

Habit Formation and Trade Unions^{*}

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Abstract

We analyse how habit formation affects collective bargaining outcomes if a firm-specific, utilitarian trade union determines wages. We show that such internal reference points induce the trade union to increase wages over time, unless habit concerns are more important for unemployed than for employed union members. Furthermore, policy changes in one period, which are either reversed in the next or anticipated in previous periods, have effects on wage outcomes for multiple periods because they affect the habit stock at times at which they are not yet or no longer in operation.

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1 Introduction

Collective wage negotiations still represent the most important way of determining an employee's remuneration in most OECD member countries, given an average collective bargaining coverage of around 35% (OECD, 2017, chapter 4). In consequence, the determinants and effects of trade union activities have been looked at intensively, both theoretically and empirically. The vast majority of theoretical contributions assume a simple specification of trade union preferences. They are an increasing function of the wage paid to union members and the relevant employment level. The empirical observation that individuals often compare their own payoffs or fates to those of others has not played an important role. There are, obviously, some exceptions. In these it is often postulated that trade unions, or members, compare wage and employment outcomes to those of other unions or employees (Oswald, 1979, Raaum, 1986, de la Croix, 1994, Mauleon et al., 2014, Goerke and Hillesheim, 2013, Chang et al., 2018). However, while external reference points are surely relevant, there is also ample evidence that individuals compare today's payoff to their own achievements in the past and, particularly, evaluate improvements positively (Havranek et al., 2017). The decisive difference between such internal and external reference points is that the former can be affected by own behaviour. This is particularly true in case of collective actors. Nonetheless, the impact of such internal reference points, often referred to as habit formation, on trade union behaviour has hardly been looked at.

In this paper, we enquire how habit concerns by union members affect, first, collective bargaining outcomes and, second, union responses to changes in exogenous parameters. For this purpose, we assume that individuals compare their consumption today to last period's level. Individual utility increases in today's consumption and, ceteris paribus, declines in the amount consumed previously. Such preferences create an intertemporal link between the trade union's preferred wages. On the one hand, the utilitarian trade union prefers wages to increase over time in order to mitigate the utility loss in later periods, originating from the wages received previously. On the other hand, higher wages translate into lower employment and this dependence limits the incentives to have an increasing wage profile over time. This effect may give rise to declining wages over time if the trade union benefits sufficiently from having fewer individuals being employed and building up a habit stock in early periods. A priori, the wage effects of habit formation in a collective bargaining setting are, thus, ambiguous.

In our analysis, we show that the first effect dominates and that the firm-specific trade union will initially set lower wages than it would have chosen in the absence of habit concerns, while wages will be above that level later on. Therefore, habit concerns result in a decreasing employment level over time. Given this benchmark, we analyse the robustness of this prediction for a variety of alterations with regard to a) the treatment of those

individuals who are not employed at the union wage ('the unemployed'), b) exogenous increases in productivity and wages over time, i.e. incorporating growth, c) the specification of preferences, and d) the extent of trade union bargaining power. While the results are, in general, remarkably robust, they turn out to be sensitive with regard to the relative strength of habit concerns of employed and unemployed union members. The more important habit formation becomes for individuals who do not work at the union wage, the greater the utility loss for these individuals and the more pronounced the disincentives for the trade union to let wages rise over time. Furthermore, we can show that irrespective of how wages develop over time, the existence of habit concerns implies that changes in the determinants of wages, such as unemployment benefits and the product price, which only vary in one period have longer lasting wage consequences. This is the case because the same-period wage effect has repercussions on previous or subsequent outcomes.

Our findings are highly relevant for unionised economies because they clarify why trade unions will always try to achieve wage increases, even in situations in which economic circumstances have deteriorated. Moreover, the findings indicate why trade unions may not fully want to exploit the scope for wage increases in a given year, as they anticipate that such pay rise will, *ceteris paribus*, reduce future payoffs. Moreover, our results suggest that policy changes in one year, which are reversed later on, will affect collective bargaining for substantially longer periods because they have an impact on the evaluation of future wage payments via habit formation aspects.

To the best of our knowledge, habit concerns and their consequences for collective bargaining have not been looked at yet. The study of [de la Croix et al. \(1996\)](#) represents a partial exception. In their model, trade union preferences are given by a Stone-Geary utility function, which depends on the difference between the bargained wage and the reservation wage. Habit concerns are integrated by assuming that this reservation payment is linearly increasing in last period's wage. The authors assume that wages increase over time and then show that 'any temporary shock will have permanent effects on the level of wages' (p. 437). Moreover, in the limiting case of the last period wage determining the reservation wage, their model effectively assumes an increasing wage profile over time, while we derive this outcome as an optimal strategy. However, since their focus is mainly an empirical one, they do not analyse the theoretical model further. [Striffler and Beissinger \(2016\)](#) consider fairness concerns and assume that the relevant standard is given by an internal reference point which is defined as current per capita output or profits. They show that such modification of the standard approach can result both in higher or lower wages than in a standard wage bargaining model. In contrast to our setting, their framework does not allow for intertemporal linkages.

Our contribution is also related to dynamic models of collective bargaining ([Jones, 1987](#), [Kidd and Oswald, 1987](#), [Jones and McKenna, 1994](#), [Chang and Lai, 1997](#)). In these ap-

proaches, union membership is endogenised and adjusts to wage and employment changes with delay. In consequence, today’s bargaining outcome will have an impact also in future periods. However, the rationale for this intertemporal linkage is completely different than in our set-up because it is not due to preferences, but to delays in adjustment. In related papers, [Beissinger and Egger \(2004\)](#) and [Heer and Morgenstern \(2005\)](#) presume that unemployment benefits are tied to wage income in the past.¹ [Lockwood and Manning \(1989\)](#), [Modesto and Thomas \(2001\)](#), and [Cabo and Martín-Román \(2019\)](#), for example, incorporate employment adjustment costs. These settings generally result in intertemporal linkages, as well.

In the remainder of the paper, we outline the model in [Section 2](#) and show in [Section 3](#) for our baseline setting that habit concerns induce a utilitarian monopoly trade union to raise wage demands over time. In this framework, individual preferences are logarithmic and increase in the ratio between this period’s wage and the habit stock which is, in turn, an increasing function of last period’s wage. Moreover, the habit stock of unemployed individuals is constant. A numerical example illustrates our findings and helps to resolve some theoretical ambiguities. In [Section 3](#) we, furthermore, investigate whether our findings can also be obtained when we assume that productivity and wages grow over time, specify individual preferences differently, allow for (Nash-) bargaining over wages and endogenise the habit stock of unemployed individuals. In [Section 4](#), we consider the impact of variations in unemployment benefits and of the product price on union behaviour. [Section 5](#) concludes. Our findings are summarised in propositions and most derivations are relegated to an appendix.

