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Modelling Market Power in Labour
and Product Markets in a Dynamic Economy

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Abstract

In this paper a unified framework is developed for modelling imperfect competition in a monopolistic economy and in a unionised economy in a dynamic setting. Concentrating on the steady state analysis, a graphical approach is developed in consumption/leisure space. In both cases, there is a distortion towards leisure and away from consumption/work. The unionised economy is dynamically efficient, in the sense that the marginal product of labour equals discount rate. However, the monopolistic economy is not: the marginal product of capital exceeds the discount rate. This enables us to compare the outcome in terms of productivity, utility and employment.

Key words: dynamic, monopolistic, unionised, Ramsey.

JEL: E6, H3, J5.

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1 Introduction

The purpose of this paper is to provide a unified framework for understanding and analysing imperfect competition in product and labour markets in the context of a dynamic general equilibrium Ramsey model. The Ramsey framework has become in many ways central to contemporary Macroeconomics. It provides the basic underlying framework both for standard macroeconomic theory and also the stochastic approach such as is found in the RBC approach. The development of a dynamic framework with endogenous labour supply is fairly well developed (see for example (Aloi et al 1998, Coto and Dixon 1999, Devereux et al 1996, Heijdra 1998, Obstfeld and Rogoff 1995, Rotemberg and Woodford 1996, Turnovsky 1995), the work on unionised economies is less well known (Aaronsen et al 1998, Gali 1995 and 1996, Hansen 1999).

This paper develops a simple unified graphical approach in which we can represent and compare both the unionised and monopolistic steady state equilibrium in terms of the consumption-leisure trade-off (the *Income Expansion path IEP*) and the intertemporal Euler condition or *Euler Frontier*. The Euler frontier represents the steady-state relationship between employment and output taking into account the equilibrium capital accumulation. Since we assume a constant returns technology for this paper, the steady-state capital-labour ratio is determined in steady-state, which defines an output-employment ratio. This paper concentrates on the steady-state equilibrium conditions. A full comparison of the dynamic systems is made in Dixon (1999) and is beyond the scope of this paper. However, in general the presence of market power makes the most difference to the steady-state rather than the dynamics *per se*.

In the monopolistic economy, the presence of imperfect competition has two effects. First, it distorts the intertemporal decision of the household by reducing the perceived return on capital; this makes the steady-state output and capital per unit labour lower than in the Walrasian case. This acts as an *income effect* which causes leisure and consumption to fall (since they are both normal). Second, it also makes the wage less than the marginal product of labour, thus causing a *substitution effect* away from work and consumption towards more leisure. The overall effect of monopolistic competition is to reduce consumption, but the income and substitution effects work in opposite directions for labour supply so that there is an ambiguous effect on equilibrium employment.

Also, since the labour market is competitive, the wage equals the marginal rate of substitution (MRS) between leisure and consumption: hence there is no *involuntary unemployment*.

The unionised economy is modelled as in (Aaronsen et al 1998), where there is assumed to be a single union setting the wage as part of an intertemporal problem, with employment being determined by labour demand (the *right-to-manage* approach). In a unionised economy, the union raises the actual wage above the MRS , its market power being determined by the elasticity of labour demand. This leads to involuntary unemployment in equilibrium, in the sense that the household would like to supply more labour than is demanded. It is possible to represent the intratemporal optimality condition between employment and consumption in the unionised economy using the concept of the *shadow wage* w' , where the shadow wage equals the actual MRS (in effect the wage which supports the actual level of employment and consumption). This shadow wage defines the actual IEP of the household.

The presence of union power has no effect on the intertemporal optimality conditions: this is because the actual and perceived marginal product of capital are equal. Hence, output and capital per unit labour are constant and equal to their Walrasian (first-best) levels. Since we assume constant returns, this also implies that the actual wage is equal to its Walrasian level. The effect of an increase in union power can be seen entirely in its effect in distorting the leisure/consumption trade-off. An increase in union power leads to a pure substitution effect on labour supply, reducing consumption and increasing leisure.

The outline of the paper is as follows. In section 2 I outline the standard monopolistic economy. In section 3 the monopoly union economy is analysed. In section 4 the two cases are compared.

2 The Ramsey Model with Monopolistic Competition.

In this section we will outline the basic closed economy Ramsey model with imperfect competition in the in the product market and an endogenous labour supply. In particular, we will consider the case of monopolistic competition where there is a fixed number of firms. This sort of model has been considered by many authors: see for example Aloï et al (1998), Heijdra (1998), Turnovsky

(1995).

There is a single Ramsey household who has utility defined over aggregate consumption C and leisure $1 - L$, where L is the labour supply and 1 the unit endowment of leisure. The aggregate consumption good itself is a homothetic sub-utility (or aggregator) defined over n monopolistically supplied products $j = 1 \dots n$

$$C = C(\mathbf{x})$$

where \mathbf{x} is the n -vector of monopolistic outputs x_j . The cost-function for $C(\mathbf{x})$ takes the form of the homogeneous of degree 1 price index P

$$P = P(\mathbf{p})$$

where \mathbf{p} is the n -vector of monopolistic output prices p_j . By Shephard's Lemma the demands for the individual outputs take the form

$$x_j = P_j C$$

where P_j is the derivative of P w.r.t. p_j . If we follow the convention that price-setters take the aggregate level of consumption as given (they are small in the monopolistic sense) then the elasticity of demand for product j is

$$\eta_j(\mathbf{p}) = \frac{p_j}{P} P_j$$

Since P is homogenous of degree 1 in \mathbf{p} , it follows that $\eta_j(\mathbf{p})$ is homogenous of degree 0 in \mathbf{p} . In the case of a symmetric equilibrium, where all prices are the same, it follows that we can treat the elasticity as a parameter η^* .

The monopolistic firms treat the wage rate w and rental r as given, and choose $\{p_j, L_j, K_j\}$ to solve

$$\max p_j x_j - w L_j - r K_j$$

subject to

$$x_j = P_j C \tag{1}$$

$$x_j = L_j f(k_j) \tag{2}$$

where $f(k_j)$ is the factor intensive form of the constant-returns technology. The firm thus faces a demand curve (1) with C treated as a constant and technology

constraint (2). The profit maximisation conditions yield

$$\mu = \frac{p_j - (f'/r)}{p_j} = \frac{1}{\eta^*} \quad (3)$$

$$w = (1 - \mu)[f - kf'] \quad (4)$$

$$r = (1 - \mu)f' \quad (5)$$

The first equation expresses the price-cost equation in terms of the Lerner index of monopoly μ : price exceeds marginal cost in proportion to the reciprocal of the elasticity of demand in symmetric equilibrium. The other two equations yield the standard marginal revenue productivity conditions for factor demands. Throughout the paper, we assume that there is a symmetric monopolistic equilibrium.

