no capital, see Ebell and Ritschl (2006).

[5] We follow Hall (2005) and Shimer (2005), who argue that the cyclical variation in separations is small enough so as to justify the assumption of a constant separation rate.

$$V_{W,k} = \frac{\left(1+\tilde{r}\right) w_k - \tilde{r} V_U}{\tilde{r} + \chi} \tag{4}$$

where $\tilde{r} \equiv \frac{1}{\tilde{\beta}} - 1$.

B. Monopolistic Competition

We assume the standard Dixit-Stiglitz monopolistic competition setup. There is a continuum of firms on the unit interval, each producing a differentiated good indexed by *i*. Agents are risk neutral in the aggregate consumption good and have Dixit-Stiglitz preferences over the continuum of differentiated goods. Demand for goods in each period is derived from the household's optimization problem:

$$\max_{c_{i,n}} \left(\int c_{i,n}^{\frac{\sigma-1}{\sigma}} di \right)^{\frac{\sigma}{\sigma-1}}$$

subject to the budget constraint $I_n = \int c_{i,n} \frac{p_i}{P} di$, where I_n denotes the real income of household *n* and $c_{i,n}$ is household *n*'s consumption of good *i*. Thus we obtain aggregate demand for good *i* given as:

$$y_i = \int c_{i,n} dn = \left(\frac{p\left(y_i\right)}{P} \right)^{-\sigma} Y \tag{5}$$

where $Y = \int I_n dn$ is aggregate real income and $P = \left(\int P_i^{1-\sigma} \right)^{\frac{1}{1-\sigma}}$ is the inverse shadow price of wealth, typically interpreted as a price index. Equation (5) is the standard monopolistic-competition demand function where σ is the demand elasticity facing the firm. Monopoly power is measured by this demand elasticity. The lower is demand elasticity, the steeper is the demand curve facing the firm and the greater is the firm's monopoly power. Perfect competition is the special case in which demand elasticity approaches infinity, leading to a flat demand curve and hence price-taking behavior.

C. The Household's Problem

Households are risk averse with CRRA preferences over the composite consumption good c_t:

$$\max_{\{c_t\}} \sum_{t=1}^{\infty} \tilde{\beta}^t \frac{c_t^{1-\gamma}}{1-\gamma}$$

where the composite good is the result of Dixit-Stiglitz aggregation over a continuum of differentiated goods as described in the previous subsection

$$c_t = \left(\int c_{i,t}^{\frac{\sigma-1}{\sigma}} di \right)^{\frac{\sigma}{\sigma-1}}$$

Consumers live in households which are large enough to facilitate complete risk-sharing. (This is the income-pooling assumption of Merz (1995)). Each period, household members earn labor income, a share of profit and capital income. They split their income between expenditures on the consumption goods and investment in the capital stock.

$$c_t + i_t = (1-u_t) w_{k,t} + r_t k_t + \pi_t$$
$$k_t = (1-\delta) k_{t-1} + i_t$$

The resulting budget constraint for households is:

$$c_t + k_t = (1-u_t) w_{k,t} + (r_t + 1 - \delta) k_{t-1} + \pi_t$$

Workers invest in diversified portfolios, so they do not consider the impact of their own wage bargaining on profits. The result of the household's optimization problem is an Euler equation describing optimal capital choice:

$$u'(c_t) = \tilde{\beta} u'(c_{t+1}) [r_{t+1} + 1 - \delta]$$

In the steady-state, this reduces to the condition that

$$\tilde{r} = \frac{1}{\tilde{\beta}} - 1 = r - \delta$$

D. The Firm's Problem

In the presence of search frictions, firms cannot adjust employment instantaneously. Rather, in order to hire a worker at date $t+1$, firms must pay κ units of output to post each of

v_t vacancies at date t which are filled at rate q_t. At the same time, the firm's 'stock' of hired workers depreciates each period at constant rate χ, representing an exogenous separation rate. Hence, the firm's stock of hired workers behaves like a capital stock with a linear and time-varying adjustment cost.

We consider two bargaining regimes: individual bargaining (IB) and right-to-manage collective bargaining (RTM). In both regimes, firms retain the right to choose employment optimally, and bargaining is over wages only. Since it takes one period for a vacancy to be converted into a hire, the current employment level is fixed at the time of wage bargaining. Hence, the firm chooses employment in advance while taking the impact on future wage bargaining outcomes into account.

Firms choose vacancies optimally in order to maximize the present discounted value of future profits taking as given the bargaining regime $k \in \{I, C\}$

$$V_k(h_k) = \max_v \left\{ \frac{p(y_k)}{P} y_k - w_k \cdot h_k - r k_k - \kappa v_k + \beta' V_k(h_k') \right\}$$

subject to:

$$\frac{p(y_k)}{P} = \left(\frac{y_k}{Y} \right)^{-\frac{1}{\sigma}}$$
$$h'_k = (1-\chi) h_k + q(\theta_k) v_k$$
$$y_k = A k_k^{\alpha} n_k^{1-\alpha}$$
$$w_k = w(h_k)$$

The last constraint anticipates that the bargained wage may depend upon the firm's employment choice h_k. [6]

[6] Note that the firm's employment stock h_k is fixed in the previous period, and hence is fixed at the time of bargaining. Hence, the firm sets employment in advance, while taking into account the future strategic implications of this choice for the wage bargaining. Cf. Smith (1999). In contrast, we assume that the capital stock is rented and may be adjusted freely at each date.

The firm's first order condition for vacancies equalizes the discounted value of a marginal worker to the cost of hiring that worker:

$$\beta' \frac{\partial V_k(h_k')}{\partial h_k'} = \frac{\kappa}{q(\theta_k)} \tag{6}$$

The cost of hiring a worker is simply the product of vacancy cost κ and the number of vacancies which must be opened to hire one worker, $\frac{1}{q(\theta_k)}$. The envelope condition gives the value of the marginal worker to the firm:

$$\frac{\partial V}{\partial h_k} = \frac{\sigma - 1}{\sigma} \frac{\partial y_k}{\partial h_k} \frac{p(y_k)}{P} - w_k(h_k) + (1-\chi) \frac{\kappa}{q(\theta_k)} - h_k \frac{\partial w_k}{\partial h_k} \tag{7}$$

Equation (7) will be useful in the treatment of wage bargaining in the following subsection, as it gives the firm's surplus in the individual bargaining problem. Combining (6) with the envelope condition (7) yields the firm's Euler equation for employment:

$$\frac{\kappa}{q(\theta_k)} = \beta' \left[\frac{\sigma - 1}{\sigma} \frac{\partial y_k}{\partial h_k} \frac{p(y_k')}{P} - w_k(h_k') - h_k' \frac{\partial w_k'}{\partial h_k'} + (1-\chi) \frac{\kappa}{q(\theta_k')} \right] \tag{8}$$

This Euler equation describes the firm's optimal employment decision. The left hand side represents the current period cost of hiring the marginal worker, which is equal to the cost per vacancy κ multiplied by the number of vacancies necessary to hire a worker $\frac{1}{q(\theta_k)}$.

The right hand side represents the discounted future benefits to hiring the marginal worker: The first two terms in brackets are standard, representing the worker's marginal revenue product net of wages. The third term, $h_k' \frac{\partial w_k'}{\partial h_k'}$, reflects firms' correct anticipation that the result of wage bargaining will depend upon the number of workers hired. In section II.E.2, we will connect this third term to the hiring externality. The fourth term in brackets represents the future savings in hiring costs from having hired the worker today, discounted by the separation probability χ.

Finally, the firm's optimal choice of capital input is given by the first-order condition

$$r = \frac{\sigma - 1}{\sigma} \frac{\partial y_k}{\partial k_k} \frac{p(y_k)}{P} \tag{9}$$

Equation (9) is the standard optimization condition which equates the cost of capital r to its marginal revenue product. The steady-state value of the firm is simply the discounted present value of a constant stream of profits:

$$V_k(h_k) = \frac{1+\tilde{r}}{\tilde{r}} \left\{ \frac{p(y_k)}{P} y_k - w_k h_k - r k_k - \kappa v_k \right\} \tag{10}$$

E. Wage Bargaining

Search frictions imply that rents to employment arise, which firms and workers divide by Nash bargaining. We consider two bargaining frameworks. Collective bargaining occurs when all workers of a firm band together to bargain with their employer. Under individual bargaining, each worker negotiates separately with his or her employer and wages can be renegotiated at any time.[7] The crucial distinction between the two bargaining regimes is that under this latter individual setup, each worker is treated as the marginal worker. The reason is that when negotiating with his employer, a worker's only threat point is to leave the firm's employment himself – not to take any other workers with him – making himself the marginal worker during wage negotiations. In contrast, under collective bargaining, workers can act jointly to shut down production in the event of a disagreement.

1. Collective Bargaining

The surplus over which the employer and the union are bargaining is the difference between profits when negotiations are successful and when they fail. Under collective bargaining, the workers are able to prevent the firm from operating if negotiations fail, so that the firm's surplus is equal to total firm profits, or equivalently its total value given by

[7] The individual bargaining framework examined here was introduced in partial equilibrium by Stole and Zwiebel (1996a, 1996b), and extended to general equilibrium by Smith (1999), Cahuc, Wasmer and Marque (2004) and Ebell and Haefke (2005).

(10)[8] The workers' surplus is the difference between the value of employment with the collective-bargaining firm and unemployment (4), multiplied by the number of workers h_C.

$$V_{w,C}h_C = \frac{(1+\tilde{r})w_C - \tilde{r}V_U}{\tilde{r}+\chi}h_C$$

Hence, the Nash bargaining problem becomes:

$$\max_{w_C} \phi \ln\left[\left(\frac{(1+\tilde{r})w_C - rV_U}{\tilde{r}+\chi}\right)h_C\right] + (1-\phi)\ln\left\{\frac{1+\tilde{r}}{\tilde{r}}\left[y_C\frac{p(y_C)}{P} - w_C h_C - rk_C - \chi\frac{\kappa}{q(\theta)}h_C\right]\right\}$$

where worker's bargaining power is given by ϕ.[9]

The first-order condition with respect to the wage is:

$$w_C = (1-\phi)\frac{\tilde{r}}{1+\tilde{r}}V_U + \phi\left[\frac{y_C}{h_C}\frac{p(y_C)}{P} - r\frac{k_C}{h_C} - \chi\frac{\kappa}{q(\theta_C)}\right] \qquad (11)$$

This is the wage curve, representing the bargaining wage as a function of labor market tightness, employment and output. We use (11) to substitute out for the $h_C\frac{\partial w_C}{\partial h_C}$ term in (8) and apply the steady state to obtain a closed form for the firm's Euler equation:

$$h_C\frac{\partial w_C}{\partial h_C} = -\phi\frac{p(y_C)}{P}\frac{y_C}{h_C}\left[\frac{1-\alpha+\alpha\sigma}{\sigma}\right] + \phi r\frac{k_C}{h_C}$$

$$w_C(h_C) = \frac{y_C}{h_C}\frac{p(y_C)}{P}\left[\frac{\sigma-(1-\phi)(1-\alpha+\alpha\sigma)}{\sigma}\right] - \phi r\frac{k_C}{h_C} - \frac{\kappa}{q(\theta_k)}[\tilde{r}+\chi] \qquad (12)$$

Equation (12) is the firm's labor demand. Firm-level equilibrium wages are found at the intersection of the wage curve (11) with the labor demand schedule (12).

[8] This is the standard right-to-manage bargaining framework. See Layard (1991) for an overview of wage bargaining setups.

[9] The microfoundation for *static* Nash bargaining is a Binmore-Rubinstein-Wolinsky alternating offer game. The bargaining power of the parties represent their relative degrees of patience. The standard choice of ϕ = 0.50 implies that firm owners and workers have identical discount factors.

$$w_C = \frac{\tilde{r}}{1+\tilde{r}} V_U + \phi \frac{1-\alpha+\alpha\sigma}{(1-\alpha)(\sigma-1)} \left[\frac{\tilde{r}}{1+\tilde{r}} V_U + \chi \frac{\kappa}{q(\theta)} \right] + \frac{\phi}{1-\phi} \frac{\sigma}{(1-\alpha)(\sigma-1)} \tilde{r} \frac{\kappa}{q(\theta)} - \phi r \frac{k_C}{h_C}$$

(13)

Rewriting (11), one can express the wage as the reservation value $\frac{\tilde{r}}{1+\tilde{r}} V_U$ plus a share of the surplus. The surplus is simply the firm's profit per worker. Hence, by bargaining collectively, workers are able to obtain a share $\frac{\phi}{1-\phi}$ of the firm's profits.

$$w_C = \frac{\tilde{r}}{1+\tilde{r}} V_U + \frac{\phi}{1-\phi} \left[\frac{y_C}{h_C} \frac{p(y_C)}{P} - w_C - r \frac{k_C}{h_C} - \chi \frac{\kappa}{q(\theta_C)} \right]$$

2. Individual Bargaining

Under individual bargaining, each worker bargains separately over wages with the firm. If negotiations break down, the worker can walk away into unemployment immediately, depriving the firm of his marginal revenue product and forcing the firm to hire a new worker (to obtain the profit-maximizing employment level). Hence, under individual bargaining, the firm's surplus is the worker's *marginal* contribution to the firm's value $\frac{\partial V}{\partial h_I}$.