2 Model

2.1 Set-up

We incorporate individual preferences exhibiting habit formation into a model of a firm-specific, utilitarian monopoly trade union. In order to do so, the standard approach ([Oswald, 1985](#)) is amended in two dimensions: First, we specify individual utility as a function not only of current consumption or income, but also of past levels. Second, we consider a multi-period framework since habit formation creates an intertemporal link between payoffs. In this sub-section, we first describe individual preferences and payoffs, second, the firm’s profits, and, finally, the union’s objective.

Individual utility u in period t is increasing in current consumption, c_t , and decreasing in the habit stock, H_t . The utility function $u(c_t, H_t^\alpha)$ is strictly concave in both arguments.

¹Other contributions considering earnings-related unemployment benefits, such as by ([Vijlbrief and van de Wijngaert, 1995](#), [Goerke et al., 2010](#)) do not explicitly allow for intertemporal repercussions.

The parameter α , $\alpha \in [0, 1]$, measures the strength of habit formation. If $\alpha = 0$, habit formation does not affect utility. The higher α is, the more relevant habit formation aspects are. The stock of habit capital, H_t , is determined by last period consumption, $H_t = c_{t-1}$. Without loss of generality, we normalise the habit stock in period one to unity ($H_1 = 1$) (cf. [Fuhrer \(2000\)](#), [Koehne and Kuhn \(2015\)](#)). Moreover, we employ the same normalisation for those individuals who are not employed at the union wage and referred to as unemployed workers. This simplification enables us to succinctly derive and explain the wage effects of habit formation. We relax the latter normalisation assumption in [Section 3.2.1](#).

Employed individuals obtain the wage w_t in period t and instantaneously consume their income. Because there is no need to save in our setting in the absence of habit formation, this assumption allows us to isolate the effects of such preferences on wage setting behaviour. We discuss the implications of this simplification in the concluding section. If there are no taxes etc., therefore wage payments and consumption coincide and utility equals $u(w_1, 1)$ in period one and $u(w_t, w_{t-1}^\alpha)$ in period $t, t > 1$. Unemployed individuals obtain an income $\bar{w}_t, \bar{w}_t > 1$ in period t , such that their utility equals $u(\bar{w}_t, 1)$. Alternative specifications of preferences are looked at in [Section 3.2.3](#).

Following, for example, [Abel \(1990\)](#), [Carroll et al. \(2000\)](#) and [Fuhrer \(2000\)](#), we presume in the main analysis that individual utility, u , is iso-elastic and depends on the ratio of current income to the habit stock, $\frac{w_t}{H_{t-1}^\alpha} = \frac{w_t}{w_{t-1}^\alpha}$. Moreover, utility is logarithmic (cf. [Pollak \(1970, 1978\)](#), [Bover \(1991\)](#)).

The firm produces a homogeneous good with labour as the only input. Its revenues in period t are given by $R(N_t) = p_t f(N_t)$, where p_t is the product price in period t . Revenues are increasing in the number of employees, N_t , at a decreasing rate ($R'(N_t) > 0 > R''(N_t)$ for $N_t > 0$ and $R'(0) \rightarrow \infty$). Labour costs equal the payroll, such that profits in period t are:

$$\pi_t = R(N_t) - w_t \cdot N_t \tag{1}$$

Profit maximisation results in a labour demand curve $N = N(w_t)$, which is characterised by $N'(w_t) < 0$. If employment declines over time, the firm retains the number of required employees and dismisses the rest at no cost. If employment increase, all employees in period t stay in the firm in $t + 1$, while the firm randomly chooses additional staff from those who had been unemployed in period t .

The trade union represents all $M, M \geq N(w_t)$ workers. In each period, its payoff equals the sum of, first, the utility of all members who do not have a union job and, second, the utility gain from being employed at the union wage for those members who have such a job. The union's objective in each period t is given by the sum of the current and

discounted future per-period payoffs.

The timing is as follows: In each period, the trade union sets the wage, w_t , taking into account that it raises the habit stock in period $t+1$.² Given the wage, the firm chooses the profit-maximising level of employment, $N(w_t)$. Because the union's optimal wage depends on the level of unemployment benefits, \bar{w}_t , which may change over time, employment can vary over time in either direction. In period $t+1$, the habit stock resulting from wage payments in period t , and the level of employment realised in that period are given from the union's and firm's perspective. In order to keep the analysis simple, we analyse a model with two periods.³ This setting already allows us to isolate the main effects of habit formation. We solve the model by backward induction.

Collecting the information laid out above, the trade union's payoff (and objective) in period two is given by

$$V_2^R(w_2) = N(w_2)\ln\left(\frac{w_2}{w_1^\alpha}\right) + [N(w_1) - N(w_2)]\ln(\bar{w}_2) + [M - N(w_1)]\ln(\bar{w}_2) \quad (2)$$

if employment weakly declines over time ($N(w_1) \geq N(w_2)$), as indicated by the superscript R . The trade union's payoff in case of rising employment is denoted by V_2^D :

$$V_2^D(w_2) = N(w_1)\ln\left(\frac{w_2}{w_1^\alpha}\right) + [N(w_2) - N(w_1)]\ln\left(\frac{w_2}{\bar{w}_1^\alpha}\right) + [M - N(w_2)]\ln(\bar{w}_2) \quad (3)$$

In period one, the union's payoff equals:

$$V_1(w_1) = N(w_1)\ln(w_1) + [M - N(w_1)]\ln(\bar{w}_1) \quad (4)$$

When choosing the wage in period one, the trade union maximises $\Omega = V_1 + \delta V_2$ with respect to the optimal first period wage w_1 , where $\delta, 0 < \delta \leq 1$, is the discount factor, and taking into account that the second period payoff depends on w_1 directly and also indirectly via adjustments in the second period wage, $w_2 = w_2(w_1)$.

2.2 Optimal Choices

We subsequently determine a monopoly trade union's choice for both settings outlined above, namely in- or decreasing employment over time. We start with the case of declining employment.

²We show in Section 3.2.4 that our basic findings also hold if the trade union and the firm Nash-bargain over wages.

³Similar frameworks have, inter alia, been looked at by [Cremer et al. \(2010\)](#), [Guo and Krause \(2011\)](#), [Tuomala and Tenhunen \(2013\)](#).

Maximisation of equation (2) with respect to w_2 yields:

$$Z^R = \frac{\partial V_2^R}{\partial w_2} = N'(w_2) \left[\ln \left(\frac{w_2}{w_1^\alpha} \right) - \ln(\bar{w}_2) \right] + N(w_2) \frac{1}{w_2} = 0 \quad (5)$$

We denote the wage which satisfies equation (5) by w_2^H . The first-order condition requires $\frac{w_2}{w_1^\alpha} - \bar{w}_2 > 0$. The second-order condition is:

$$\frac{\partial Z^R}{\partial w_2} = N''(w_2) \left[\ln \left(\frac{w_2}{w_1^\alpha} \right) - \ln(\bar{w}_2) \right] + 2N'(w_2) \frac{1}{w_2} - N(w_2) \frac{1}{w_2^2} < 0 \quad (6)$$

In the case of increasing employment, the first-order condition for the optimal wage in period two is given by

$$Z^D = \frac{\partial V_2^D}{\partial w_2} = N'(w_2) \left[\ln \left(\frac{w_2}{\bar{w}_1^\alpha} \right) - \ln(\bar{w}_2) \right] + N(w_2) \frac{1}{w_2} = 0 \quad (7)$$

while the second-order condition is the same as defined in (6), with w_1 being replaced by \bar{w}_1 .