Profits of firm j are given by¹

$$\Pi_j = \mu L_j f(k_j)$$

I assume that the homothetic subutility satisfies the simple aggregation condition

$$1 = C(\mathbf{1})$$

where $\mathbf{1}$ is the unit n -vector. This is in effect a normalisation which enables us to write the aggregate production function and profits simply as

$$C = Lf(k)$$

$$\Pi = \mu Lf(k)$$

The household solves the following problem

$$\max \int_0^\infty U(C, 1 - L)e^{-\beta t} dt$$

s.t.

$$\dot{K} = wL + rK + \Pi - C$$

¹Note that by Euler's Theorem, since production is homogeneous to degree 1

$$L_j f = [f - rf']L_j + f'K_j$$

Using the marginal revenue productivity conditions and the definition of profits yields the result.

It should be noted that explicit expressions for w, r, Π can be substituted from the factor market conditions and profit equation. However, from the household's perspective, it treats all of these as parameters. In particular, as is standard in general equilibrium theory, it does not take into account the effects of its decisions on profits.

The current value Hamiltonian (CVH) is thus

$$H(C, K) = U(C, 1 - L) + \lambda[wL + rK + \Pi - C]$$

This yields the standard *F.O.C.*

$$\begin{aligned} H_C &= U_C - \lambda = 0 \\ H_L &= -U_\ell + \lambda w = 0 \\ H_K &= \lambda f' = -\dot{\lambda} + \beta\lambda \end{aligned}$$

And the standard transversality condition. The first two *FOC* define the intertemporal optimality conditions in the consumption-leisure trade-off. Using the factor market equations (4) we can write this as

$$\frac{U_\ell}{U_C} = (1 - \mu)[f - kf'] \quad (6)$$

This simply states that the marginal rate of substitution between leisure and consumption is equal to the wage, thus defining an *Income Expansion Path*, or *IEP*. Since we assume that both leisure and consumption are normal, the *IEP* must be upward sloping.

Secondly, we can derive the standard *Euler equation*

$$-\frac{\dot{\lambda}}{\lambda} = \sigma((1 - \mu)f' - \beta)$$

where σ is the intertemporal elasticity of substitution. In this paper we will only be analysing and comparing the steady-states across unionised and monopolistic equilibrium. Hence we have the steady state Euler condition

$$f'(k^M) = \frac{\beta}{1 - \mu}$$

This implicitly defines the steady-state capital-labour ratio k^M , which we can represent as a decreasing function of μ : $k^M(\mu)$.

Note that the steady-state Euler condition also defines the marginal product of labour and hence the wage

$$w^M(\mu) = (1 - \mu) [f(k^M(\mu)) - k^M(\mu)f'(k^M(\mu))]$$

where w^M is decreasing in μ (the marginal product of labour is lower with lower k^M and the gap between wage and marginal product is larger).

We can represent the steady-state equilibrium in consumption/Leisure space as in figure 1. The *IEP* represents the intratemporal optimality condition, giving the tangency between the indifference curve that the steady state wage w^M . The steady-state Euler condition is represented by the *Euler Frontier*, *EF*. As L varies, output is given by

$$C = Lf(k^M(\mu))$$

Clearly, output per unit labour (productivity) is decreasing in μ . The overall equilibrium occurs at point M where the *IEP* intersects the *EF*.

In Fig.2 the effect of an increase in μ is shown, representing an increase in the market power of monopolistic firms. One effect of an increase in μ is to rotate the Euler frontier anti-clockwise as the resultant fall in the capital labour ratio reduces productivity. The effect on the *IEP* is to shift/rotate to the right (as the wage falls, relatively more leisure is consumed). The inward rotation of the *EF* is in represents an income effect which reduces both leisure and consumption. The fall in the wage represents a pure substitution effect, a shift from consumption to leisure. The overall effect on the equilibrium is that

- Consumption falls with μ .
- Employment L may increase or decrease with μ . The income effect increases the labour supply; the substitution effect reduces it. Assuming that substitution effects dominate, L increases (as in Fig.2).
- The capital/labour ratio and productivity decrease with μ .

Having examined the determination of the steady state in a monopolistic economy and how it responds to μ , we will now proceed to explore the Unionised economy.

3 The Unionised Economy

In this section, we analyse the case of a unionised economy with perfectly competitive output markets. The model we adopt here is a development of Aaronsen-Löfgren-Sjogren (1998), *ALS* here-after. This integrates a monopoly

union model into the Ramsey framework in a particularly transparent and simple way. Other similar models are (Gali 1995, 1996, Hansen 1999), and a full analysis is given in (Dixon 1999). The basic *ALS* approach rests on the assumption that employment is *demand determined*: inverting the factor market equilibrium² condition yields

$$L = L(w, K) \quad (7)$$

Clearly, there should ideally be a min-condition (employment is the minimum of labour supply and demand). However, on the assumption that unions would not set a wage involving a supply constraint, we ignore this case and assume that optimal wages are always in the demand-constrained region.

The second key assumption is that the union sets the wage to maximize lifetime household utility, only taking into account the effect of its wage-setting on the labour income (and not, crucially, via profits). The third assumption is that when the household chooses its consumption, whilst it does consider the effect of capital accumulation, it ignores any effect on utility via the labour demand curve (7). Both the second and third assumptions can be justified by saying that we are dealing, albeit not explicitly, with representative households and unions, for whom their individual decisions have negligible effects on aggregate capital and labour demand³.

These three assumptions enable us to use a very simple intertemporal union model which is directly comparable to the standard Walrasian monopoly union model and the monopolistic model in the previous sections. Of course, the two models could in principle be combined, but in this paper we will keep the two separate.

Following *ALS* we combine the household and union optimisations in the following way. We assume that there is a social planner who chooses $\{w, C\}$ to maximize lifetime utility, but adjusting the first order equations to reflect the fact that in choosing the wage no account is taken of the effect on capital income and Consumption is chosen ignoring any effect of capital accumulation

²This means simply inverting the cost-minimisation condition

$$w = F_L(L, K)$$

to express L as a function of w, K .