The individual Nash bargaining problem becomes:

$$\max_{w_I} \phi \ln V_I^W + (1-\phi) \ln \frac{\partial V}{\partial h_I}$$

The worker's surplus is obtained from equation (4), while the firm's surplus term can be obtained from the envelope condition of the firm's problem (7). The first order condition of the individual bargaining problem yields a first-order linear differential equation:

$$w_I(h_I) = (1-\phi) \frac{\tilde{r}}{1+\tilde{r}} V_U + \phi \left[\frac{\sigma-1}{\sigma} \frac{\partial y_I}{\partial h_I} \frac{p(y_I)}{P} - h_I \frac{\partial w_I}{\partial h_I} + (1-\chi) \frac{\kappa}{q(\theta_I)} \right]$$

with solution[10]

[10] The solution is derived in the appendix.

$$w_I\left(h_I\right)=\left(1-\phi\right)\frac{\tilde{r}}{1+\tilde{r}}V_U+\phi\left[\frac{\sigma-1}{\sigma-\phi\left[1+\alpha\left(\sigma-1\right)\right]}\frac{\partial y_I}{\partial h_I}\frac{p\left(y_I\right)}{P}+\left(1-\chi\right)\frac{\kappa}{q\left(\theta_I\right)}\right] \qquad (15)$$

Next, we can use (15) to obtain $h_I\frac{\partial w_I}{\partial h_I}$, which can then be substituted into (8), resulting in firms' steady-state labor demand:

$$h_I\frac{\partial w_I}{\partial h_I}=-\frac{\phi\left[1+\alpha\left(\sigma-1\right)\right]}{\sigma-\phi\left[1+\alpha\left(\sigma-1\right)\right]}\frac{\sigma-1}{\sigma}\frac{p\left(y_I\right)}{P}\frac{\partial y_I}{\partial h_I}$$

$$w_I=\frac{\partial y_k}{\partial h_k}\frac{p\left(y_k\right)}{P}\left[\frac{\sigma-1}{\sigma-\phi\left[1+\alpha\left(\sigma-1\right)\right]}\right]-\frac{\kappa}{q\left(\theta_k\right)}\left(\tilde{r}+\chi\right) \qquad (16)$$

Firm-level employment and bargained wages are found at the intersection of the wage curve (15) and the labor demand schedule (16). This yields an expression for the bargained wage:

$$w_I=\frac{\tilde{r}}{1+\tilde{r}}V_U+\frac{\phi}{1-\phi}\left(1+\tilde{r}\right)\frac{\kappa}{q\left(\theta_I\right)} \qquad (14)$$

Once again, the bargained wage can be expressed as the sum of the reservation utility and a share of the surplus. Under individual bargaining, however, the surplus share is not related to profits, but rather to hiring costs. The intuition is that under individual bargaining, the worker's value to the firm is his marginal value. At the optimum of the firm's problem, this marginal value is equated to the cost to hiring that worker. Put another way, the main cost that an individually bargaining worker can impose on a firm when negotiations break down is the cost to rehiring him.

3. Choice of bargaining regime

We consider two labor law regimes. First, one regime restricts the ability of workers to form collective bargaining coalitions, effectively mandating the use of individual bargaining. Under the second, more liberal regime, workers may freely choose whether to form a collective bargaining coalition or not. When choosing a bargaining regime, workers compare not total wages but bargaining surpluses, as their reservation wage will be unaffected by the choice of bargaining regime at their own firm.[11] Under each bargaining regime, the steady-state surplus may be found as:

$$V_{W,k} = \frac{(1+r)w_k - rV_U}{r+\chi} \tag{15}$$

Hence, workers prefer collective bargaining, and will form unions when allowed, as long as the collective bargaining surplus exceeds its individual bargaining counterpart. This is the case whenever:

$$(1+\tilde{r})\frac{\kappa}{q(\theta_1)} < \pi \tag{16}$$

where π is the firm's profit per worker. As a result, workers are more likely to prefer collective bargaining when monopoly power is high. The intuition is that collective bargaining surpluses are profit shares, which are increasing in monopoly power.

F. Reservation Value of Unemployment

Next, we need to find a closed form solution for the reservation value of unemployment. This reservation value will differ, depending on whether the economy is in its individual or collective bargaining regime. The reason is that the reservation value of unemployment is composed of two terms: the flow value to unemployment *b* plus a term which

[11] The reason is that the firm is assumed to be small enough with respect to the aggregate so that its choice of bargaining regime has negligible impact on employment prospects at other firms, unemployment benefits and the value to home production.

captures the probability of obtaining a new job and the surplus obtained when employed. The second term obviously differs according to the bargaining regime.

Using (2) and (3) to obtain an expression for $V_{U,I}$ as a function of b and w_I, and then combining with the individual bargaining wage (14) yields a closed form expression for $V_{U,I}$:

$$\frac{r}{1+r}V_{U,I} = b + \frac{\phi}{1-\phi}\kappa\theta_I - \frac{\phi}{1-\phi}(1-\chi)\frac{\kappa}{q(\theta_I)} \tag{17}$$

Similarly, one can obtain the reservation value for unemployment under collective bargaining by combining (2), (3), (10) and (11) to obtain:

$$\frac{\tilde{r}}{1+\tilde{r}}V_U = \frac{(\sigma-1)(1-\alpha)}{(\tilde{r}+\chi+f\phi)(\sigma-1)(1-\alpha)+f\phi\sigma}\left[(\tilde{r}+\chi)b + \phi\left[\frac{1}{1-\alpha}\frac{\sigma}{\sigma-1}\left(\frac{\tilde{r}}{1-\phi}+\chi\right)-\chi\right]\kappa\theta_C - \phi fr\frac{k_C}{h_C}\right] \tag{18}$$

G. Equilibrium

To close the model, a market clearing constraint for goods is needed, which guarantees that aggregate demand equals supply.

$$Y = \frac{p(y_k)}{P}y_k \tag{19}$$

It is easy to see that (19) implies that $\frac{p(y_k)}{P} = 1$. Now, we can use (9) to obtain the equilibrium capital-labor ratio, which is independent of the bargaining regime.

$$\frac{k_k}{h_k} = \left(\frac{\sigma-1}{\sigma}\frac{\alpha A}{r}\right)^{\frac{1}{1-\alpha}} \tag{20}$$

Under individual bargaining, we can combine the wage curve (15) with the firm's steady-state labor demand (16) to obtain an equation relating the capital-labor ratio to equilibrium market tightness θ_I:

$$\frac{k}{h} = \left\{\frac{1}{A}\frac{\sigma-\phi\left[1+\alpha(\sigma-1)\right]}{(\sigma-1)(1-\alpha)}\left[b + \frac{\phi}{1-\phi}\kappa\theta_I + \frac{1}{1-\phi}\frac{\kappa}{q(\theta_I)}(\tilde{r}+\chi)\right]\right\}^{\frac{1}{\alpha}} \tag{21}$$

Equation (21) pins down equilibrium labor market tightness under individual bargaining θ_I.

Similarly, under collective bargaining, we can combine the wage curve (11) with the firm's steady-state labor demand (12) to obtain

$$\frac{k}{h}=\left\{\frac{1}{A}\frac{1}{1-\alpha}\frac{\sigma}{\sigma-1}\left[\frac{\tilde{r}}{1+\tilde{r}}V_U+\frac{\kappa}{q_C}\left(\frac{1}{1-\phi}\tilde{r}+\chi\right)\right]\right\}^{\frac{1}{\alpha}} \tag{22}$$

where $\frac{\tilde{r}}{1+\tilde{r}}V_U$ is given by (18). Equation (22) pins down equilibrium labor market tightness under collective bargaining θ_C. Equations (21) and (22) close the model. Now, equilibrium unemployment can be obtained as a decreasing function of equilibrium tightness via the Beveridge curve:

$$u_k=\frac{\chi}{\chi+f\left(\theta_k\right)} \tag{23}$$

With θ_k, u_k and $\frac{k}{h}$ in hand, it is straightforward to obtain all other equilibrium variables $\left(w_k,h_k,k_k,y_k,v_k,\pi_k,i_k,c_k\right)$. Details are given in the appendix.

Mixed Equilibria

Assume that the fraction of firms engaged in collective bargaining is $\mu\in(0,1)$, so that both bargaining institutions coexist in the economy. For this to be an equilibrium, it must be that case for a given (μ,σ) pair that all workers are content to retain their current bargaining regime. The equilibrium condition becomes

$$\mu\frac{p\left(y_C\right)}{P}y_C+\left(1-\mu\right)\frac{p\left(y_I\right)}{P}y_I=Y \tag{24}$$

Once again, substituting in from the demand function facing the firms yields

$$\mu^{\frac{\sigma}{\sigma-1}}y_C+\left(1-\mu\right)^{\frac{\sigma}{\sigma-1}}y_I=Y$$

G. Qualitative Results

In section IV below, we will present quantitative results based on the model presented in this section. At this point, we summarize several important qualitative conclusions that emerge. First, when monopoly power is sufficiently high, workers have strong incentives to try to form collective bargaining coalitions. Hence, if restrictions on union organization fall, the model predicts that union activity will increase.

Second, firms' profits must be lower under collective bargaining for two reasons: first, collectively bargaining firms must give up a profit share to workers, while individually bargaining firms do not. In addition, individually bargaining firms have an additional degree of freedom to maximize profits, due to their ability to manipulate wages via overhiring. A switch from individual bargaining to collective bargaining causes firms' profits and stock market valuations to fall.

Third, the model predicts that a switch from individual to collective bargaining leads to output to be more tightly restricted by firms, provided monopoly power is sufficiently high. The reason is that when monopoly power is high enough, then (21) and (22) guarantee that $\theta_C < \theta_I$, so that $u(\theta_C) > u(\theta_I)$, and hence $y_C < y_I$. In addition, the gap between y_C and y_I is increasing in the degree of monopoly power. Hence, we can conclude that the negative impact of an increase in monopoly power on employment and output is greater under collective bargaining than under individual bargaining[12].

These three conclusions form an intriguing picture (see Figure 5). Collective bargaining shifts a share of profits from firms to workers. If monopoly power is strong and profits are high, workers have strong incentives to organize and bargain collectively, while firms have equally strong incentives to restrict workers' ability to organize, so that monopoly power can be seen as sowing the seeds of labor conflict.

[12] In a quantitative model, Ebell and Haefke (2005) show that the impact of monopoly power on employment and output under individual bargaining is very close to zero, due to the counteracting first principles and overhiring effects.

In addition, for a given level of monopoly power, output and employment will be greater under individual bargaining, as will profits. Hence, when restrictions on union formation are lifted, the subsequent switch from individual to collective bargaining leads to a drop in output, employment and firm values, and presents as a recession. The stronger is monopoly power, the greater the gap between the two regimes, and hence the sharper the induced slump.

IV. Quantitative Results

A. Calibration

The parameter values used are summarized in Table IV.1. The period length is one quarter. There are ten parameters to choose: the technology parameter A, the discount factor $\tilde{\beta}$, the depreciation rate δ, the output elasticity of capital α, vacancy costs κ, matching elasticity η, the flow value of unemployment b, worker's bargaining power ϕ, , the match destruction rate χ and the matching scale parameter s.

Parameter	Description	Value	Comment
A	Technology level	1.0	Normalization
$\tilde{\beta}$	Discount factor	0.99	4.0 % annual interest rate
ϕ	Bargaining power	0.50	Standard
η	Matching elasticity	0.50	Data
B	Flow value of unemploymt		Pre-UIA replacement rate of 15 %.
χ	Separation rate	0.118	Data
S	Scaling factor	0.25	Normalization
κ	Vacancy posting cost		natural rate of unemployment 5.0 %
δ	Depreciation rate		Investment share of income = 9.2 %
α	Output elasticity of capital		Capital share of income = 0.3

Table IV.1: Interwar parameterization for Great Britain

Without loss of generality, *A* is set to unity, and there are no shocks to productivity.[13] The discount factor $\tilde{\beta}$ is chosen so that the annual risk-free interest rate is 7 % on the balanced growth path. Assuming a growth rate of 1.1% annually, this leads to a quarterly value of $\tilde{\beta} = 0.986$.[14] The matching elasticity η is set to 0.50, as is standard in the literature on search frictions and wage bargaining, and in the range of estimates $[0.4, 0.7]$ reported in Petrongolo and Pissarides (2001). Also standard is the imposition of the Hosios condition that matching elasticity and workers' bargaining power are equal, $\eta = \phi$.[15]

The depreciation rate δ is chosen so that the investment share of income is $\frac{i}{y} = 0.092$, its average value during the 1920s.[16]. The output elasticity of capital is chosen so that the capital share of income is 0.30 under perfect competition, so that $\alpha = 0.30$.[17] Factor shares add up to 1, so that $\Pi_k + \Pi_l + \Pi_v + \Pi = 1$, where Π is the share of pure profits in national income, while $\Pi_v = \kappa v_k$ is the share of vacancy costs in national income. Vacancy costs κ are chosen so that equilibrium unemployment under individual bargaining and perfect competition reaches its 'natural rate' of 5.0 %. The resulting vacancy costs ofκ = 0.155, in conjunction with the firm's matching rate $q(\theta)$ = 0.25, yield a cost of about 0.62 units of output per hire. This corresponds to about 19% of a worker's annual wage, in line with the estimates reported in Hamermesh and Pfann (1996).

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[13] This implies that our results do not depend on real business cycle type shocks to total factor productivity.