When choosing the optimal wage in period two, the trade union trades off the loss in its payoff due to fewer employees obtaining the utility resulting from the wage w_2^H , instead of the alternative income \bar{w}_2 , with the gain due to higher wages in period two for those members who retain their job. In contrast to a standard monopoly union model featuring time-separable preferences, the costs of employment reductions are mitigated by the impact of the habit stock. In the case of decreasing employment, the habit stock is given by wages, if employment rises, it equals the income of a formerly unemployed union member. Moreover, the marginal utility from increasing the wage is unaffected by habit considerations, owing to the logarithmic specification of preferences, and therefore the same, irrespective of the change of employment over time.

As a consequence, the second period wage, w_2^H , rises either with w_1 or unemployment benefits \bar{w}_1 , because a higher period one wage or level of benefits raises the habit stock and, thereby, reduces the utility decline from losing the job.

The first-order condition for the first period wage, if employment in period two is less than in period one, is given by:

$$\begin{aligned} \Omega^R &= \frac{\partial V_1}{\partial w_1} + \delta \frac{\partial V_2^R}{\partial w_1} + \frac{\partial V_2^R}{\partial w_2} \frac{\partial w_2^H}{\partial w_1} \\ &= N'(w_1) \ln \left(\frac{w_1}{\bar{w}_1} \right) + N(w_1) \frac{1}{w_1} - N(w_2) \frac{\alpha \delta}{w_1} = 0, \end{aligned} \quad (8)$$

since $\frac{\partial V_2^R}{\partial w_2} = 0$. The second-order condition is:

$$\frac{\partial \Omega^R}{\partial w_1} = N''(w_1) \ln \left(\frac{w_1}{\bar{w}_1} \right) + 2N'(w_1) \frac{1}{w_1} + \frac{1}{w_1^2} [\alpha \delta N(w_2) - N(w_1)] < 0 \quad (9)$$

Since income \bar{w}_1 exceeds unity, ensuring that utility is positive, the wage w_1^H , which maximises Ω , is also strictly greater than one. This wage w_1^H balances the gain from a higher wage for all $N(w_1^H)$ union members employed in period one with the costs of raising the wage. These costs consist of the utility reduction for those individuals who lose the job in period one on account of a higher wage, as it is the case in the standard monopoly union model. In addition, the union knows that raising the wage in period one reduces the utility from a given wage payment in period two, because the habit stock rises. This constitutes a further cost of raising the wage. Moreover, we know that the second period wage rises in the first period wage. Since the monopoly trade union chooses wages in period two optimally, the envelope theorem implies that this last effect has no repercussion on the optimal value of w_1^H .

The first-order condition for the first period wage, if employment rises over time, is given by:

$$\Omega^D = (1 - \delta\alpha) \left[N'(w_1) \ln \left(\frac{w_1}{\bar{w}_1} \right) + N(w_1) \frac{1}{w_1} \right] = 0 \quad (10)$$

while the second-order condition is:

$$\frac{\partial \Omega^D}{\partial w_1} = (1 - \delta\alpha) \left[N''(w_1) \ln \left(\frac{w_1}{\bar{w}_1} \right) + 2N'(w_1) \frac{1}{w_1} - N(w_1) \frac{1}{w_1^2} \right] < 0 \quad (11)$$

In the case of rising employment, wages set in period one alter the second period payoff in proportion to the alteration in period one. Therefore, the gain and costs of raising the wage are qualitatively the same as in a world without habit formation.

The wages defined by equations (5) and (8) on the one hand, and by (7) and (10) on the other hand, maximise the trade union's payoff as the inequalities in (9) and (6), respectively (6), with w_1 being replaced by \bar{w}_1 and (11), hold and if, additionally, the determinant, D , of the system is positive. We show in Appendix A.1 that this is unambiguously the case for a setting of increasing employment and derive a condition for $D > 0$ if employment falls from period one to period two.

3 Wage Effects of Habit Formation

In this section, we first show how habit formation affects the monopoly union's wage choices in the baseline framework outlined in the previous section. Subsequently, we consider a number of extensions and investigate if and in how far they affect the findings obtained for our baseline setting.

3.1 Baseline Setting

3.1.1 Analytical Results

In this sub-section we analyse how habit formation affects wages. We will show that relative to a situation without habit concerns, period one wages are never higher in the presence of habit concerns, while period two wages are surely greater. We will demonstrate this for both feasible situations, namely employment which decreases or increases over time. We commence with a setting in which employment declines.

If individuals exhibit no habit effects, the parameter α in equations (5) and (8) is zero. Evaluating the first two terms prior to the last equality sign in the first-order condition (8) at the monopoly union wage in the absence of habit effects, w_1^w , their sum is found to be zero. Since the third term, $N(w_2) \frac{\alpha \delta}{w_1}$, in (8) is positive for any positive value of α and is subtracted, (8) is negative if evaluated at $w_1 = w_1^w$. Therefore, the optimal wage in period one in the presence of habit effects is less than the monopoly union wage in the absence of such preferences ($w_1^H < w_1^w$), given the assumption that employment decreases over time. If employment rises over time, the optimal wage in period one is independent of the value of α , as inspection of (10) clarifies. Hence, $w_1^H = w_1^w$ holds.

Turning to the optimality condition (5) for the second period wage, applicable in case of declining employment, we can note that it differs from the respective condition for a setting in which there are no habit effects ($\alpha = 0$) only in so far as that the first term in square brackets contains $\frac{w_2}{w_1^\alpha}$ as argument instead of w_2 . The same basic insight holds true for the setting with increasing employment, with the exception of the relevant term in (7) containing \bar{w}_1 instead of \bar{w}_1^α . Since $\bar{w}_1, w_1 > 1$, the cost of a wage increase in period two is smaller in the presence of habit formation than in the absence of such effects. Furthermore, the gains from raising the wage are unaffected by a variation of α . Thus, the second period wage in the presence of habit effects exceeds the respective value in the absence of such concerns, irrespective of how employment changes over time.

Accordingly, the wage and employment effects of habit formation can be summarised as follows:

Proposition 1. *Assume that*

- a) *individuals have logarithmic preferences which*
- b) *depend on the ratio of current income to the (value of the) habit stock, while*
- c) *the habit stock of unemployed individuals is normalised to unity.*

Wages set by a monopoly trade union never exceed the level chosen in the absence of habit effects in period one and are greater than the respective level in period two ($w_1^H \leq w_1^w$; $w_2^w < w_2^H$). The reverse is true with respect to employment ($N(w_1^H) \geq N(w_1^w)$; $N(w_2^w) > N(w_2^H)$).