³In fact, this is made explicit in Hansen (1999) where he introduces a unionized intermediate sector.

on labour demand. Of course, if these effects were taken into account then the first-best outcome would obtain.

$$\max_{w(t), c(t)} \int_0^\infty U(C, 1 - L) e^{-\beta t} dt$$

subject to

$$\begin{aligned} \dot{K} &= rK + wL - C \\ L &= L(w, K) \end{aligned}$$

The *CVH* is

$$H(w, K) = U(C, 1 - L) + \lambda[rK + wL(w, K) - C]$$

The adjusted first-order conditions are

$$\begin{aligned} H_C &= U_C - \lambda \\ H_w &= -U_\ell L_w + \lambda[L + wL_w] = 0 \\ H_K &= \lambda f' = -\dot{\lambda} + \beta\lambda \end{aligned}$$

with the usual transversality conditions. As in the monopolistic case, we have two conditions: the intertemporal and the intra-temporal. For simplicity, we concentrate on the steady-state inter-temporal condition when $\dot{\lambda} = 0$. These conditions are

$$\text{Intratemporal: } w = \frac{\varepsilon}{\varepsilon - 1} \frac{U_\ell}{U_C}$$

$$\text{Intertemporal: } f(k) = \beta$$

Where ε is the elasticity of labour demand where we assume that⁴, $\varepsilon > 1$. The intra-temporal condition gives the union markup of the wage over the *MRS* between leisure and consumption: the markup is greater the less elastic is the demand for labour. The dynamic condition is the standard Euler condition. We will examine these two conditions and how they can be combined.

⁴The definition is

$$\varepsilon = -\frac{w}{L} L_w$$

With Cobb-Douglas technology, $Y = L^\alpha K^{1-\alpha}$, $\varepsilon = (1 - \alpha)^{-1} > 1$. With intermediate production, the demand would be a composite depending on the demand for intermediates and factor substitution, as in Hansen (1999).

3.1 Intra-temporal Equilibrium and Involuntary unemployment.

The wage markup equation can be understood as involving some sort of *Involuntary unemployment IU*. The term *IU* has been interpreted in a variety of ways: I use it in the purely technical sense that the household would like to supply more labour at the current wage⁵. In fact, if w is the actual wage set, we can define the *shadow wage* w' , which is equal to the *MRS* at the actual employment/consumption pair.

$$w' = MRS = \frac{\varepsilon - 1}{\varepsilon} w \quad (8)$$

We can then define two *IEPs*, one for the actual wage w , the other for the shadow wage w' . These are depicted in Fig.3. Clearly, since $w' < w$, the *IEP* for the actual wage is above the *IEP* for the shadow wage, since at a higher wage the household will substitute more leisure for consumption. We can look at $IEP(w)$ as the desired labour supply at the prevailing wage w . *Actual* employment will take place on the shadow $IEP(w')$, since the actual *MRS* is defined by $\{C, 1 - L\}$.

Fig.3

Now, if we take a point such as A on $IEP(w')$ we can see two budget lines passing through it. One is the shadow budget line passing through with slope w' which is a tangent to the indifference curve (not shown) at A ; the other with the steeper slope is the budget line with the slope of the actual wage w . The actual consumption/leisure decision is at point A : the desired point is at point B . The difference in employment between A and B is the level of *IU*. In fact, there is also an excess demand for consumption if we compare A to B : since there are only two goods the excess supply of labour is exactly mirrored in the excess demand for consumption⁶.

⁵Other terms such as union-voluntary would be just as appropriate, but I use *IU* since it is generally accepted and used.

⁶Clearly, without a third good (e.g. money) we cannot make the standard neo-Keynesian distinction between notional and effective demands (e.g. Benassy 1986).

3.2 Inter-Temporal Equilibrium.

The Euler equation is unaffected by the union, and satisfies the Walrasian intertemporal optimality condition (this result also appears in Hansen 1999 Proposition 1). With *CRTS* this ties down both the equilibrium capital/labour ratio and the wage: they are both equal to their Walrasian level.

$$f'(k^*) = \beta \quad (9a)$$

$$f(k^*) - k^* f'(k^*) = w \quad (9b)$$

Starting from (9a) this determines k^* , and hence the *MPL* (9b) and wage. Essentially, the Euler condition determines the steady-state real wage and the effect of union power is simply to lead to unemployment: this is analogous to the Shapiro-Stiglitz efficiency wage model where the level of unemployment adjusts to ensure that the no-shirking condition is satisfied.

Of course, the fact that the union has no effect on the equilibrium wage is a consequence of the assumption of *CRTS*: with diminishing returns the wage would not be tied down by the Euler condition. In this case, the two equations (9b, 9a) can be combined to yield

$$F_K(K, L(w, K)) = \beta$$

This equation implicitly defines K and L given w except with *CRTS*. With *CRTS* F_K is homogeneous of degree 0 in $\{K, L\}$, so that only the ratio k is determined and hence w can take only one value. If there are *diminishing returns to scale*, then w may take a range of values and hence be different from the Walrasian value.

Note that the unionised economy is *dynamically efficient*. This is meant in the sense that the capital labour ratio defined by (9a) satisfies the modified Golden Rule for a given level of employment. As we shall see, since employment in the Walrasian economy is greater than in the unionised economy, the total capital stock is smaller than in the Walrasian economy.

3.2.1 Unionised Equilibrium

The unionised equilibrium can be represented as in the monopolistic case, as the intersection of the *EF* and the shadow wage $IEP(w')$ in $\{C, 1 - L\}$ space. The *EF* is the Walrasian one; from (9b) the union wage is also the Walrasian wage

w^* , so that the desired $\{C, 1 - L\}$ bundles are given by the Walrasian $IEP(w^*)$. Just as the degree on monopolistic power is determined by the elasticity of demand, the union's market power is determined by the elasticity of labour demand ε , which determines the markup of the wage over the MRS . The shadow wage is then determined with reference to the Walrasian wage

$$w' = \frac{\varepsilon - 1}{\varepsilon} w^* \quad (10)$$

The Walrasian equilibrium occurs at point PC (*Perfectly Competitive*), where $IEP(w^*)$ intersects EF . The actual unionised equilibrium occurs at point A in Fig.4 where the shadow wage $IEP(w')$ intersects the EF . The desired consumption-leisure pair is at point B where the Walrasian wage line⁷ intersects the Walrasian $IEP(w^*)$. The difference in employment between A and B is the level of IU .

Fig.4

What happens if the union-markup increases (ε falls)? The shadow wage (10) falls, so that $IEP(w')$ shifts to the right/downwards as in Figure 5 to the new $IEP(w'_1)$. Hence, we can say unambiguously that an increase in the market power of unions leads to a fall in consumption and an increase in leisure as the equilibrium moves from U to $U1$. This contrasts to the monopolistic case, where the EF also shifts and there is an income effect working to increase labour supply.