[14] Recall that the annual real interest rate $\tilde{r}$ leads to an annual discount factor $\tilde{\beta} = \frac{1+g_c}{1+\tilde{r}}$ where g_c is the growth rate of consumption.

[15] In the economies studied here, the Hosios condition is necessary but not sufficient for efficiency. For a detailed welfare analysis, see Ebell and Haefke (2005).

[16] This value is obtained as $\frac{i}{y} = \frac{I/Y}{I/Y + C/Y}$, where X/Y is the appropriate expenditure share in Table II of Cole and Ohanian (2002). This is the appropriate way to abstract from government spending and the trade balance.

[17] Note that under imperfect competition the capital share of income is lower than α, $\Pi_k < \alpha$, because of the impact of increasing the share of pure profits in the economy from zero.

The flow value of unemployment b is set to ??? to match a replacement rate of 15%.. This low baseline replacement rate reflects the state of unemployment insurance before the Unemployment Insurance Act of 1920. In subsequent experiments, we will examine the impact of increasing the replacement rate in order to assess the impact of the UIA's introduction on unemployment. The exogenous rate of job destruction is set at $\chi = 0.118$, so that 11.8 % of jobs are destroyed each quarter, corresponding to the average total separation rate between 1922 and 1930 reported in the Monthly Labor Review of July 1929 and February 1931.18 The matching scale parameter s is chosen to replicate a firm's matching rate of 0.25. As emphasized by Shimer (2005), the choices of *s* and *q* are merely a normalization, and hence innocuous.

This parameterization allows us to characterize equilibrium at each degree of competition in the goods markets. Figure 1 shows the behavior of output, unemployment, asset values and wages as a function of monopoly power (measured as the demand elasticity σ facing firms). Clearly, when demand elasticity is lower than 14.0, or equivalently when individual bargaining markups exceed 3.8 %, a switch from individual to collective bargaining induces a recession involving a decrease in output, an increase in unemployment, an increase in wages and a drop in asset values. The magnitude of the respective macro and asset price movements are increasing in the degree of monopoly power. In the next subsection, we describe how we pin down the demand elasticities at crucial junctures using data on asset price movements. This allows us to examine the impact of changes in the bargaining regime without having to restrict the behavior of macro variables a priori.

B. Results

In the following we present results from two calibration exercises along with a more speculative scenario that extends the application of our model from the postwar period to the 1980s.

[18] By comparison, the post-war job destruction rate estimated by Shimer (2005) is 10.0% quarterly.

First we evaluate the relative force of two institutional changes affecting labor markets simultaneously in the early 1920s. The first was the increase in benefit levels, modeled here as an increase in the replacement ratio *b/w* from 15% to 35%. In the sequel we loosely refer to this increase as the Benjamin/Kochin effect. The second was the universal adoption of collective bargaining (CB) instead of individual bargaining (IB), which gave unionized labor a share of the profits obtained by UK firms under the prevailing monopolistic competition.

To pin down the effects, we somewhat arbitrarily assume the demand elasticity σ to be around 3.5, consistent with markups over cost exceeding 30%. It will soon be seen that the evidence points to the possibility of even lower levels of σ prevailing in the interwar years. An increase in the replacement ratio would increase workers' reservation utility from unemployment in the normal way, represented in eqs. (17) for IB and (18) for CB.

(Figure 6a about here)

Results presented in Figure 6a show the Benjamin/Kochin effects on unemployment of increasing the replacement ratio for both IB and CB. As can be seen, the effect under IB is rather muted, and is almost unaffected by variations in σ. The reason is that variations in monopoly power under IB exert an only minimal influence on both job finding rates and on the surplus that workers can extract from firms when employed. This is quite different under CB, provided that monopoly power is high. In this case, the value of unemployment is increased markedly through the prospects of the worker extracting a share of the firm's monopoly rent when employed. The Benjamin/Kochin effect thus depends on the degree of monopoly power in product markets, as well as on the wage bargaining regime. If CB prevails and monopoly power is high, the Benjamin/Kochin effect will be high, too. In a competitive economy under IB, however, the power of the Benjamin/Kochin effect is much reduced.

To this adds a direct effect of CB on equilibrium unemployment. We loosely term this the Broadberry/Crafts effect of unionization around 1920. For all but the most extreme parameter values of σ, the introduction of CB will have strong direct effects on equilibrium unemployment (Figure 6b).

(Figure 6b about here)

As can be seen, the direct effect of unionization quantitatively dominates the Benjamin/Kochin effect even including the indirect effects of CB on the latter. For the paramter values chosen, roughly two thirds of the increase in equilibrium unemployment during the early 1920s can be attributed directly to the adverse effects of CB on employment. The remaining third is directly or indirectly attributable to the Benjamin/Kochin effect of increasing the replacement ratio.

Increasing unemployment in the UK economy also translated into lower equilibrium levels of output and investment (Figures 6c and d). Again, the direct effect of introducing CB dominates the Benjamin/Kochin effect. As with unemployment, a *ceteris paribus* increase of the replacement ratios would have only muted effects on output and investment. What matters is the introduction of CB at the same time.

(Figure 6c and 6d about here)

As Figure 6e shows, the Benjamin/Kochin effect on wages is rather minor, while the effect of introducing CB is ambiguous and changes signs at low levels of σ.

(Figure 6e about here)

Only for very high degrees of monopoly power are wages higher under CB than under IB. In more competitive economies, wages under CB fall short of wages under IB, ren-

dering union activity collectively irrational. At a somewhat higher level of σ, even the wage share under CB falls short of the wage share under IB (Figure 6f).

(Figure 6f about here)

The results gathered so far help to pin down a range of plausible values for σ during the interwar period. Broadberry (1986) found that both unit wage cost and the labour share in the UK economy in the 1920s exceeded their 1913 levels. This would suggest levels of σ below the critical value of 3.5 suggested for wages, and certainly below the 5.5 threshold for an increase in the wage share. All this points to rather low levels of competitive pressure, which is consistent with research on British industry in the interwar period. None of the parameters in question underwent radical changes in the interwar period, suggesting that the forces keeping output and employment low in the 1920s also continued to operate in the 1930s, after the cyclical shock of post-1929 hat petered out.

The second exercise in this section is an application of the same mechanism to the early 1950s. As has been argued in the literature, a decrease in the replacement ratio combined with political conditions that limited union power for a while. Both forces would act to lower unemployment. Figure 7a attempts to disentangle the effects.

(Figure 7a about here)

As can be seen, the Benjamin/Kochin effect was in operation again, this time with signs reversed. However, in spite of the effect being enhanced through the combination of high monopoly power in product markets and CB in labour markets, the reduction of the replacement ratio alone would clearly fail to explain the decrease in unemployment. We follow the literature (see Broadberry, 1994) for a moment in assuming that in the partly nationalized economy of the 1950s, unions' bargaining power was artificially suppressed, pushing the economy towards a situation with IB. Figure 7a show the results of combining a decrease in the replacement ratio to 39% with a temporary decrease in the unions'

bargaining weight to .2. We nevertheless hesitate to make this assumption, which is in violation of the Hosios condition.

In the context of our model, the temporary reduction of union power would increase output and investment, while decreasing wages. All this is qualitatively consistent with the evidence on union wage restraint in return for higher investment gathered by historians of the postwar period (Figures 7b-d).

(Figures 7b-d about here)

On the whole, our results for the 1950s still seem to under-predict the decline in unemployment and to over-predict the increase in output. Still, they are fully in line with conventional wisdom that has highlighted the gradual increase in investment and the low rise in wages a s a result of institutionalized wage restraint in the context of a semi-planned economy in the 1950s.

The last exercise in this section provides a dynamic perspective on the 1960s to 1980s from the viewpoint of the mechanics of our model. We see this period as characterized by the interplay of two counteracting forces in the UK labor market. On the one hand, union power recovered, and benefits were once again more generous than in the 1950s. Both forces would tend to restrict output and employment. On the other hand, a gradual tightening of competition policy and intensified exposure to competition from Europe helped to wash out monopoly rents and hence alleviate the effects of collective bargaining on labor market outcomes. Figure 8a sketches a possible trajectory of outcomes for unemployment.

(Figure 8a about here)

The basic dynamics in Figure 8a is the secular tendency towards higher degrees of competition in product markets. Notice that for every given replacement ratio, unemployment

decreases as σ increases. Variations of the replacement ratio in an environment of increasing σ could hence merely accelerate or slow down the fall of unemployment but not permanently reverse it. Increased product market competition diminishes monopolistic profits and hence the incentive for producers to restrict output in response to collective wage bargaining.

We believe it is for this reason that the labor market response to the conflicts over Britain's labor market institutions in the 1970s was relatively muted, and that the reforms of the 1980s had such lasting effects. The increasing exposure of Britain to product market competition from Europe and overseas probably did just as much to diminish the popwer of unions and alleviate the effects of collective bargaining as the labor market reforms of the Thatcherites themselves. Notice in Figure 8a how the Benjamin/Kochin effect of reducing the replacement ratio would have a lower quantitative impact in the 1980s when competitive pressure σ was high than at mid-century, when σ was low.

The same reasoning applies to output and investment (Figures 8b and c). Increasing competitive pressure in product markets would *ceteris paribus* reduce the incentive of producers to restrict output in response to tighter collective bargaining.

(Figures 8b and 8c about here)

The net effect of increasing product market competition, growing union power and an expansion of benefits in the 1960s and 1970s on output and investment could then still be weakly positive. Compare this to the long-lasting depression associated with a similar increase in union power around 1920, when product market competition was low and remained low.

The combined effects on wages are again weakly positive, while the effect on the labor share is ambiguous (Figures 8d and e). Increasing union power and benefits both work in favor of higher wages under CB for given values of σ. Increasing product market com-

petition associated with higher σ will lower the wage share under CB but, from a certain point on, increase the labor share under IB. The overlay of those two effects in the 1970s generated a slight increase in the labor share, followed by an equally slight decline, which may have been mitigated by the decreasing importance of CB in the British economy towards the end of the millennium.

V. Conclusions

Between 1920 and the early 1980s, the British economy went through a long lasting depression. Relative to its own historical trend, the British economy had to cope with significant, persistent output gaps. This paper has adopted a general equilibrium perspective to link this astounding lack of macroeconomic performance to two factors inhibiting competition in the British economy, weak competition in product markets and combinations of union power and unemployment benefits in labor markets. Both factors have been the focus of intense scrutiny in previous research. Our approach has been to provide a unifying perspective and a joint quantitative evaluation. We carried out two calibrated exercises, one for the 1920s, the other for the postwar economy. We find that both the transition to mandatory collective wage bargaining in 1920 emphasized by Broadberry/Crafts (1992, 2003) and the increase in benefits highlighted by Benjamin/Kochin (1979) and again by Cole/Ohanian (2002) played a role but the first effect dominated the second. For the 1950s, we again find that a combination of both effects was at work, this time reducing benefit levels and union power simultaneously. We argued that the subsequent recovery of union power that culminated in the strike waves of the 1970s was mitigated by gradually increasing levels of product market competition, which eroded monopoly rents and thus reduced the effects of unionization on output and employment.

The essential mechanism of our model lies in the effects of collective wage bargaining on the behavior of multi-worker firms posting vacancies and deciding on output levels, as well as on the decisions of workers searching for jobs. Under individual bargaining, the most a worker matched with a firm can extract from their future employer is the cost of

posting a vacancy, weighed by the probability of a separation. Under collective bargaining, the union appropriates a share of the firm's profits. Firms will respond to this threat mainly by reducing output and employment, the strength of their response being determined by the degree of monopoly power they enjoy in product markets. The interplay of the forces of monopolistic competition in product markets, switches in wage bargaining regimes, and benefit levels to the unemployed between them determine the levels of unemployment, output, and investment.

Our application of this paradigm to the UK evidence also sheds new light on the success of the Thatcher reforms, which we view as buttressed by higher exposure to product market competition from Europe and overseas. We see high levels of competition in product markets at the end of the millennium as a major reason why responses of unemployment to institutional and macroeconomic shocks towards the end of the millennium have been much more moderate than in the historical record we examined in this paper.