Proof: See above. ■

To explain this result, note that a repercussion from period two outcomes on behaviour in period one arises because choices in period one affect the habit stock in period two. This is the case as the habit stock alters the evaluation of period two wage payments. In period two, the utility derived from being employed declines with the habit stock. Therefore, the union's loss from raising the wage, *ceteris paribus*, declines. In the case of logarithmic utility, the change in the habit stock does not alter marginal utility. Hence, the incentives to raise wages in period two are greater in the presence of habit effects than in their absence. In period one, the union anticipates that raising the contemporaneous wage reduces the utility for employed members in period two if employment declines over time. Accordingly, there is an additional incentive, relative to a world without habit formation, to lower period one wages. If employment rises over time, habit concerns affect the gains and losses from raising the period one wage proportionally. Hence, there is no reason for the trade union to alter the wage it sets in period one.

Inspection of (5) and (7) clarifies that wages in period two are unaffected by discounting. This is the case because the payoff in period two affects the union's behaviour only insofar as future consequences of a change in the first period wage affect the (discounted) payoff. However, if employment rises over time, all changes in period two due to habit concerns are changed proportionally due to discounting. Therefore, if employment rises over time discounting the future does not alter the consequences of habit concerns for trade union behaviour. However, if employment declines over time, raising the wage in period one increases the habit stock in period two and, thereby, reduces the gain from raising the first period wage. If the future is discounted more strongly, that is, the discount factor δ declines, the consequences of habit formation become less relevant. Hence, the first period wage in the presence of habit concerns will still be less than the optimal level in their absence, but the difference will be smaller, the more the future is discounted. Having established that the extent of discounting the future does not qualitatively affect the wage effects of habit formation, we will subsequently assume for simplicity that current and future outcomes are valued equally and set the parameter δ to 1.

In the absence of habit concerns, wages and employment will vary over time if unemployment benefits differ from period one to period two. If benefits were constant, $\bar{w}_1 = \bar{w}_2$, wages and employment will be the same in both periods if habit concerns played no role ($w^w = w_1^w = w_2^w$). Since habit concerns imply that wages rise over time, employment has to decline from period one to period two and the only equilibrium will be one in which wages rise. We summarise these insights in Corollary 1.

Corollary 1. *Assume that*

- a) *individuals have logarithmic preferences which*
- b) *depend on the ratio of current income to the (value of the) habit stock,*
- c) *the habit stock of unemployed individuals is normalised to unity, while*
- d) *unemployment benefits are constant.*

In the only equilibrium feasible in this setting, the monopoly trade union lowers wages in period one to below the level which is optimal in the absence of habit concerns, while the reverse is true for period two wages ($w_1^H < w^w < w_2^H$). Hence wages rise over time, while reverse is true with respect to employment ($N(w_1^H) > N(w^w) > N(w_2^H)$).

Inspection of (10) and (7) clarifies that the trade union will never have an incentive to set wages in such a manner that they fall over time. Since higher wages, result in less employment, there will not be an equilibrium in the presence of habit concerns and constant unemployment benefits in which employment rises from period one to period two. Thus, the only equilibrium is the one characterised by Corollary 1. The rationale is that individuals who do not have a union job in period one obtain the alternative income and, accordingly have the lowest feasible habit stock in period two. Hence, by making members unemployed in period one, the trade union could, *ceteris paribus*, raise its payoff in period two. Reducing employment in period one clearly also has costs because those members who do not have a job in period one incur an income and utility loss in that period. A priori, the net impact of the two effects is uncertain. However, irrespective of whether the employment induced change in incentives relating to period one wage choices is positive or negative, it does not qualitatively alter the union's incentives to set period two wages. This is because employment in period one is given at the beginning of period two and, hence, does not affect the optimal wage choice in that period. Moreover, the trade union's incentives to reduce the habit stock of its members in period two by making them unemployed in period one is exactly balanced by the incentives to achieve this objective via lower wages in the first period. Hence, the net impact of habit formation on period one wages is zero. Thus, the presumption that habit formation alters incentives in such a way that the trade union prefers wages to (weakly) decline over time cannot be substantiated.

If wages rise over time due to habit formation, while employment falls, the union's optimality conditions are given by (8) and (5). We will in the remainder of the paper, with

the exception of Section 3.2.2, focus on this situation. This has no qualitative impact on results because we have shown in Proposition 1 that the predicted outcomes also arise, relative to a situation without habit formation, if we consider a setting in which such concerns exist. However, assuming $\bar{w}_1 = \bar{w}_2$, implying that $N(w_1^H) > N(w^w) > N(w_2^H)$ results, makes it possible to concentrate on one case and to sharpen the exposition. Moreover, it allows us to highlight the effects of habit formation and to clearly separate them from the consequences of changes in unemployment benefits.

3.1.2 Numerical Example

In the above subsection, we have established that the existence of habit formation results in an increasing wage profile over time, assuming $\bar{w}_1 = \bar{w}_2$. This comes about because wages in period one fall, while they rise in the second period. Analytically, however, it is not possible to establish, first, whether wages change monotonously in the intensity of habit concerns and, second, whether the wage change in period two is stronger than the alteration in period one, or vice versa. The first ambiguity comes about because an increase in the parameter measuring the strength of habit concerns, α , and the resulting decline in the first period wage, w_1^H , may actually reduce the habit stock. The second ambiguity occurs because the extent of wage changes depends on the magnitude of the adjustments in labour demand, $N(w)$ and the slope of the labour demand curve, $N'(w)$. In order to obtain an impression of the magnitude of the various effects, we subsequently present a numerical example, assuming the product price to be unity and the production function to be given by $f(N_t) = (N_t/\kappa)^\kappa$, $0 < \kappa < 1$. Therefore, the labour demand schedule and its slope are given by: $N(w) = w^{\frac{1}{\kappa-1}}$ and $N'(w) = \frac{1}{\kappa-1}w^{\frac{2-\kappa}{\kappa-1}} < 0$. In addition, we set $\kappa = 0.5$ and normalise the income of unemployed individuals to e , $\bar{w}_t = e$.⁴

Solving equations (5) and (8) for first and second period wages as functions of the intensity of habit formation, α , Figure 1 shows that wages are the same for $\alpha = 0$.⁵ The first period wage initially declines with α and then rises again, while the second wage monotonously increases. However, the first period wage does never reach the level that prevails in the absence of habit concerns. These results illustrate Proposition 1.