Fig.5

3.3 Fiscal Policy in a Unionised Economy.

Finally, we can introduce a simple fiscal policy exercise into this framework. We shall take the case where there is a permanent increase in government expenditure financed by a (flow) balanced budget lump-sum tax. In this case, the accumulation equation becomes

$$\dot{K} = wL + rK + \Pi - C - G$$

The analysis of fiscal policy in $\{C, 1 - L\}$ space can be made by noting that the EF now becomes

$$C = Lf(k^*) - G$$

⁷This has a slope of w^* . Note that $w^* < f(k^*)$, so that B lies inside the EF .

As in Aloï et al (1998) and Dixon (1999), a permanent increase in G results in a vertical shift downwards in $\{C, 1 - L\}$ space, preferences unaffected. This is depicted in Fig 6 below. Clearly, since taxation is non-distortionary, the IEP is unaffected. The increase in taxation is paid for by the household in two ways: first, it reduces consumption; secondly it reduces leisure (works more). The multiplier will certainly be between zero and unity. The multiplier will be larger the larger is proportion of leisure in the households marginal consumption/leisure choice. If preferences are homothetic, then the IEP is linear and the marginal and average consumption leisure mix are the same. More union power means that leisure takes up a larger proportion for any given utility level, hence

Proposition 1 *Let preferences be homothetic. Then the output multiplier for a permanent increase in government expenditure is increasing in the degree of union power.*

Fig 6

This is easily seen graphically in Figure 6. The vertical shift in the EF results in a smaller decrease in output when the IEP is flatter: the IEP is flatter when the union markup is bigger ($\varepsilon' > \varepsilon$).

Intuitively, this is exactly the same interpretation as in the original papers on imperfect competition and the multiplier in static models (Dixon 1987, Mankiw 1988, Startz 1989). Since output per unit labour is not affected by variations in union power, there is a pure substitution effect of an increase in union power: higher market power means that for a given level of consumption there is more leisure. The household responds to an increase in taxation by reducing both consumption and leisure. Since greater union power means there is proportionately more leisure, the tax results in a greater response of leisure (i.e. increase in labour supply) than a reduction in consumption (i.e. crowding out). The resultant multiplier is thus larger (although less than unity).

4 A Comparison of the Unionised and Non-Unionised Economies.

There is no direct way to compare unionised and non-unionised economies: the nature of the market imperfections are simply different. However, we can draw together some of the points made into a simple listing. Also, we construct a benchmark case for comparison which allows for a direct comparison.

The main differences are

- The unionised economy is dynamically efficient given employment; the monopolistic economy is not.
- Both productivity (output per head) and the capital labour ratio are larger in the unionised economy than in the monopolistically competitive economy.
- There is involuntary unemployment in the unionised economy; all unemployment is voluntary in the monopolistic economy.
- Employment is definitely lower than the Walrasian level in the unionised economy, whilst it may be higher or lower in the monopolistic economy.

All four of these properties are really just different ways of looking at the fact that the unionised EF is the same as the Walrasian. The key reason for this is that imperfect competition in the output market reduces the marginal revenue product of both labour and capital. The reduction in the marginal revenue product of capital below its marginal product leads to a tendency for under-accumulation of capital. This effect is absent in a unionised economy.

Whilst these are general qualitative points, we can make a more "direct" comparison between the monopolistic and unionised economy. To do this we make compare two economies that are in some precise sense similar, defining a *benchmark* case:

Benchmark Case The unionised shadow wage equals the monopolistic wage:
 $w' = w^M.$

This assumption means that the MRS between consumption and leisure in the two economies are the same, and hence the IEP are the same, as depicted

in Figure 7. In effect it means that the product market elasticity of demand equals the elasticity of demand for labour.

Fig 7

In the benchmark case, we can derive the following direct comparisons

Proposition 2 *In the Benchmark case $w' = w^M$, we have:*

- (a) *Utility is (strictly) higher in the unionised economy.*
- (b) *Leisure and Consumption are (strictly) higher in the unionised economy.*

Both of these results can be seen directly from comparing the unionised equilibrium point U with the monopolistic equilibrium M in Fig.7.

Corollary 3 *Clearly, since the ranking of the two economies is unambiguous in the benchmark case, we can generalise the Proposition 2 to the case where $w' \geq w^M$. Furthermore, by continuity, there exists $\delta > 0$ such that if $w' > w^M - \delta$ then the Proposition will also hold.*

Hence, if the actual MRS between consumption and leisure are similar, with the unionised shadow wage being not too far below the monopolistic wage, then the clear rankings of the corollary are valid. Of course, the benchmark case is a way of comparing fundamentally different types of economies, so there is no *a priori* reason to expect the corollary to be applicable.

5 Conclusion.

This paper has developed a common framework for understanding and analysing monopolistic and unionised economies in a common dynamic Ramsey framework. In particular, a common graphic analysis has been developed for understanding the steady-state. First, there is the intra-temporal relationship between consumption and leisure which can be captured using an appropriate Income Expansion path. In both the case of monopolistic competition and a unionised economy, the effect of imperfect competition is to reduce the incentive to work and consume resulting in a substitution effect towards leisure. Secondly there is the intertemporal optimality condition, represented by the Euler frontier. This determines the steady-state relationship between leisure, capital

and output. Here there is a significant difference between the monopolistic and unionised economy: the monopolistic economy is dynamically inefficient because there is a wedge between the marginal productivity of capital and the rental; the unionised economy is dynamically efficient.

Clearly, there are alternative ways of modelling the unionised economy: in particular a richer micro-structure with different labour markets and union objectives could be developed (as in Hansen 1999). However the simplicity of the *ALS* model is particularly appealing and yields the same basic insights. However, further insights could be gained by developing a dynamic model with bargaining over wages and/or employment. This is a task for future work.