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Appendix A1: Solving the Differential Equation

The differential equation to be solved is:

$$w_I\left(h_I\right)=\left(1-\phi\right)\frac{\tilde{r}}{1+\tilde{r}}V_U+\phi\left[\frac{\sigma-1}{\sigma}\frac{\partial y_I}{\partial h_I}\frac{p\left(y_I\right)}{P}-h_I\frac{\partial w_I}{\partial h_I}+\left(1-\chi\right)\frac{\kappa}{q\left(\theta_I\right)}\right]$$

The solution method is standard, and this exposition follows Cahuc, Marque and Wasmer (2004). Begin by noting that one can initially disregard the constant terms (those terms which do not depend upon h), and simply add them back in later. Hence, we are looking for a solution to:

$$w_I\left(h_I\right)=\phi\frac{\sigma-1}{\sigma}\frac{\partial y_I}{\partial h_I}\frac{p\left(y_I\right)}{P}-\phi h_I\frac{\partial w_I}{\partial h_I} \tag{A1.1}$$

Rearranging slightly, using the demand function facing the firm to substitute out for $\frac{p\left(y_I\right)}{P}$ and using the Cobb-Douglas production function yields:

$$\frac{w\left(h_I\right)}{\phi h_I}+\frac{\partial w_I}{\partial h_I}-\frac{\sigma-1}{\sigma}\frac{\left(1-\alpha\right)A^{1-\frac{1}{\sigma}}}{Y^{-\frac{1}{\sigma}}}k_I^{\alpha\left(1-\frac{1}{\sigma}\right)}\left(h_I\right)^{-\alpha-1-\frac{1}{\sigma}(1-\alpha)}=0 \tag{A1.2}$$

Next, write down the homogeneous version:

$$\frac{w\left(h_I\right)}{\phi h_I}+\frac{\partial w_I}{\partial h_I}=0 \tag{A1.3}$$

which has the well known solution

$$w\left(h_I\right)=Kh_I^{-\frac{1}{\phi}} \tag{A1.4}$$

Take the derivative of (A1.4), using the fact that K may depend upon h_I:

$$\frac{\partial w_I}{\partial h_I}=-K\frac{1}{\phi}h_I^{-\frac{1}{\phi}-1}+h_I^{-\frac{1}{\phi}}\frac{\partial K}{\partial h_I} \tag{A1.5}$$

Now, substitute (A1.4) and (A1.5) back into (A1.2) to obtain:

$$\frac{\partial K}{\partial h_I}=\frac{\sigma-1}{\sigma}\frac{\left(1-\alpha\right)A^{1-\frac{1}{\sigma}}}{Y^{-\frac{1}{\sigma}}}k_I^{\alpha\left(1-\frac{1}{\sigma}\right)}\left(h_I\right)^{-\alpha-1-\frac{1}{\sigma}(1-\alpha)+\frac{1}{\phi}} \tag{A1.6}$$

Taking the integral over both sides of (A1.6) yields

$$K = \phi \frac{(\sigma - 1)}{\sigma - \phi\sigma\alpha - \phi(1-\alpha)} \frac{\partial y_I}{\partial h_I} \frac{p(y_I)}{P} h^{\frac{1}{\phi}} + J \qquad \text{(A1.7)}$$

where J is a constant of integration. Now substitute (A1.7) into (A1.4) to obtain

$$w_I = \phi \frac{(\sigma - 1)}{\sigma - \phi\sigma\alpha - \phi(1-\alpha)} \frac{\partial y_I}{\partial h_I} \frac{p(y_I)}{P} + J h_I^{-\frac{1}{\phi}} \qquad \text{(A1.8)}$$

Finally, we need to pin down J using a terminal condition. Following Cahuc, et. al. (2004), we choose the condition that $\lim_{h_I \to 0} h_I w_I = 0$, that is, the firm-level bargained wage should not explode as firm-level employment h_I approaches zero. This implies that $J = 0$. Adding back the constant terms yields the solution to the differential equation:

$$w_I = (1-\phi)\frac{\tilde{r}}{1+\tilde{r}} V_U + \phi \left[\frac{(\sigma - 1)}{\sigma - \phi\sigma\alpha - \phi(1-\alpha)} \frac{\partial y_I}{\partial h_I} \frac{p(y_I)}{P} + (1-\chi)\frac{\kappa}{q(\theta_I)} \right] \qquad (15)$$

Appendix A2: Solving for the Remaining Equilibrium Variables

Starting from $\left(\theta_k, u_k, \frac{k}{h}\right)$, one can derive all remaining equilibrium equations as follows:

1. Equilibrium wages under individual and collective bargaining can be obtained from (16) and (12) respectively.
2. Due to the assumption of inelastic labor supply, equilibrium employment h_k is simply given by $h_k = 1 - u_k$.
3. Equilibrium vacancies in steady-state can be found from $h_k' = h_k(1-\chi) + v \cdot q(\theta_k)$ as $v_k = \chi \frac{h_k}{q(\theta_k)}$.
4. Equilibrium capital stock can be found as $k_k = \left(\frac{k}{h}\right) h_k$.
5. Equilibrium profits per firm are now pinned down by $\pi_k = y_k - w_k h_k - r k_k - \kappa v_k$.

6. Taking the steady state of the household's capital accumulation equation $k_k' = (1-\delta)k_k + i_k$ yields steady-state equilibrium investment as $i_k = \delta k_k$.
7. Finally, equilibrium consumption is pinned down by the household's budget constraint $c_k = w_k(1-u_k) + (r-\delta)k_k + \pi_k$. Substituting in from profits yields the equivalent expression $c_k = y_k - i_k - \kappa v_k$ so that consumption is equal to output net of steady-state investment and vacancy posting costs.