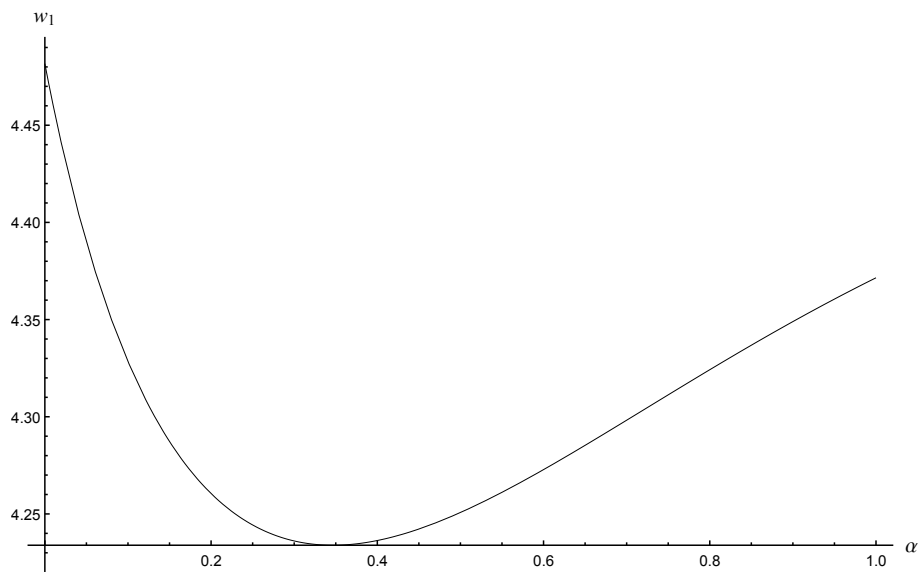
Figure 1a clarifies that the first period wage is not always varying with the intensity of habit formation in the same direction. Inspection of equation (8) indicates that for low values of α the existence of habit concerns raises the costs of a higher wage sufficiently,

⁴Similar results as reported below can be obtained for different values of κ .

⁵Given the Cobb-Douglas production function, the second-order conditions are given by: $\frac{\partial Z^R}{\partial w_2} = \frac{w_2^{\frac{3-2\kappa}{\kappa-1}}}{(\kappa-1)^2} \left[(2-\kappa) \left(\ln\left(\frac{w_2}{w_1^\alpha}\right) - \ln(\bar{w}_2) \right) + (3-\kappa)(\kappa-1) \right] < 0$ and $\frac{\partial \Omega^R}{\partial w_1} = \frac{w_1^{\frac{3-2\kappa}{\kappa-1}}}{(\kappa-1)^2} \left[(2-\kappa)(\ln(w_1) - \ln(\bar{w}_1)) + (3-\kappa)(\kappa-1) + (\kappa-1)^2 \left(\frac{w_2}{w_1}\right)^{\frac{1}{\kappa-1}} \right] < 0$. We check for our numerical example that they are fulfilled.

Figure 1: First and second period effect

(a) First period



(b) Second period

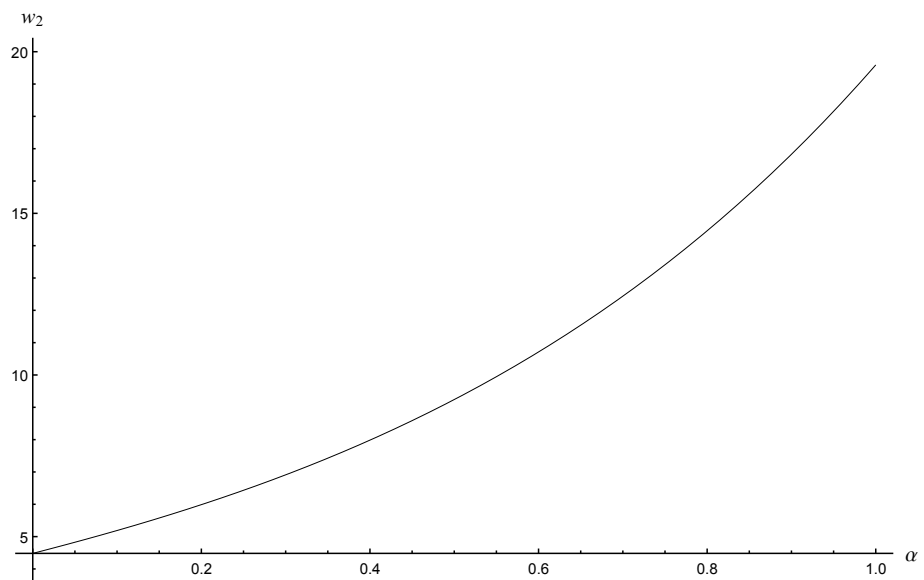
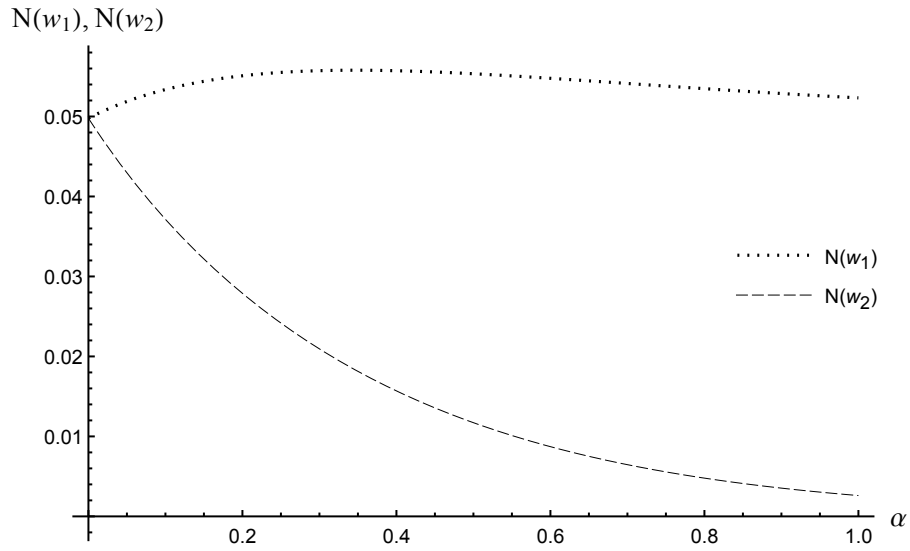
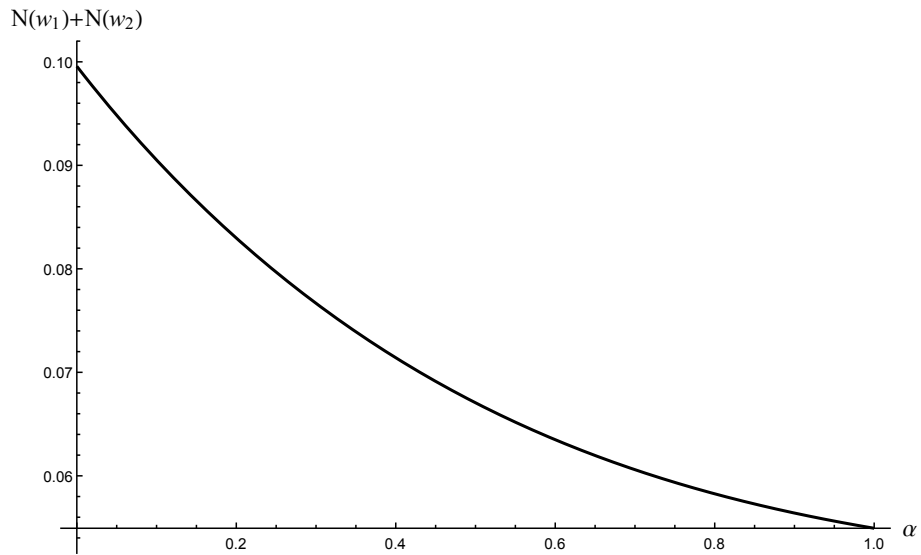