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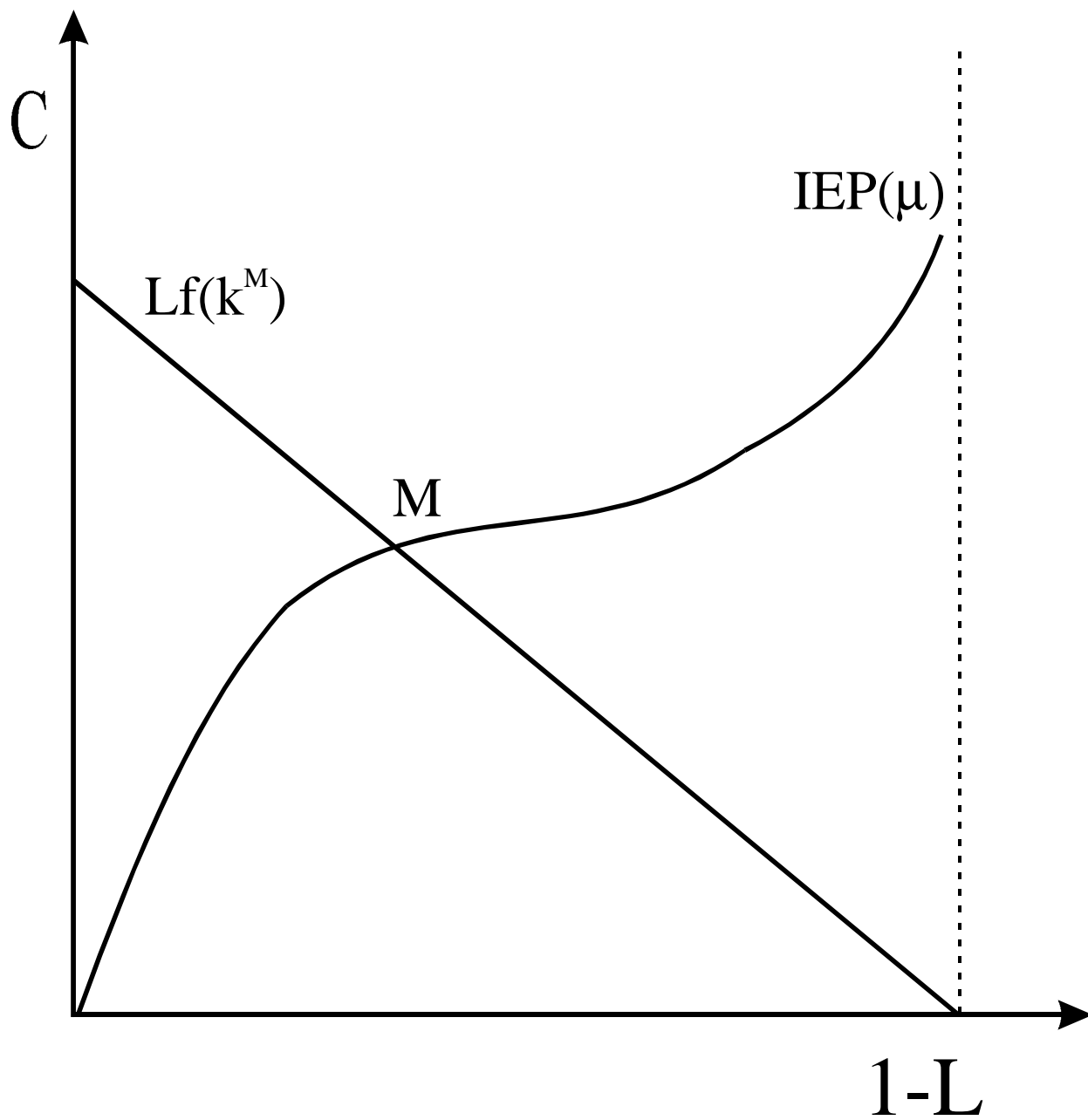