Figure 1

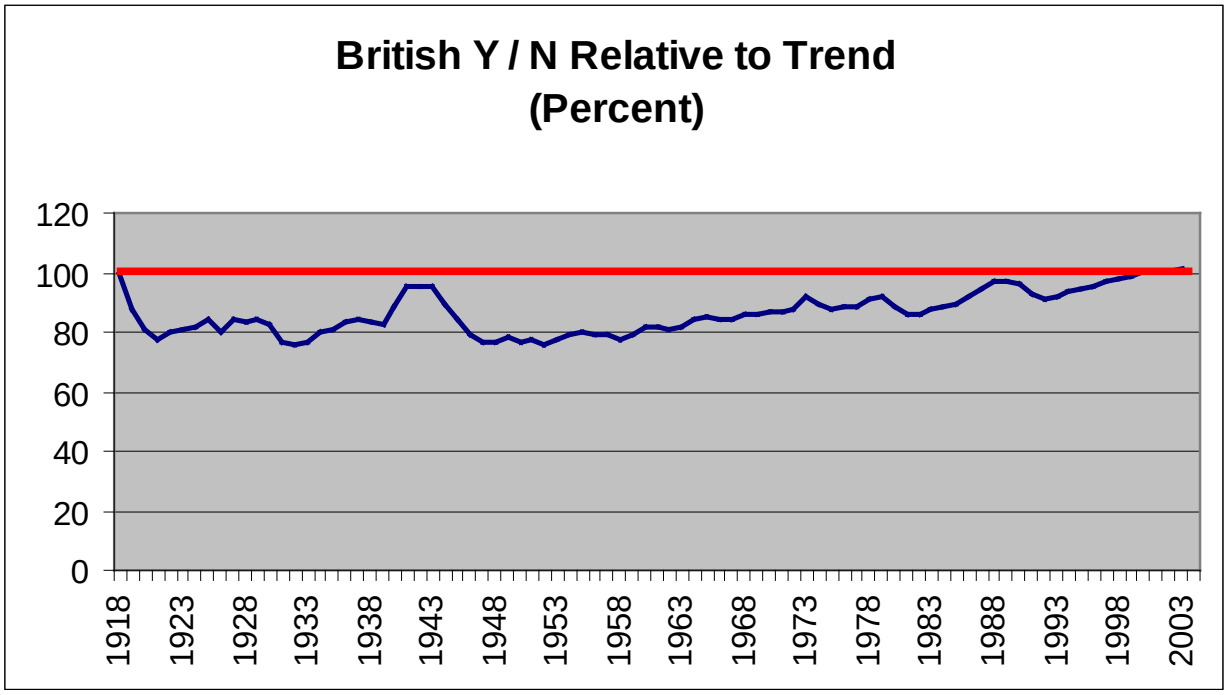


Figure 2

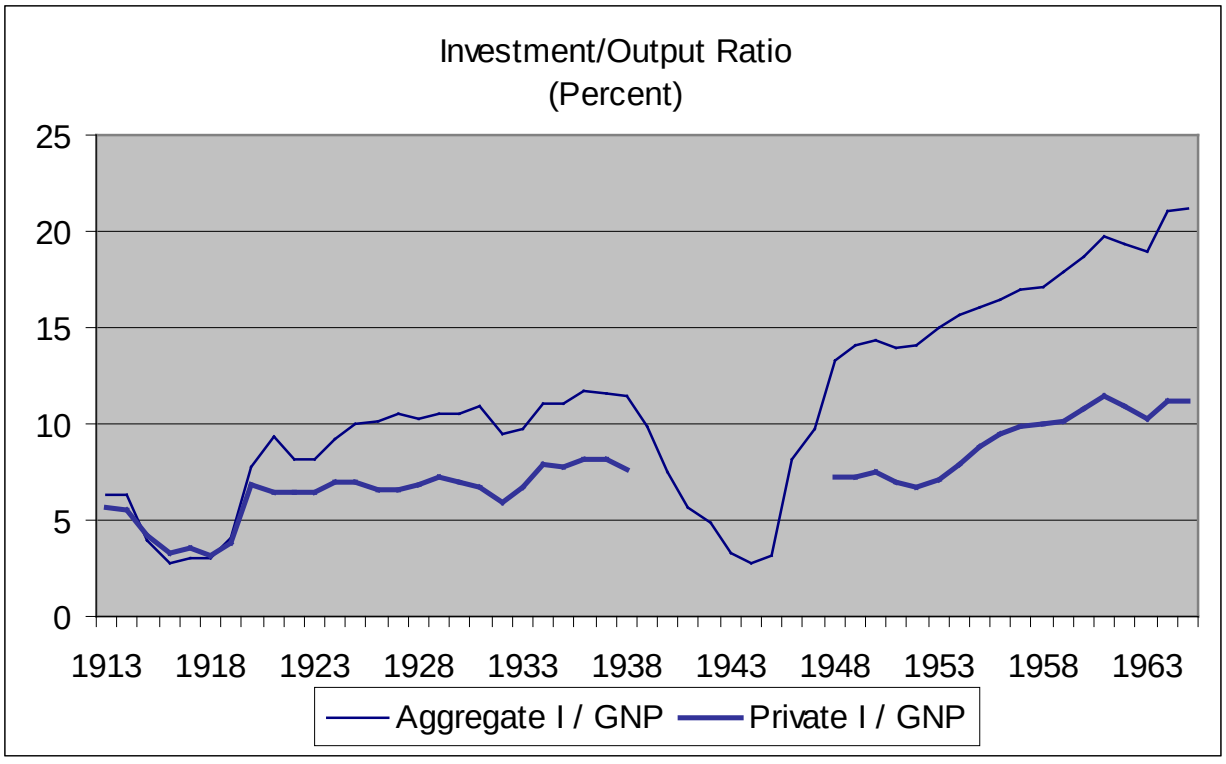


Figure 3

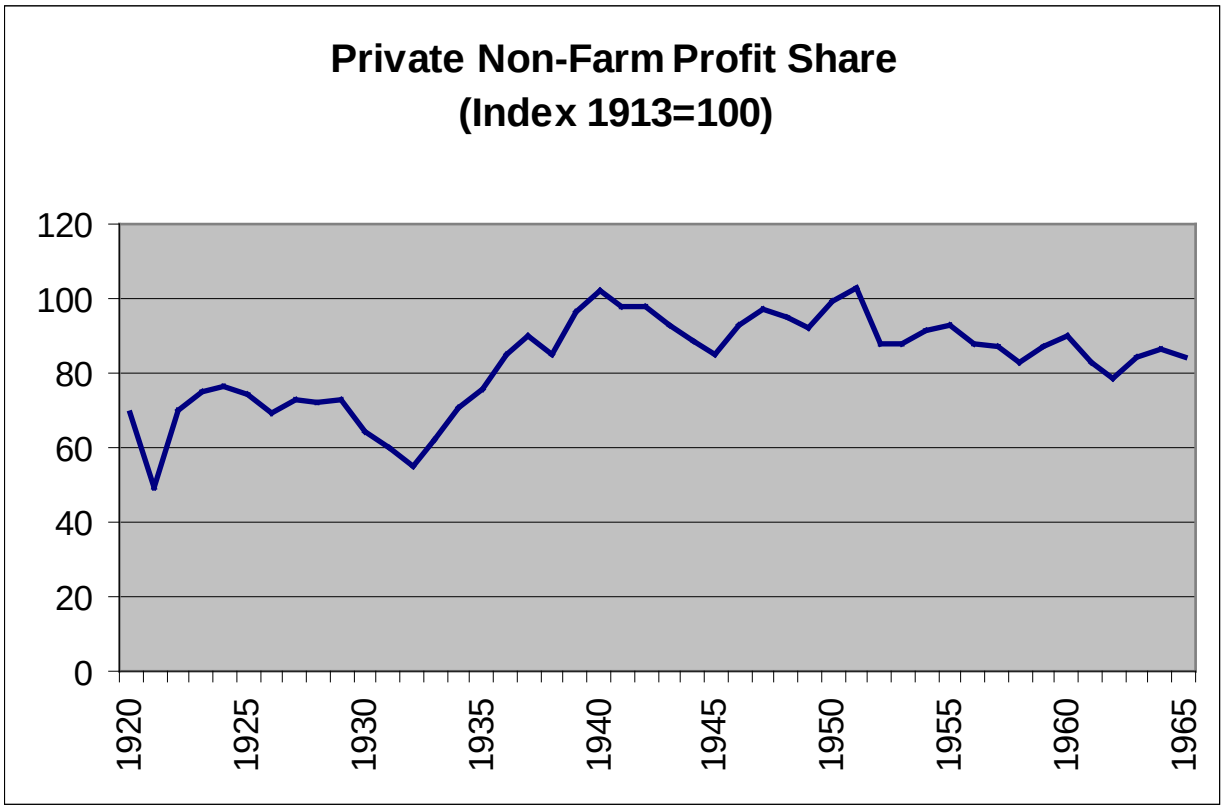


Figure 4

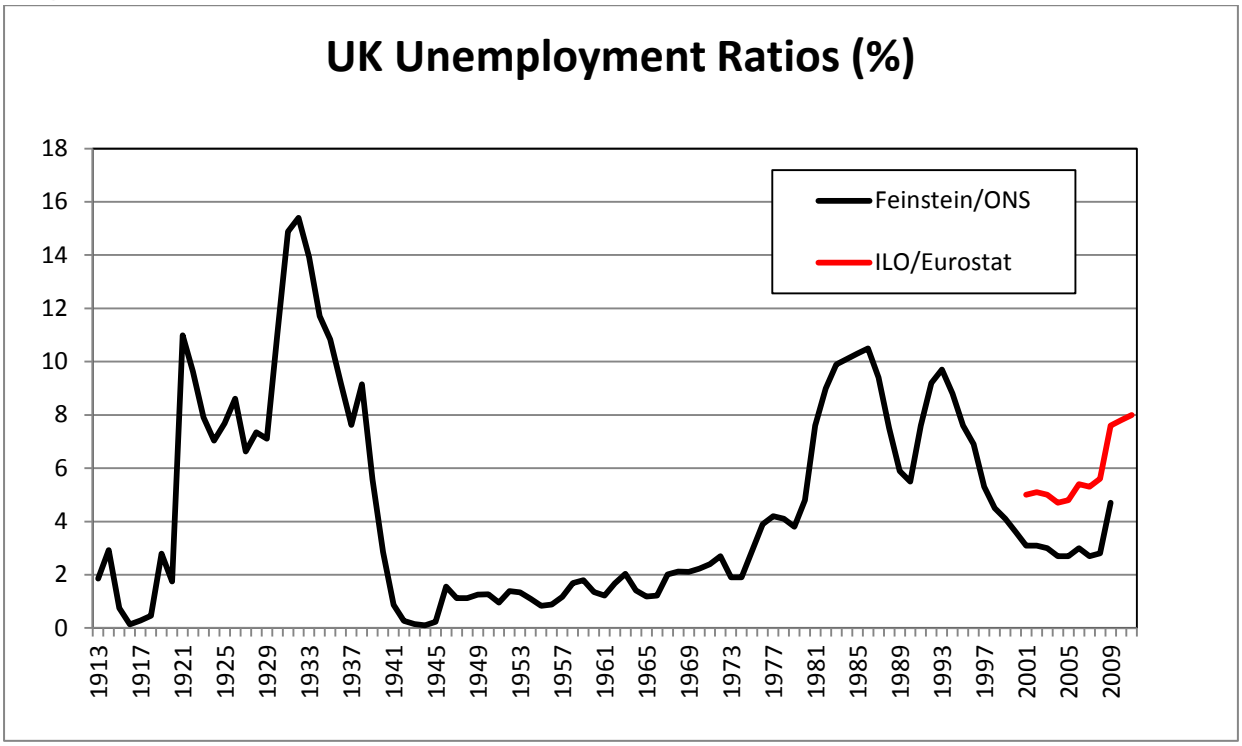


Figure 5: baseline equilibria

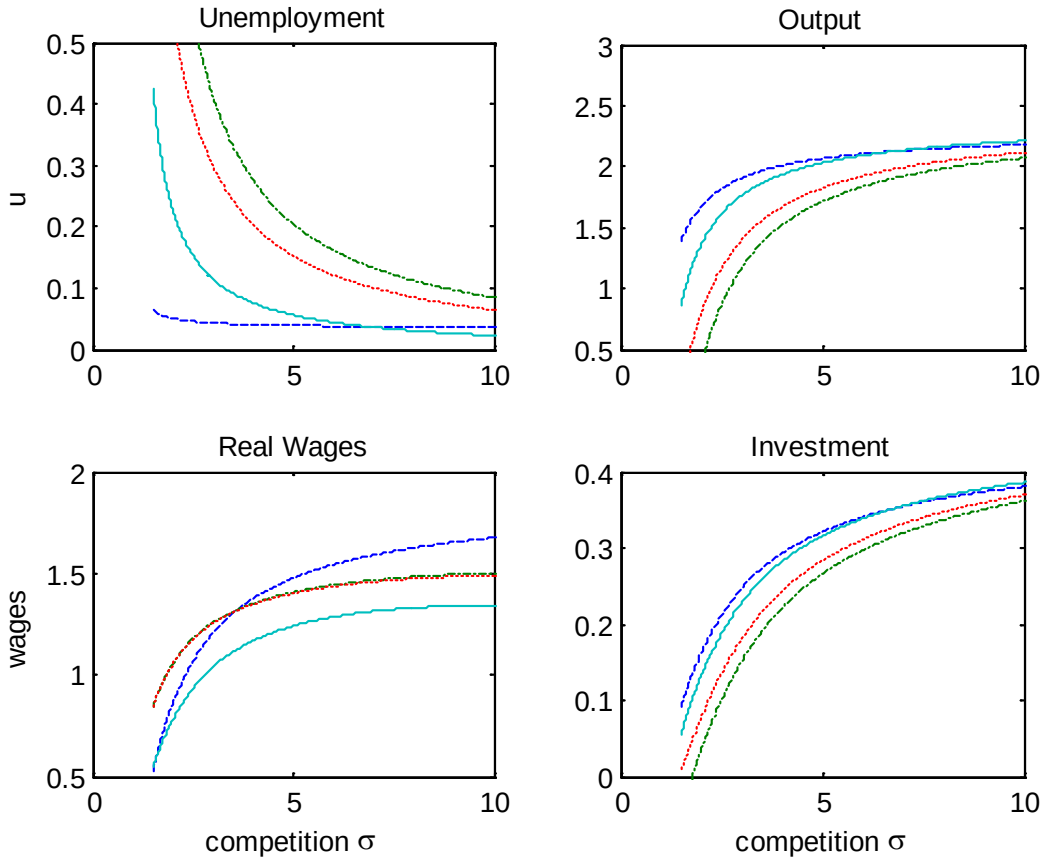


Figure 6a

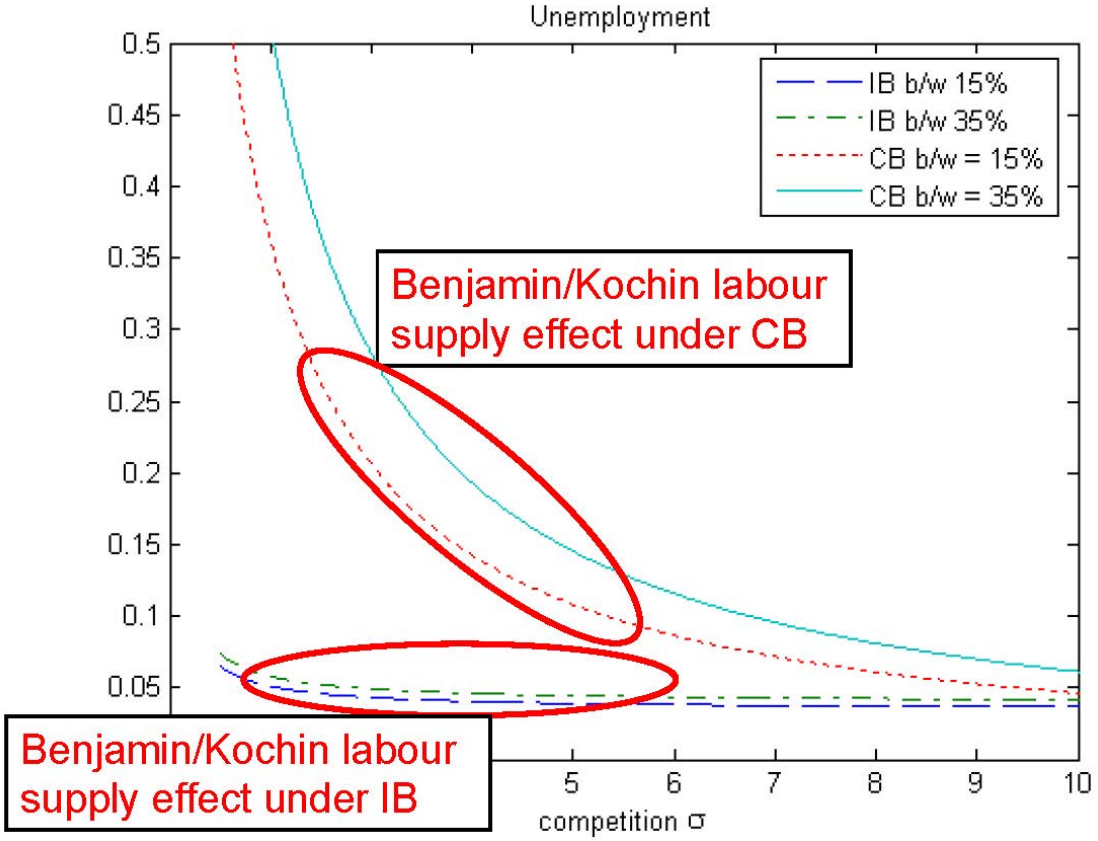


Figure 6b

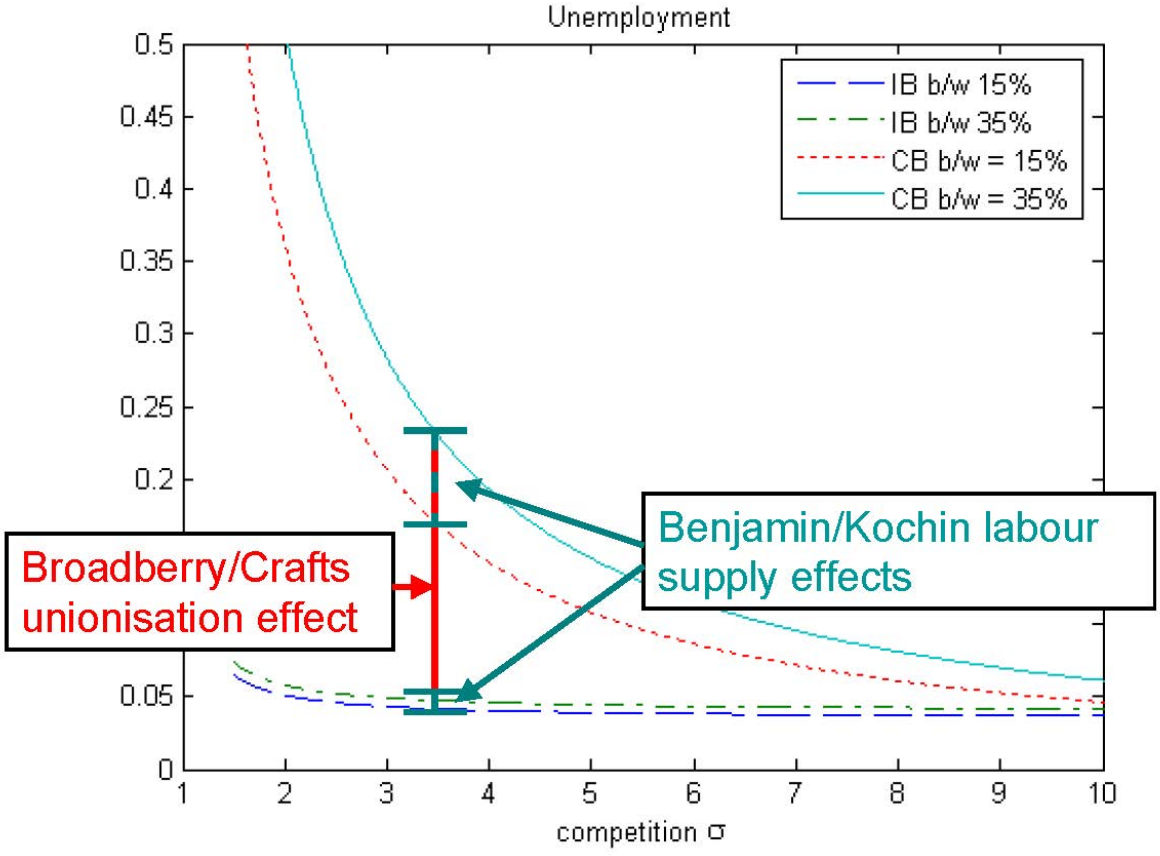


Figure 6c