Figure 2: Employment effects of habit formation

(a) First and second period effect



(b) Overall effect



for the union to lower the first period wage with α . When the intensity of habit formation becomes more pronounced, the second period wage rises by such a great amount that labour demand in period two declines substantially. In consequence, the overall cost of a wage increase owing to habit formation can actually fall with greater intensity of such effects. Hence, the first period wage starts to rise again.

Figure 2a illustrates the impact of α on the employment levels in the first and second period, respectively. In line with Figure 1a, we find that the employment level in period one increases for lower levels of α and decreases once habit preferences are more distinct, while the employment level of period two decreases monotonously in α . Since the wage increase in period two dominates the variation in the wage in period one, average employment declines with the intensity of habit formation as shown in Figure 2b.

3.2 Extensions

The results summarised in Proposition 1 have been derived for a number of possibly restrictive assumptions. Whether they affect our findings is investigated in this subsection with regard to a) the normalisation of the habit stock of unemployed workers, b) the constant labour productivity, c) logarithmic preferences, d) the ratio formulation of habit effects, and e) the ability of the trade union to unilaterally set wages.

3.2.1 Habit Stock of Unemployed Workers

In the previous analysis we have assumed that the habit stock of unemployed individuals is unity. In this sub-section, we relax this assumption and presume their habit stock in period t to be given by H_t^μ , where the parameter μ , $0 \leq \mu \leq 1$ measures the intensity of habit concerns of unemployed individuals.

Given this modification, the trade union's objective in period two, denoted by $V_2^{\mu,R}$, assuming wages to weakly rise over time, is given by:

$$V_2^{\mu,R} = N(w_2) \ln \left(\frac{w_2}{w_1^\alpha} \right) + (N(w_1) - N(w_2)) \ln \left(\frac{\bar{w}_2}{w_1^\mu} \right) + (M - N(w_1)) \ln \left(\frac{\bar{w}_2}{\bar{w}_1^\mu} \right) \quad (12)$$

The union's payoff in period one continues to be given by equation (4). The optimal second period wage is defined by:

$$Z^{\mu,R} = N'(w_2) \ln \left(\frac{w_2}{\bar{w}_2 w_1^{\alpha-\mu}} \right) + N(w_2) \frac{1}{w_2} = 0 \quad (13)$$

Assuming wages to rise over time, the first-order condition for the maximum of the union's

objective in period one, $\Omega^{\mu,R} = V_1 + V_2^{\mu,R}$, is:⁶

$$\Omega^{\mu,R} = (1 - \mu) \frac{\partial V_1}{\partial w_1} + N(w_2) \frac{\mu - \alpha}{w_1} = 0 \quad (14)$$

Inspection of equations (13) and (14) shows for the case of declining wages that if and only if habit concerns have a stronger impact on employed than on unemployed union members ($\alpha > \mu$), wages set by a monopoly trade union fall short of the level chosen in the absence of habit effects in period one and exceed the respective level in period two ($w_1^{\mu,H} < w^w < w_2^{\mu,H}$), while the reverse is true with respect to employment ($N(w_1^{\mu,H}) > N(w^w) > N(w_2^{\mu,H})$).⁷ Moreover, following the same approach as employed for the proof of Proposition 1 it can be shown that wages which decline over time cannot constitute an equilibrium, assuming $\alpha > \mu$.

In our basic setting, habit formation affects wage behaviour because a given wage payment in period two is 'discounted' by the habit stock. This effect is restricted to employed workers. Therefore, the utility loss due to a fall in employment declines, while the gain resulting from a higher wage rises. If habit formation concerns are stronger for employed individuals ($\alpha > \mu$), wage payments in period two are effectively 'discounted' more strongly than payments to unemployed union members. Consequently, as long as $\alpha > \mu$ holds, the basic incentives are preserved, ensuring that the trade union prefers a wage profile which increases over time. Assuming the intensity of habit formation for employed and unemployed individuals to be the same ($\alpha = \mu$) implies that payments in each of the feasible states - being employed for two periods, being employed only in period one, etc. - are 'discounted' proportionally. Given logarithmic preferences, habit formation, therefore, leaves the incentives to alter period two wages unchanged. In consequence, also period one wages are unaffected. If, finally, habit concerns of unemployed are more pronounced than of employed individuals ($\alpha < \mu$), the impact of unemployed union members dominates and wages would fall over time.

3.2.2 A Growing Economy

The analysis in sub-section 3.1 is based on the assumption of a stationary economy in which productivity, demand and wages are constant over time in the absence of habit formation. If productivity and, more importantly from our perspective, also wages increased over time, the incentives to raise wages from period one to two on account of habit concerns may be mitigated or even be absent. In order to investigate the consequences of habit formation on union wage setting in a growing economy we assume that output in period two is given by $f(N_2) + rN_2$, where $r, r \geq 0$. This specification ensures that labour

⁶The second-order conditions resemble those for the baseline setting.

⁷The proof is analogous to that of Proposition 1 and available upon request.

demand in period two is higher than in period one, while the slope of the labour demand curve is unaffected ($\frac{\partial(N(w_2,r))}{\partial w_2} = -\frac{\partial(N(w_2,r))}{\partial r}$ and $\frac{\partial(N(w_2,r)/\partial w_2)}{\partial r} = 0$). In consequence, wages rise over time, such that $w_1^{w,g} = w^w < w_2^{w,g}$ holds, where we use the superscript w,g to indicate outcomes in a setting without habit formation and with growth of productivity over time.