Fig 1. Steady State Equilibrium

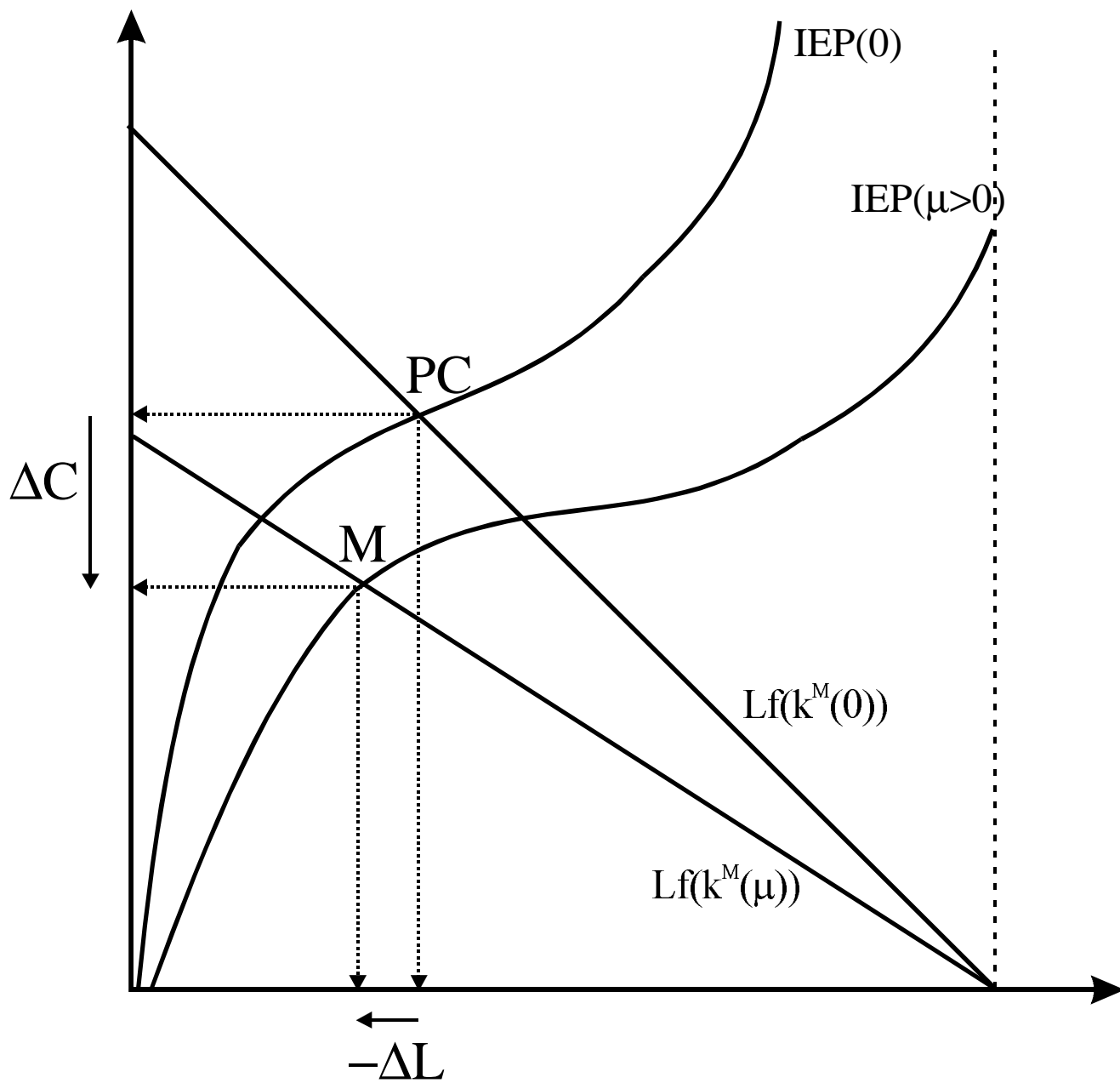


Fig 2: Monopolistic Equilibrium
And an Increase in μ

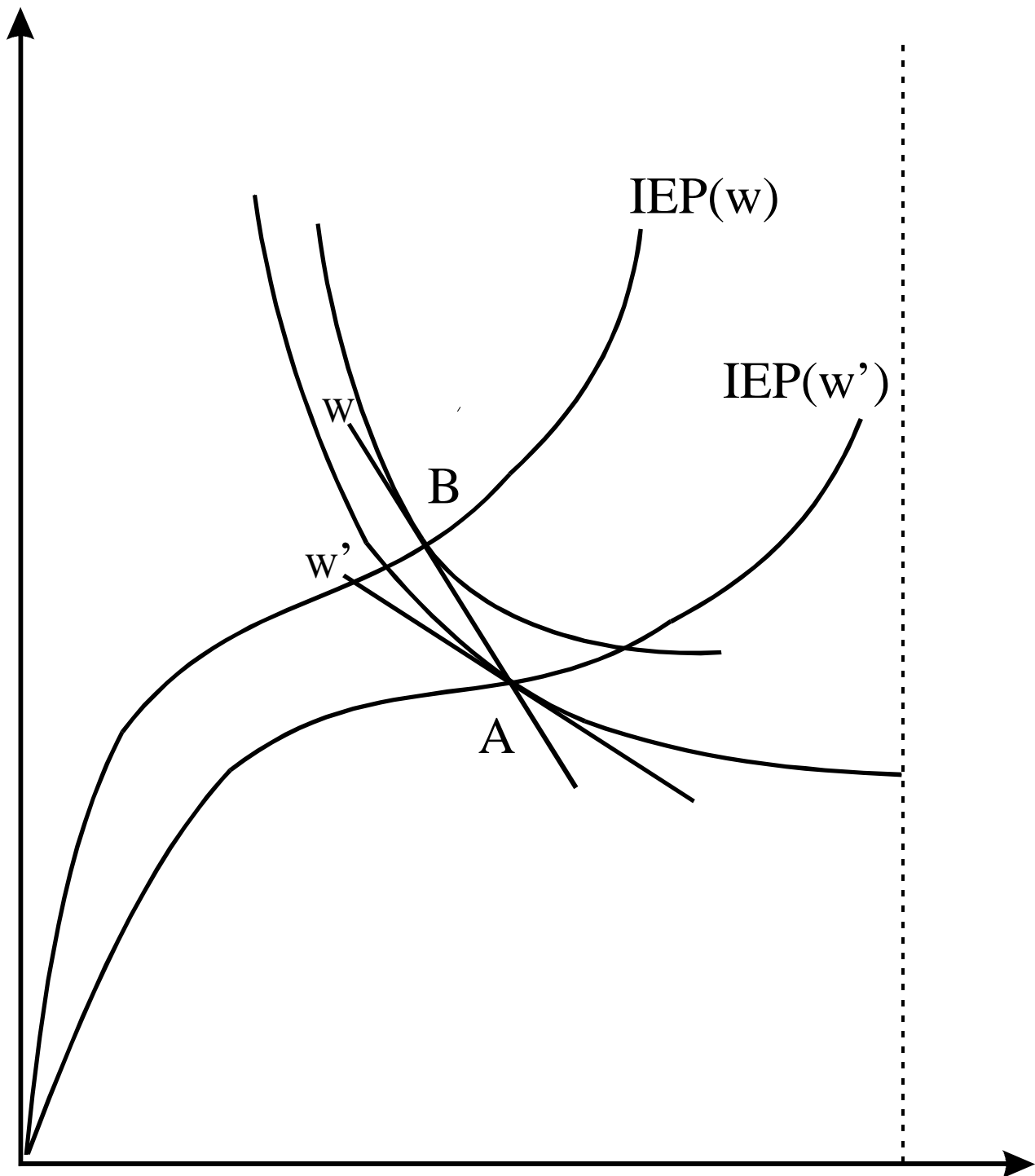


Fig 3: The Psuedo $IEP(\epsilon)$ for shadow wage w' and desired trades IEP for actual wage w