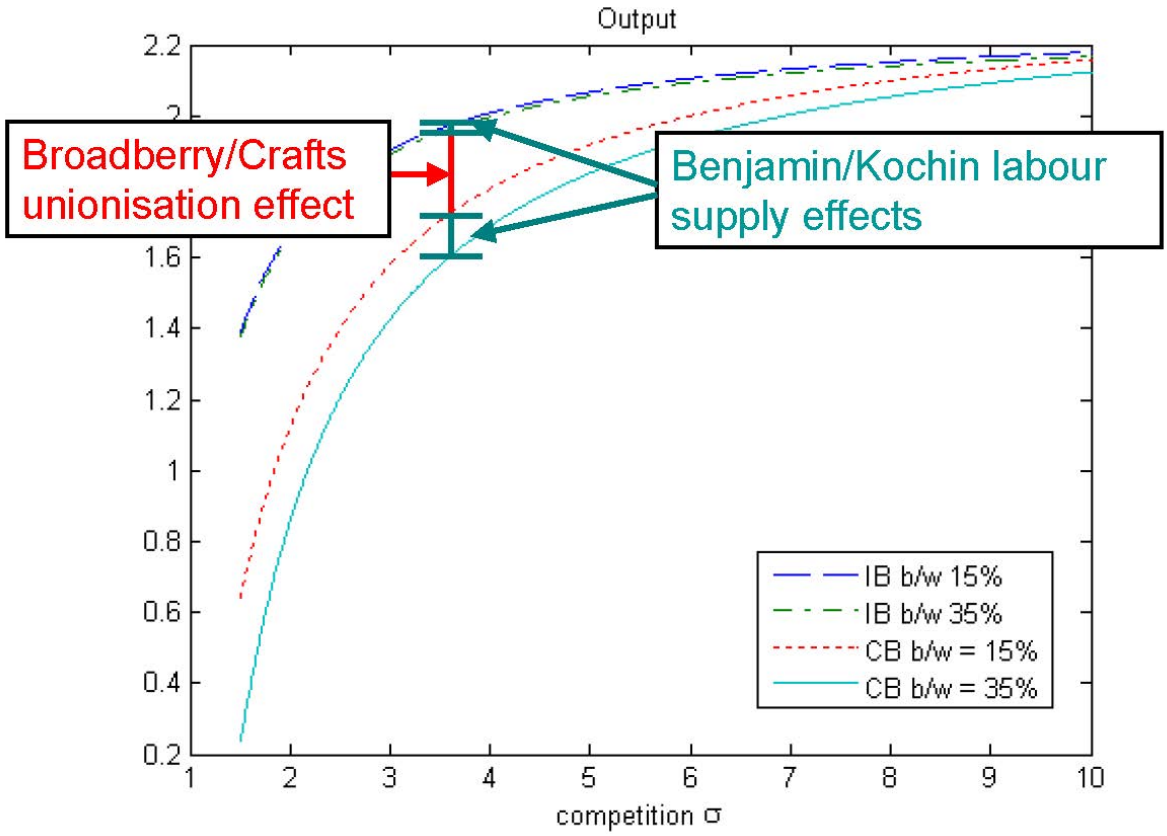


Figure 6d

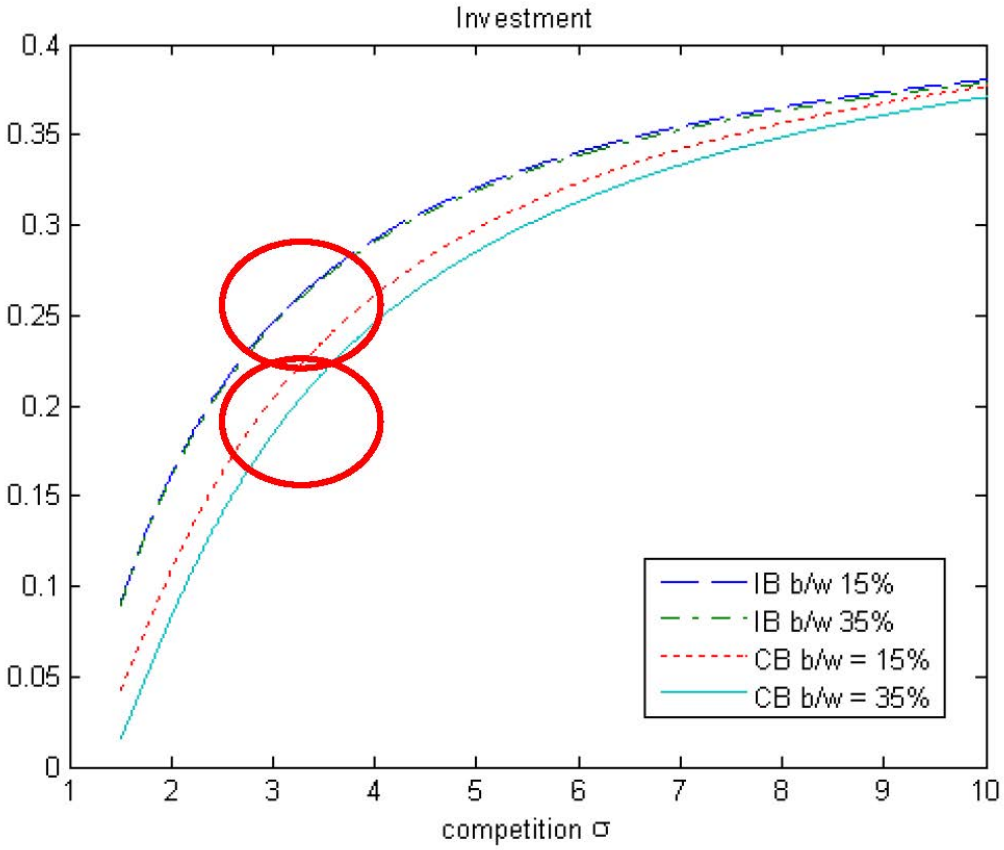


Figure 6e

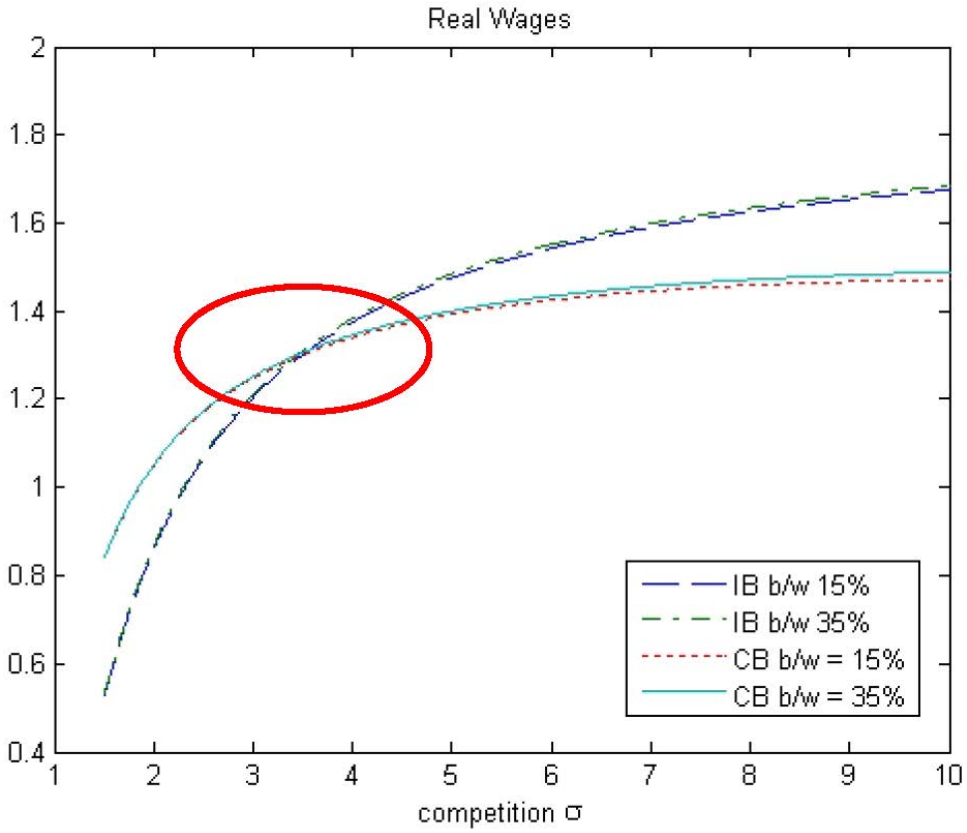


Figure 6f

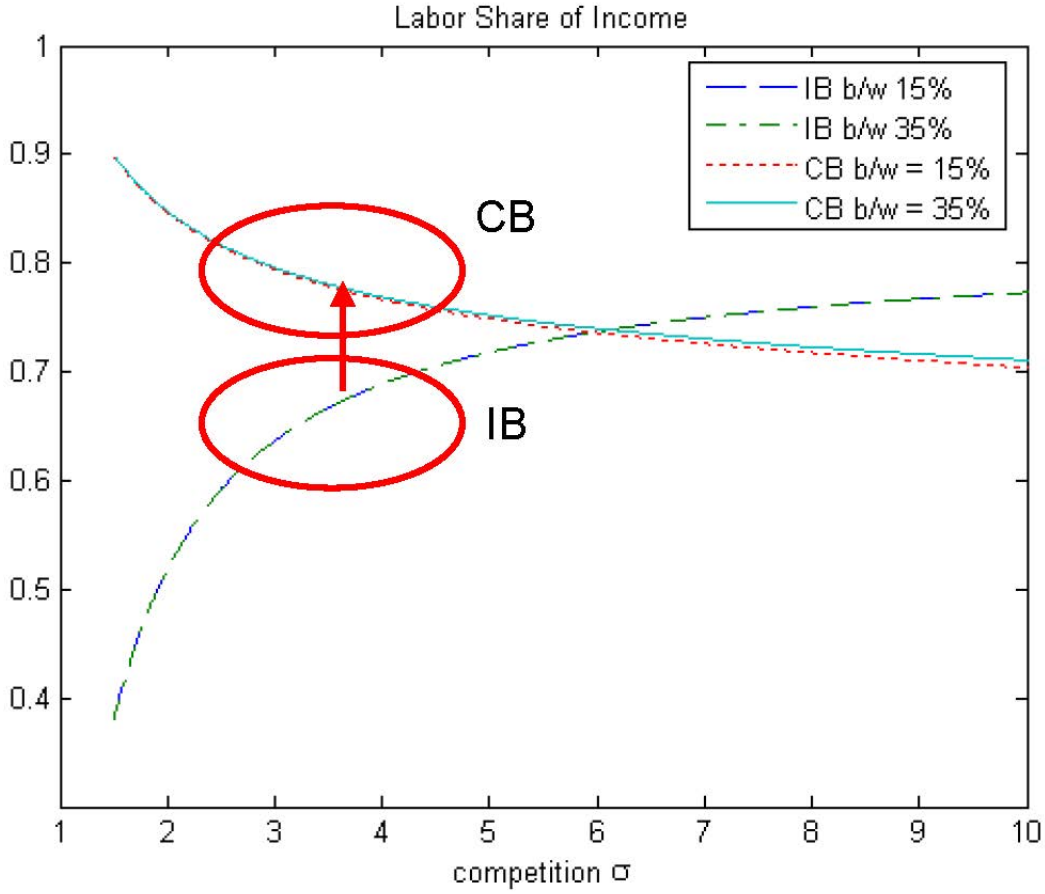


Figure 7a

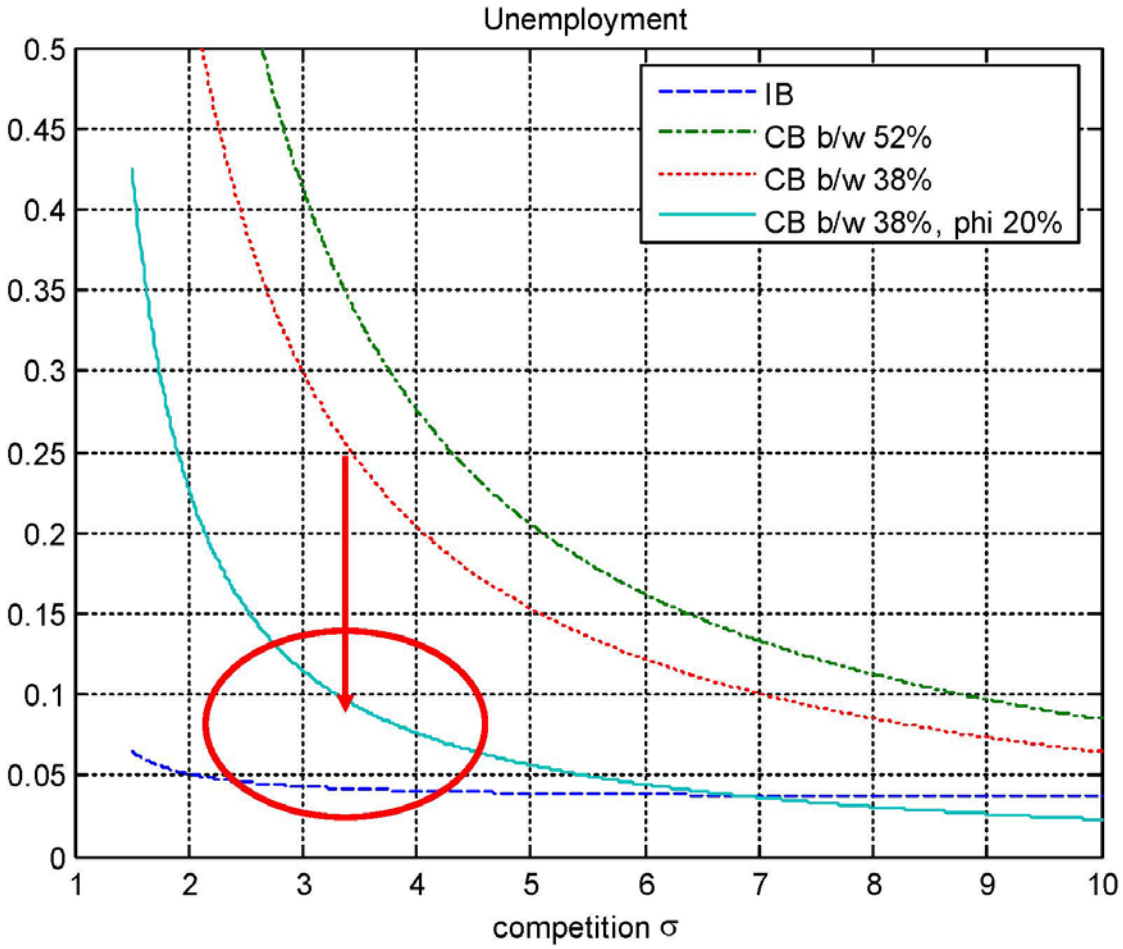

Unemployment
IB
CB b/w 52%
CB b/w 38%
CB b/w 38%, phi 20%
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
1
2
3
4
5
6
7
8
9
10
competition σ