The objectives of the trade union are unaffected by the growth in productivity and given by equations (2) and (3), as well as Ω , with $N(w_2)$ being replaced by $N(w_2, r)$. While we distinguished between a situation of growing and declining wages in the set-up with constant productivity, which implied opposite variations in employment, we now explicitly differentiate between increasing and decreasing employment because the employment change over time determines how the union objective needs to be specified. The first-order condition for the optimal second period wage in case of declining employment are given by:⁸

$$Z^{R,g} = \frac{\partial V_2^{R,g}}{\partial w_2} = \frac{\partial N}{\partial w_2} \left[\ln \left(\frac{w_2}{w_1^\alpha} \right) - \ln(\bar{w}_2) \right] + N(w_2, r) \frac{1}{w_2} = 0 \quad (15)$$

The trade union will raise the wage in period two above the level prevailing in period one, irrespective of the intensity of habit formation. This is the case because labour demand, $N(w_2, r)$, rises with r , such that the gain from increasing the second period wage goes up. The variation in period two employment owing to the growth in productivity will be positive, if the trade union does not raise the wage by the full amount of the rise in productivity.

$$\frac{dN(w_2, r)}{dr} = \frac{\partial N(w_2, r)}{\partial r} + \frac{\partial N(w_2, r)}{\partial w_2} \frac{\partial w_2}{\partial r} = \frac{\partial N(w_2, r)}{\partial r} \left(1 - \frac{\partial w_2}{\partial r} \right) \quad (16)$$

Irrespective of the sign of (16), employment in period two may be less than in period one if the impact of habit formation is sufficiently strong. Therefore, continuing our considerations for both cases, increasing and decreasing employment over time, the first-order condition for the choice of the first-period wage are given by equation (8) or (10), with $N(w_2)$ being replaced by $N(w_2, r)$. From inspection of these four first-order conditions, we can note that if employment declines over time, $w_1^{H,g} < w_1^{w,g} < w_2^{w,g} < w_2^{H,g}$ holds, while in a situation in which employment rises over time, $w_1^{H,g} = w_1^{w,g} < w_2^{w,g} < w_2^{H,g}$ results. In consequence, wages continue to rise in period two due to the existence of habit formation also in an economy in which productivity grows over time, while they weakly decline in period one. Since wages rise already in the absence of habit concerns, the wage profile will surely be increasing over time in a growing economy with habit formations as

⁸For a setting with growing employment over time, the first-order condition is defined analogously, see equation (5). The second-order conditions are comparable to those of the baseline setting and presumed to hold.

well. This result is independent of the development of employment, which may also grow from period one to two because of the productivity impact.

The intuition for this outcome is the following: Habit formation results in a discounting of wage income in period two in accordance with the habit stock acquired in period one. This habit stock is unaffected by productivity growth from period one to period two. Hence, the trade union's costs of raising period two wages are unaffected by productivity growth. Moreover, the gain from raising period two wages becomes larger on account of the increase in labour demand. In consequence, it can be argued that, in contrast to the initial conjecture that productivity growth may mitigate the wage effects of habit concerns, they tend to be more pronounced in a growing economy.

3.2.3 Alternative Specifications of Preferences

The specification of preferences in the preceding analysis, and also in subsequent sections, is based on two particular assumptions: First, the utility function is logarithmic and, second, its argument is the ratio of wages to the effective habit stock. In this sub-section we illustrate that our main findings are basically unaffected by our particular choice of preferences and also hold for alternative specifications of an individual's utility function if weak additional assumptions are imposed. We discuss the two aspects - the exact shape of the utility function and its argument - in turn.

Suppose, preferences are given by a power utility function, such as $u(c_t, H_t) = \frac{(c_t/H_t^\alpha)^{1-\gamma}-1}{1-\gamma}$, $\gamma \geq 0$ (cf. Gómez (2012), Grishchenko (2010) and, for comparable specifications, Carroll et al. (2000), Fuhrer (2000).) In this case, the Arrow-Pratt measure of relative risk aversion amounts to γ , while preferences continue to be iso-elastic and u collapses to the logarithmic specification for $\gamma \rightarrow 1$.

The trade union's first-order condition for the wage in period two, assuming wages to rise over time, is given by:

$$w_1^{\alpha(\gamma-1)} \left[N'(w_2) \left(\frac{w_2^{1-\gamma}}{1-\gamma} - \frac{\bar{w}_2^{1-\gamma}}{1-\gamma} \right) + N(w_2)w_2^{-\gamma} \right] - (1 - w_1^{\alpha(\gamma-1)})N'(w_2)\frac{\bar{w}_2^{1-\gamma}}{1-\gamma} = 0 \quad (17)$$

The term in square brackets is zero in the absence of habit concerns, while the second summand is positive in the presence of such preferences, irrespective of the magnitude of the parameter γ . Therefore, for $\alpha > 0$ the derivative in (17) will be positive if evaluated at the union's optimal wage, w^w , in the absence of habit concerns. Hence, there is an incentive for the trade union to raise the second period wage to above the level, w^w , that is optimal in the absence of habit concerns. Moreover, the optimality condition for the first period wage can be shown to be positive if evaluated at w^w (see Appendix A.2). In

consequence, if preferences are given by a power function such as $u(c_t, H_t^\alpha) = \frac{(c_t/H_t^\alpha)^{1-\gamma}}{1-\gamma}$, there is an equilibrium in the presence of habit formation, which is characterised by increasing wages over time.

If we allow for more general preferences, $u(c_t, H_t) = u(\frac{c_t}{H_t^\alpha})$, where $u' > 0 > u''$ holds, a sufficient condition for the second period wage in the presence of habit effects to be higher than the respective level in the absence of such preferences is that $u' \left(\frac{w_2}{w_1^\alpha} \right) \frac{1}{w_1^\alpha} > u'(w_2)$, as the first-order condition for the second period wage is:

$$N'(w_2) \left[u \left(\frac{w_2}{w_1^\alpha} \right) - u(\bar{w}_2) \right] + N(w_2) u' \left(\frac{w_2}{w_1^\alpha} \right) \frac{1}{w_1^\alpha} = 0 \quad (18)$$

Once more, the optimality condition for the first period wage can be shown to be positive if evaluated the wage which is optimal in the absence of habit concerns (cf. Appendix A.2). Summarising the insights from the above considerations, we can conclude that the restriction imposed by the logarithmic specification of preferences, $u = \ln \left(\frac{c_t}{H_t^\alpha} \right)$ does not affect the prediction that wages increase over time on account of habit preferences.

Turning to the second aspect, an alternative also popular specification of habit preferences, instead of the ratio formulation, is given by the difference approach. Consequently, utility in period t is determined by $u(c_t - \alpha H_t)$ (cf. Aronsson and Schöb (2017a,b), Campbell and Cochrane (1999), Chen and Ludvigson (2009), Loewenstein et al. (2003)). Normalising the habit stock in period one to zero, the first-order condition for the wage in period two, assuming wages to rise over time, can be expressed as:

$$N'(w_2)[u(w_2 - \alpha w_1) - u(\bar{w}_2)] + N(w_2)u'(w_2 - \alpha w_1) = 0 \quad (19)$$

Since the utility from having a union job, $u(w_2 - \alpha w_1)$, declines with habit formation preferences, for a given second period wage, the loss from raising the wage in period two is reduced. In addition, the gain due to a higher wage, $u'(w_2 - \alpha w_1)$, is enlarged by habit formation. Consequently, the trade union will raise the second period wage in the presence of habit formation to above the level which is optimal in the absence of such concerns, $w_2^H > w_w$. Moreover, habit formation provides incentives for the trade union to lower the first period wage below the level in the absence (see Appendix A.2). Hence, there is an equilibrium with increasing wages over time also if individual payoffs are determined by the difference between current income and the habit stock.