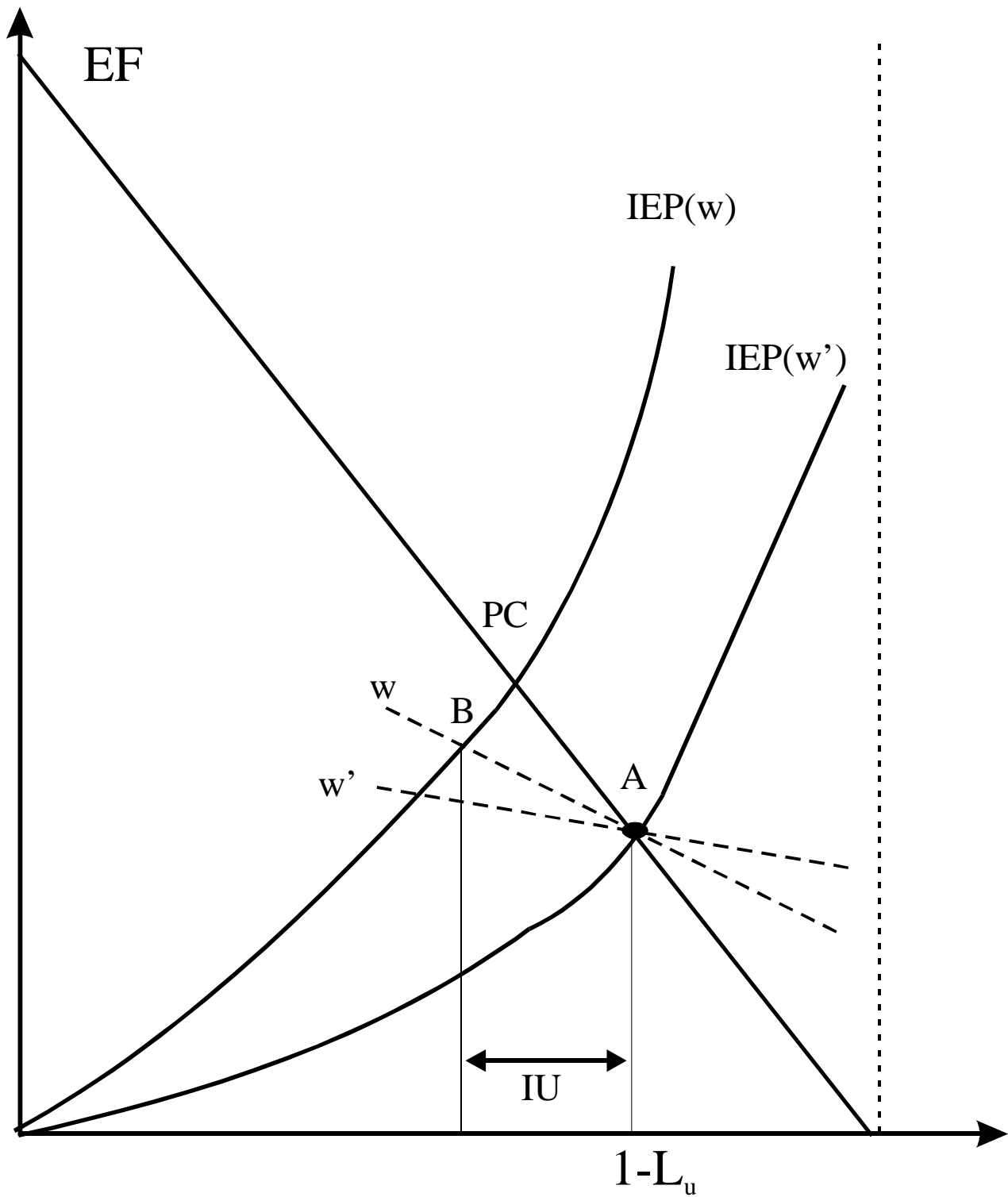


Fig 4: Unionised Equilibrium and Involuntary Unemployment.

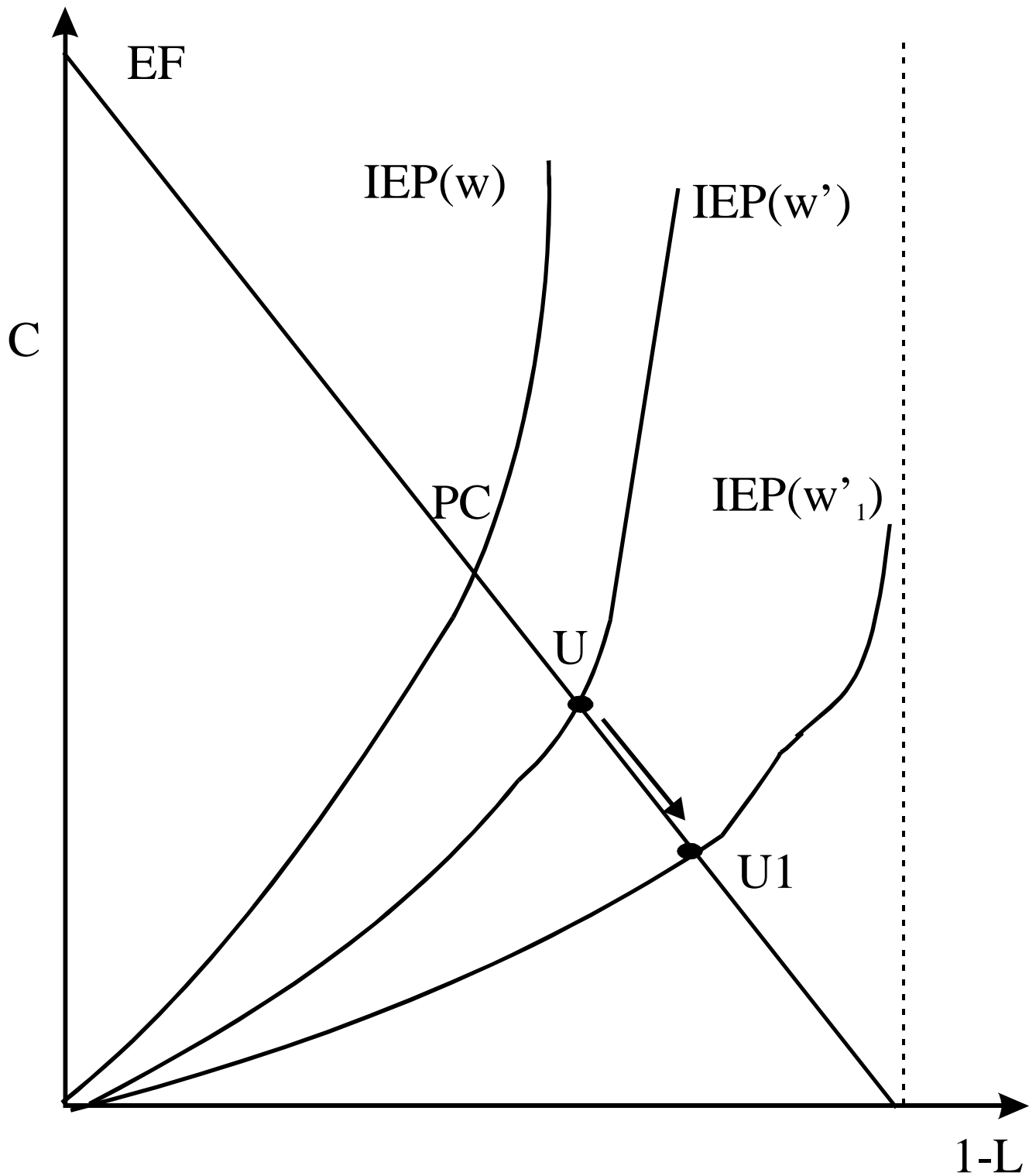


Fig 5: Unionised Equilibrium and increased Union Power.