Figure 7b

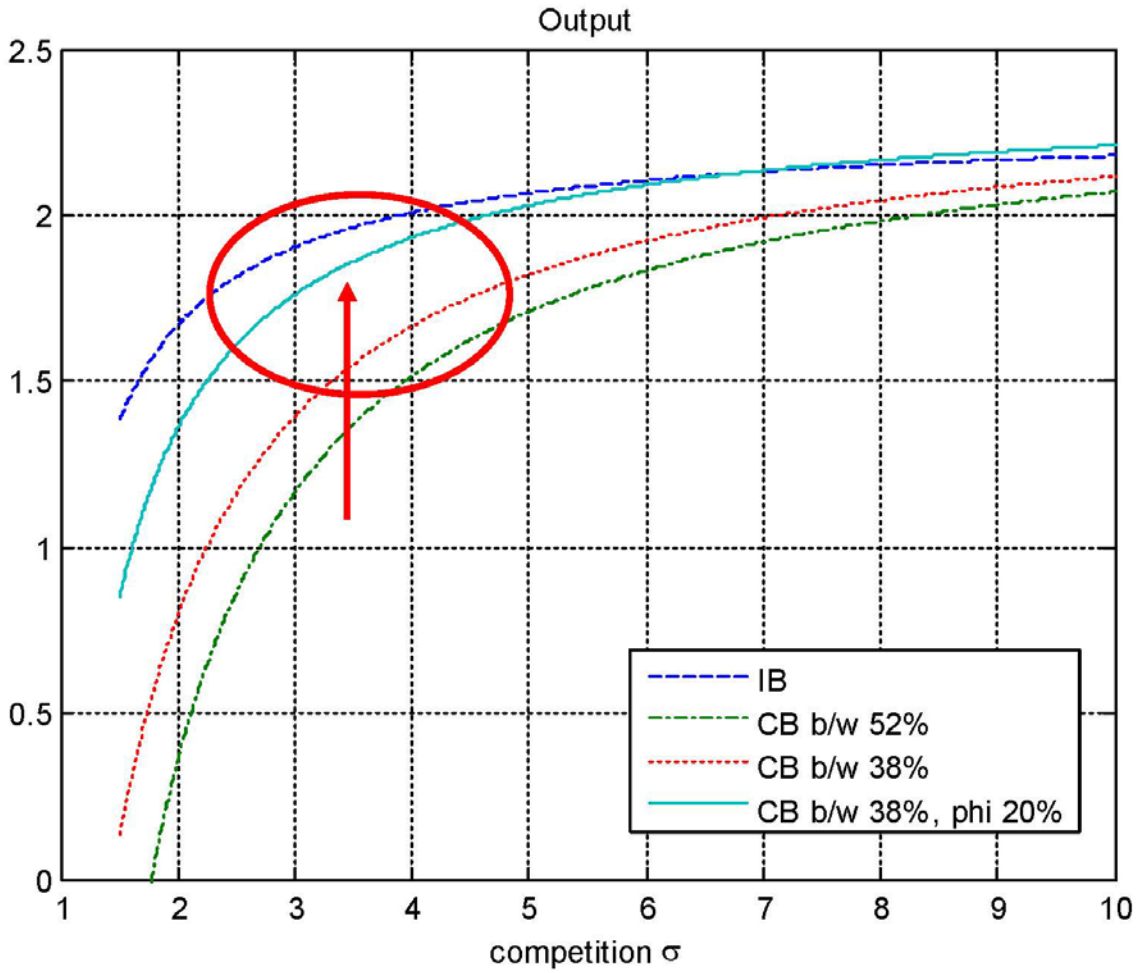

Output
2.5
2
1.5
1
0.5
0
1
2
3
4
5
6
7
8
9
10
competition σ
IB
CB b/w 52%
CB b/w 38%
CB b/w 38%, phi 20%

Figure 7c

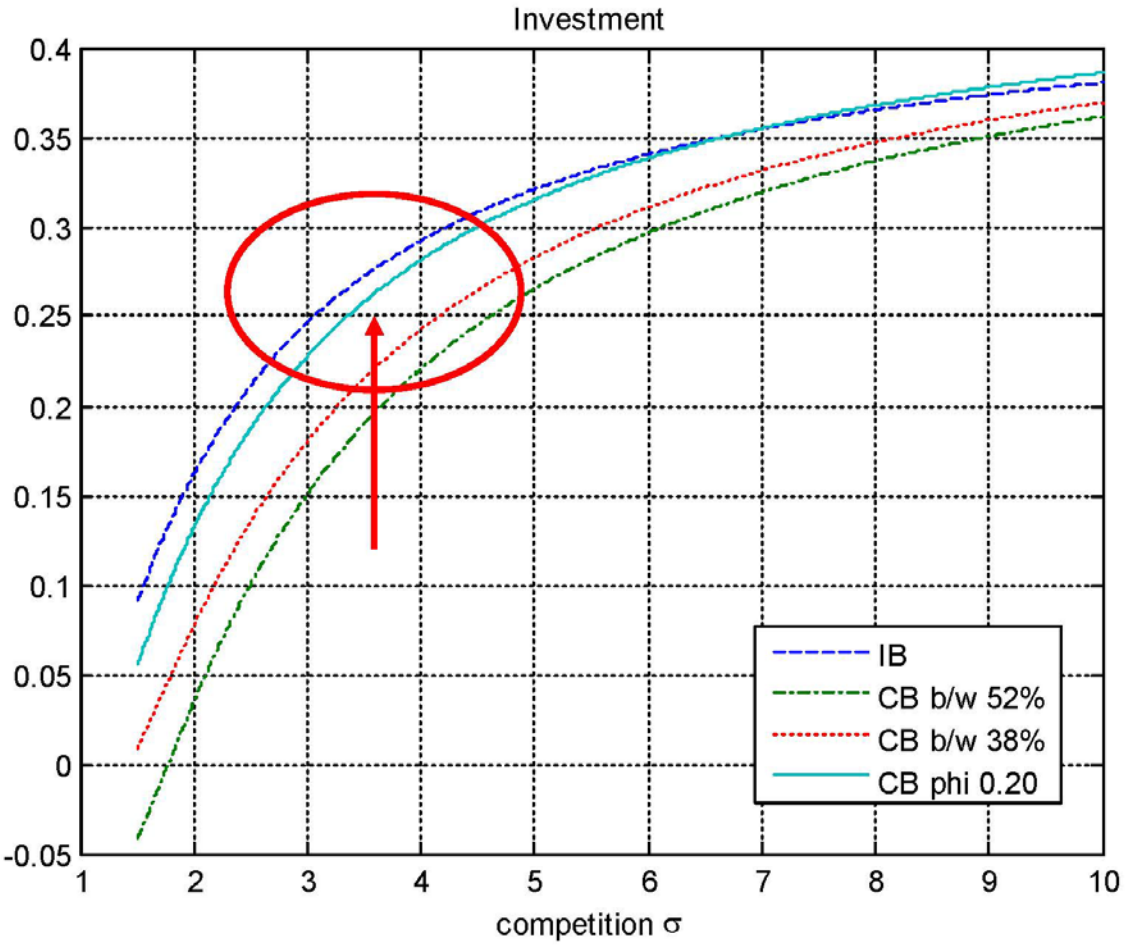

Investment
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
-0.05
1
2
3
4
5
6
7
8
9
10
competition σ
IB
CB b/w 52%
CB b/w 38%
CB phi 0.20

Figure 7d


Real Wages
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
1
2
3
4
5
6
7
8
9
10
competition σ
IB
CB b/w 52%
CB b/w 38%
CB b/w 38%, phi 20%

Figure 8a

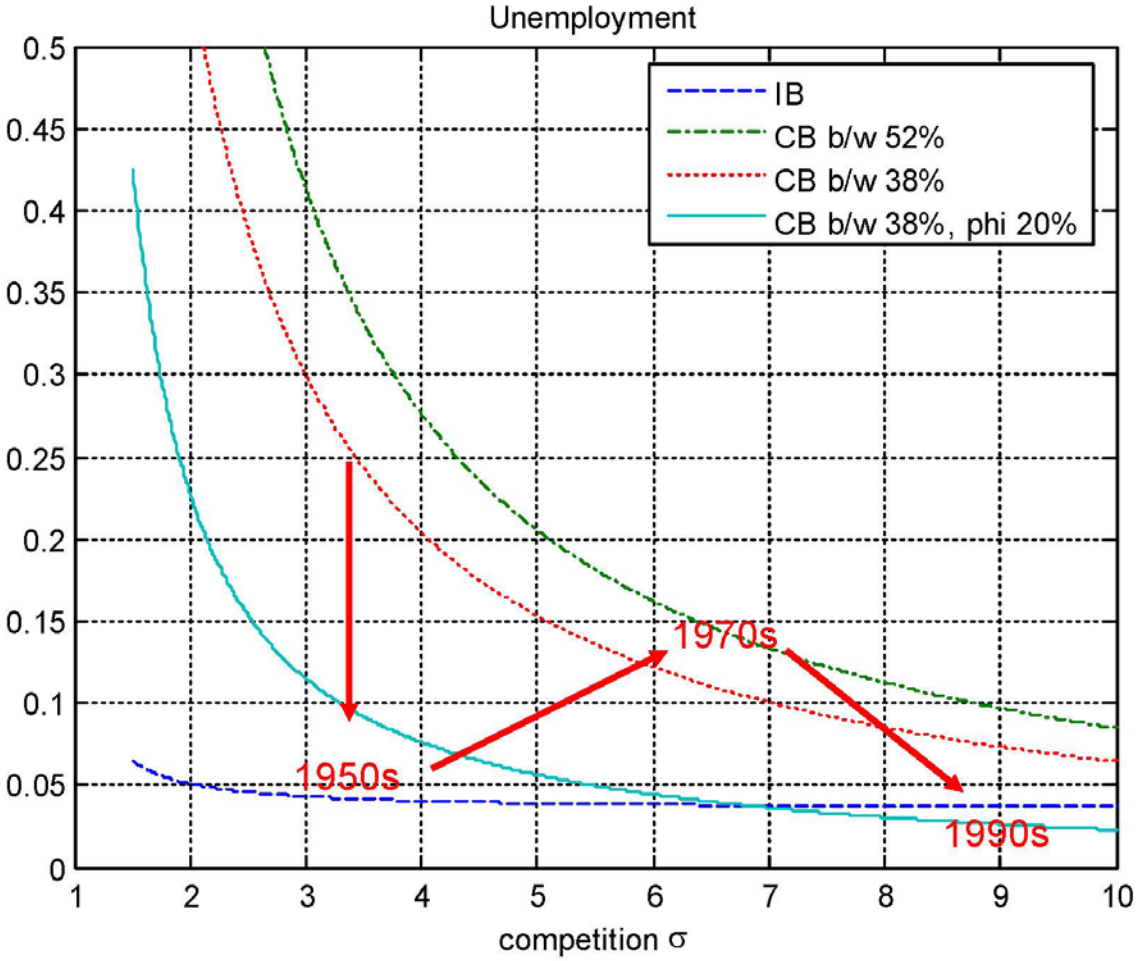

Unemployment
IB
CB b/w 52%
CB b/w 38%
CB b/w 38%, phi 20%
1950s
1970s
1990s
competition σ
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
1
2
3
4
5
6
7
8
9
10

Figure 8b

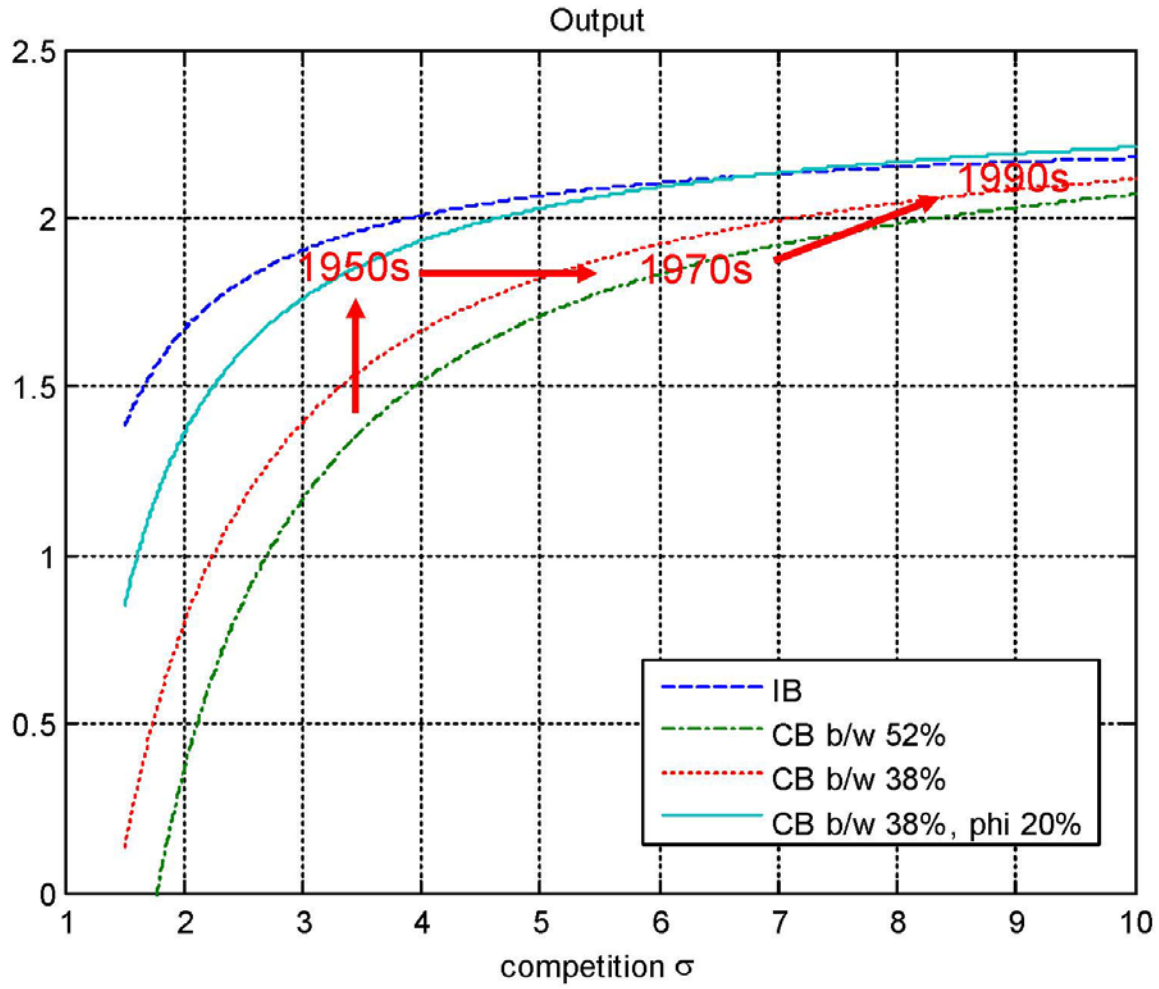

Output
2.5
2
1.5
1
0.5
0
1
2
3
4
5
6
7
8
9
10
competition σ
1950s
1970s
1990s
IB
CB b/w 52%
CB b/w 38%
CB b/w 38%, phi 20%

Figure 8c

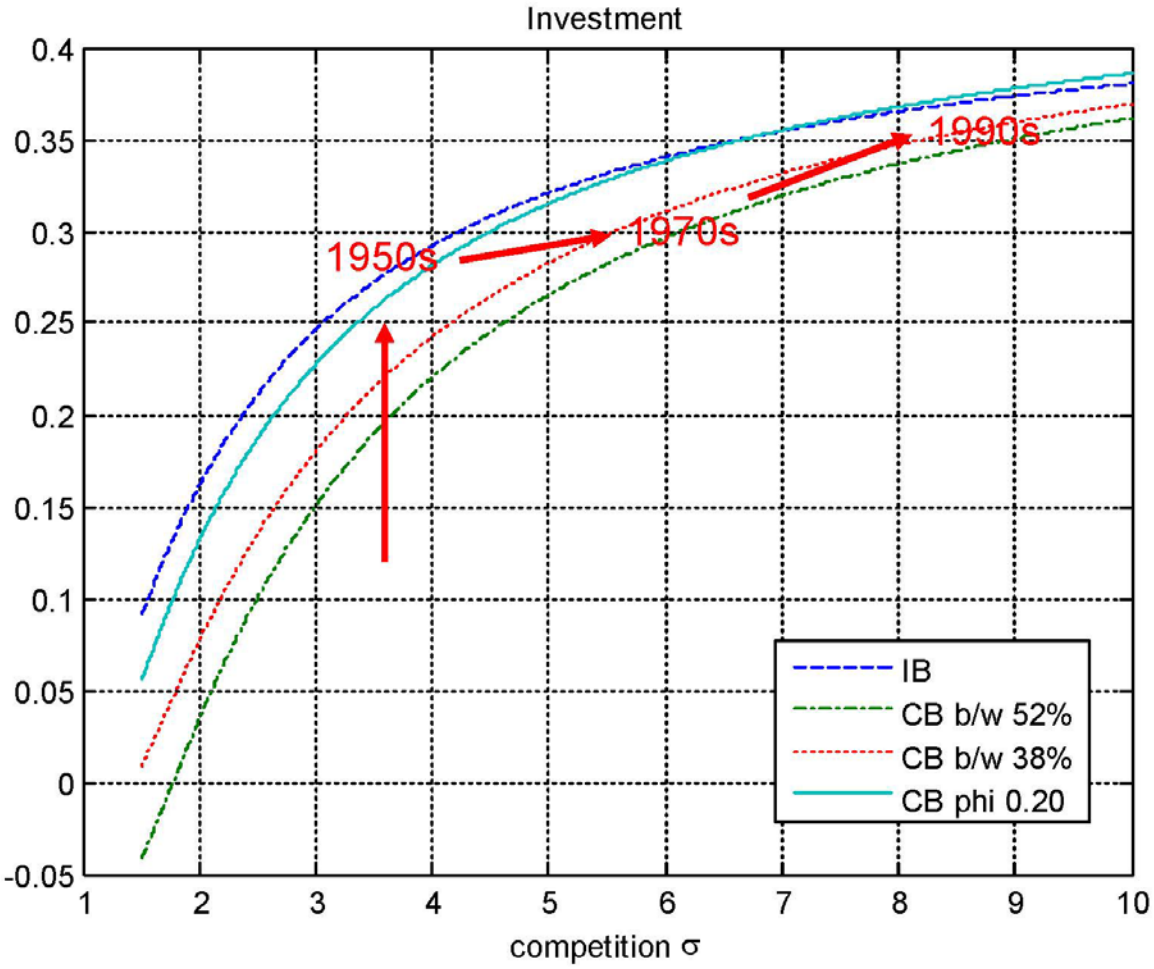

Investment
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
-0.05
1
2
3
4
5
6
7
8
9
10
competition σ
1950s
1970s
1990s
IB
CB b/w 52%
CB b/w 38%
CB phi 0.20

Figure 8d

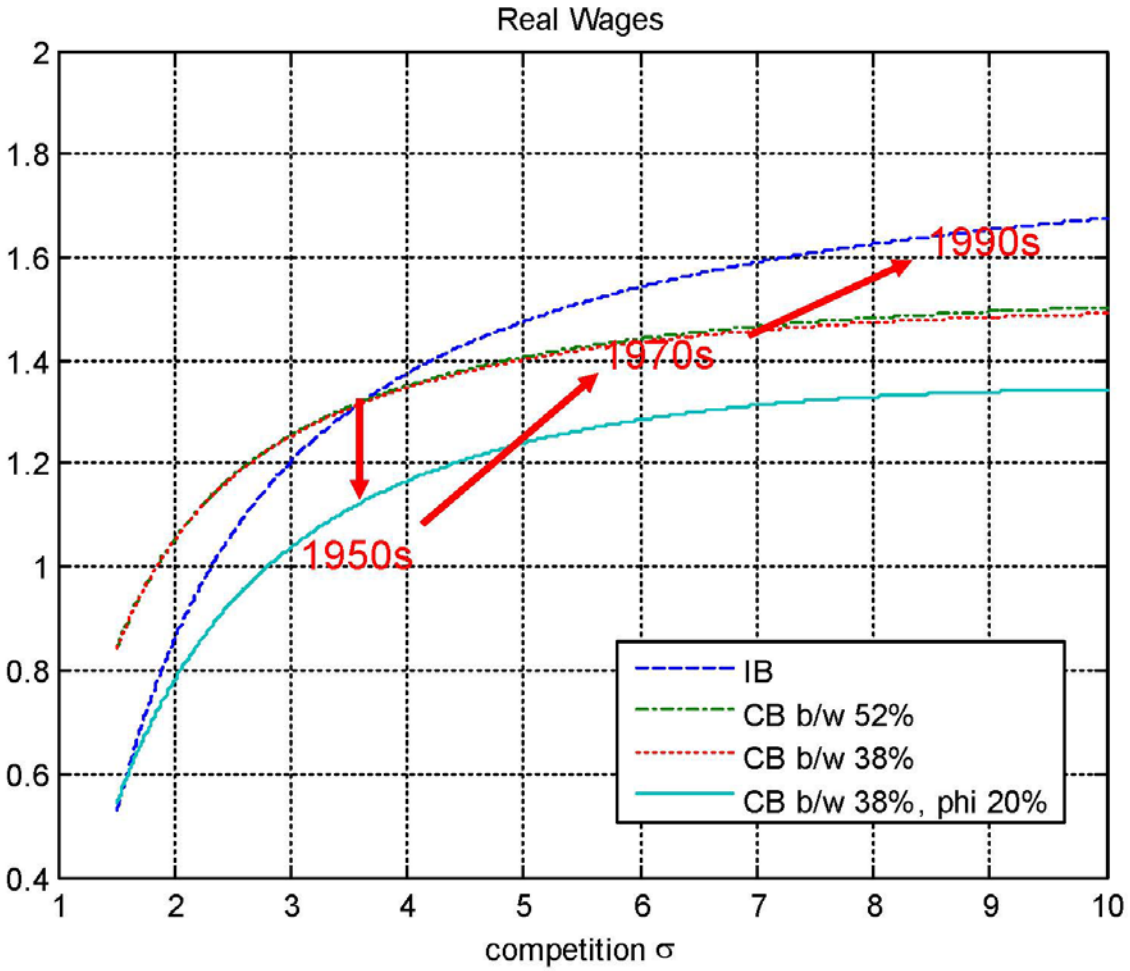
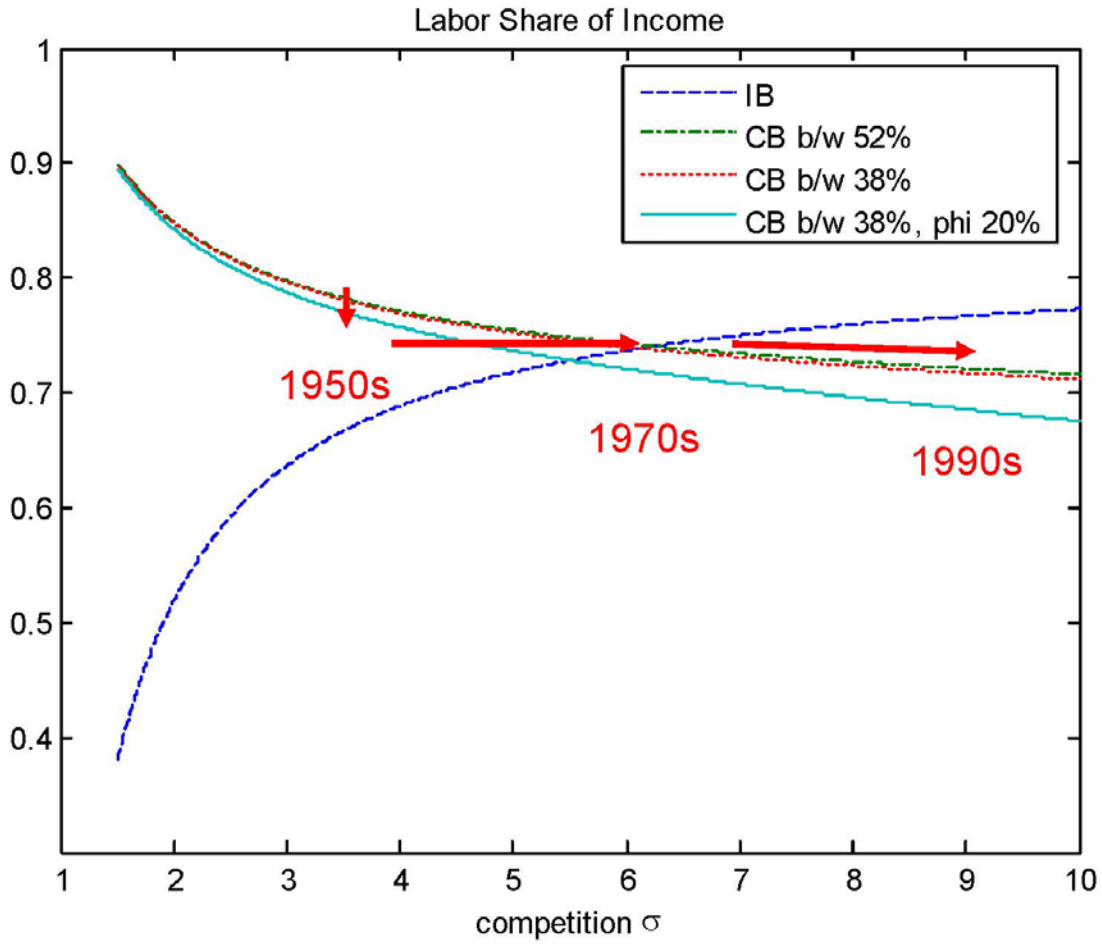

Real Wages
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
1
2
3
4
5
6
7
8
9
10
competition σ
1990s
1970s
1950s
IB
CB b/w 52%
CB b/w 38%
CB b/w 38%, phi 20%

Figure 8d


Labor Share of Income
IB
CB b/w 52%
CB b/w 38%
CB b/w 38%, phi 20%
1950s
1970s
1990s
competition σ
1
0.9
0.8
0.7
0.6
0.5
0.4
1
2
3
4
5
6
7
8
9
10