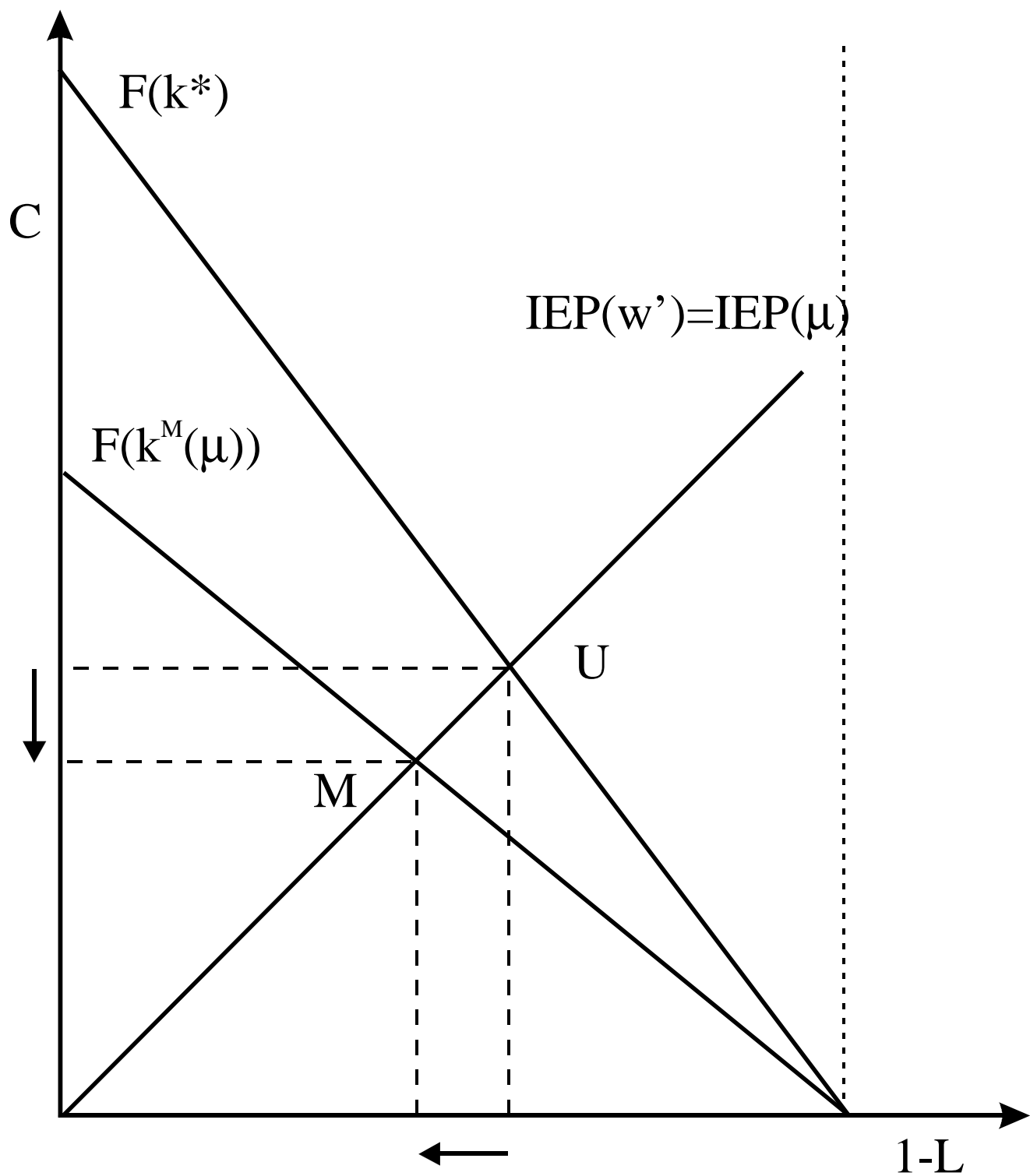


Fig 7: A comparison of Unionised and Monopolistic equilibrium.

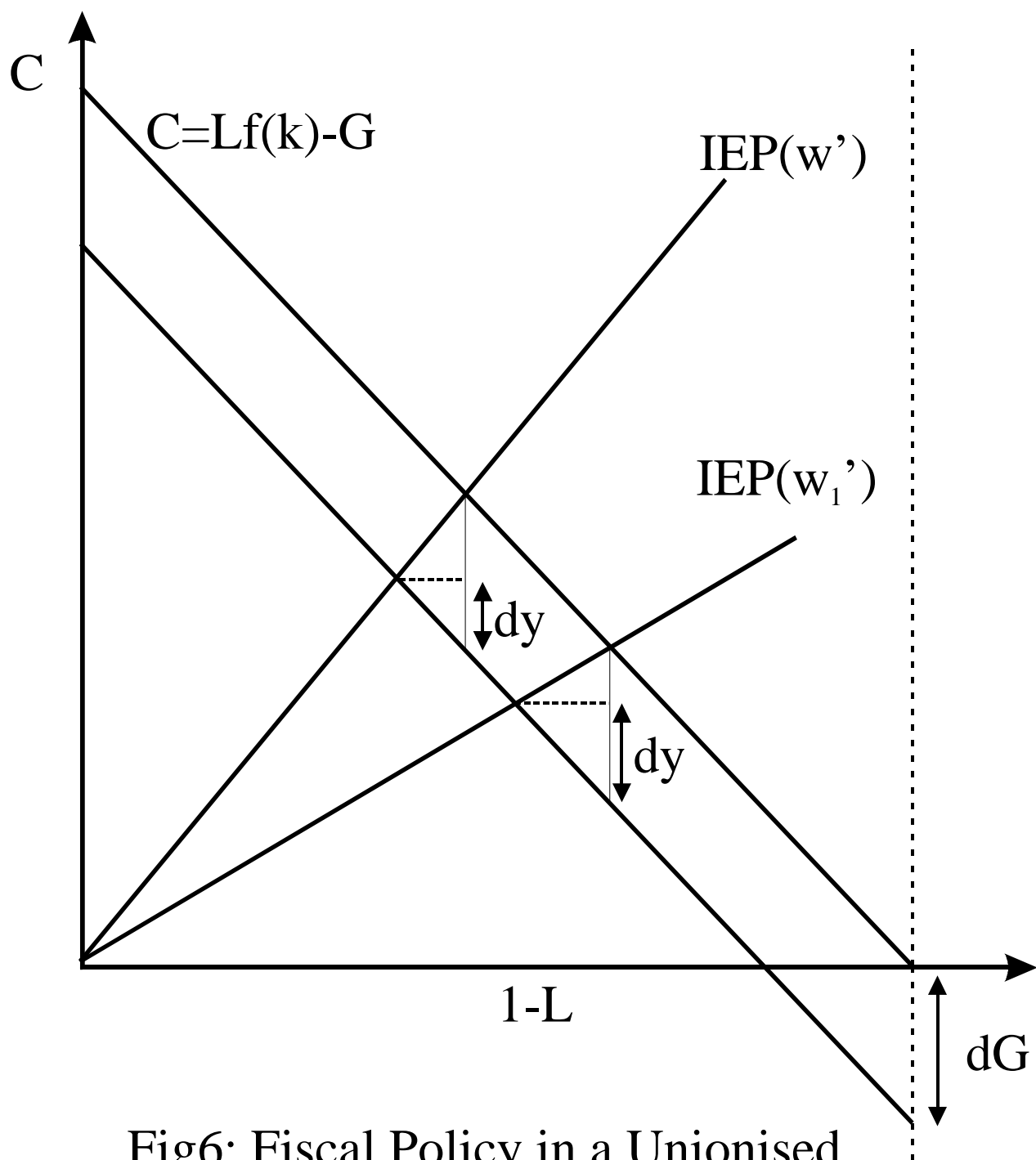


Fig6: Fiscal Policy in a Unionised Economy: $w_1' < w'$