We capture the findings of this sub-section in:

Proposition 2. *Assume that*

- a) *individual preferences are given by either (i) $u(c_t, H_t) = \frac{(c_t/H_t^\alpha)^{1-\gamma}}{1-\gamma}$, or (ii) $u(c_t, H_t) = u(\frac{c_t}{H_t^\alpha})$, or (iii) $u(c_t - \alpha H_t)$, where $u' > 0 > u''$ for (ii) and (iii), while*
- b) *the habit stock of unemployed individuals is normalised to unity.*

For specifications (i) and (iii), there is an equilibrium in which wages set by a monopoly trade union fall short of the level chosen in the absence of habit effects in period one and exceed the respective level in period two ($w_1^H < w^w < w_2^H$). For the second specification (ii), such equilibrium exists if $u' \left(\frac{w_2}{w_1^\alpha} \right) \frac{1}{w_1^\alpha} > u'(w_2)$. If wages rise over time, the reverse is true with respect to employment ($N(w_1^H) > N(w^w) > N(w_2^H)$).

Proof: See equations (17), (18), and (19) above and Appendix A.2. ■

Proposition 2 clarifies that a firm-specific, utilitarian trade union which sets wages has incentives to increase wages over time, irrespective of how individual preferences are specified. This can unambiguously be shown for the case of a logarithmic utility function and the ratio specification of payoffs. In other cases, additional, mild restrictions may be required to ensure this outcome. Moreover, in case of iso-elastic preferences it is easily feasible to establish that the equilibrium characterised by $w_1^H < w^w < w_2^H$ is the only feasible one, whereas such proof is less straightforward in the case of the other formulations of individual preferences.

3.2.4 Nash Bargaining

The analysis has, thus far, assumed a trade union which can set the wage unilaterally. While this constitutes a convenient analytical simplification, the available empirical evidence (see, for example, Amador and Soares (2017), Boulhol et al. (2011), Dobbelaere (2004), Moreno and Rodríguez (2011), Hirsch and Schnabel (2014)) suggests that firms have substantial say in the determination of wages. Moreover, in the monopoly union setting changes in period one wages do not have an indirect impact on period two behaviour via adjustments in period two wages, because the latter are chosen optimally.

We, next, scrutinise whether the simplification of a wage-setting trade union affects the impact of habit formation. In order to do so, we assume that wages are the outcome of a Nash-bargain, while the firm continues to determine employment. Moreover, the entire bargaining relationship would be dissolved if the union and the firm could not agree on a wage in period one. This simplification implies that bargaining in period two will take place against the background of an agreement in period one.

In each period the bargained wage maximises the Nash-product which is given by the product of the trade union's and firm's payoff gain. It is defined as the payoff in case of an agreement less the fallback payoff obtained if no agreement is reached. In order to streamline the exposition, we further assume that the union's fallback payoff in period two is unaffected by habit considerations and given by the utility for all M members obtaining

an income \bar{w}_2 .⁹ The union's no agreement payoff in period one equals the utility for M members from obtaining the utility from income \bar{w}_1 in period one and from income \bar{w}_2 in period two. The firm's payoff in case of no agreement is given by its profits if there is no production and, thus, equals zero. Denoting the trade union's bargaining power by β , $0 \leq \beta \leq 1$, and assuming that wages rise over time, we can express the Nash-product in period two as:

$$NP_2(w_2) = \left(N(w_2) \left[\ln \left(\frac{w_2}{w_1^\alpha} \right) - \ln(\bar{w}_2) \right] \right)^\beta (R(N(w_2)) - w_2 N(w_2))^{1-\beta} \quad (20)$$

In period one, the trade union and the firm take into account that the optimal wage in period two depends on the bargaining outcome in period one, such that $w_2(w_1)$ holds. The Nash-product can be expressed as:

$$NP_1(w_1) = \left(N(w_1)[\ln(w_1) - \ln(\bar{w}_1)] + N(w_2(w_1)) \left[\ln \left(\frac{w_2(w_1)}{w_1^\alpha} \right) - \ln(\bar{w}_2) \right] \right)^\beta \cdot \left(R(N(w_1)) - w_1 N_1(w_1) + R(N(w_2(w_1))) - w_2(w_1) N(w_2(w_1)) \right)^{1-\beta} \quad (21)$$

Once again, we solve the model by backward induction. Maximisation of $NP_2(w_2)$ yields $Z(\beta) = 0$, where the functional dependence indicates that the bargained wage varies with the measure, β , of the union's bargaining power, $w_2 = w_2^H(\beta)$, and where $Z(\beta)$ is given by:

$$Z(\beta) := \frac{\partial NP_2}{\partial w_2} = \beta \left(N'(w_2) \left[\ln \left(\frac{w_2}{w_1^\alpha} \right) - \ln(\bar{w}_2) \right] + N(w_2) \frac{1}{w_2} \right) (R(N(w_2)) - w_2 N(w_2)) - (1 - \beta) \left(N(w_2) \left[\ln \left(\frac{w_2}{w_1^\alpha} \right) - \ln(\bar{w}_2) \right] \right) N(w_2) = 0 \quad (22)$$

We assume that the second-order derivative is negative. Since $Z(\beta)$ rises in the first period wage, the wage bargained in period two increases with the wage agreement in period one.

$$\begin{aligned} w_2'(w_1) &= \frac{dw_2}{dw_1} = - \frac{\partial^2 NP_2 / \partial w_2 \partial w_1}{\partial^2 NP_2 / \partial (w_2)^2} \\ &= - \frac{\alpha (1 - \beta) N(w_2)^2 - \beta N'(w_2) (R(N(w_2)) - w_2 N(w_2))}{w_1 \underbrace{\partial^2 NP_2 / \partial w_2^2}_{<0 \text{ required by SOC}}} > 0 \end{aligned} \quad (23)$$

⁹It could be argued that the trade union's payoff in the case of no agreement is influenced by habit formation because, first, the competitive wage changes over time with habit formation and, second, those union members who had been employed in period one have built up a stock of habit. Both effects can easily be incorporated but make the interpretation less plausible that the Nash-bargaining solution approaches the competitive outcome if the trade union's bargaining power becomes arbitrarily small. This is because the impact of habit formation on the fallback income depends on whether the labour market is competitive or unionised in period one.

Moreover, $Z(\beta)$ is positive if evaluated at that second period wage, $w_2(\beta)^w$ which maximises the trade union's payoff in the absence of habit formation. Therefore, for any given value of the trade union's bargaining power, β , the bargained wage in period two in the presence of habit formation exceeds the respective value resulting in the absence of such preferences, $w_2(\beta)^H > w_2(\beta)^w$.

The positive impact of habit formation on period two wages in a Nash-bargaining setting arises because such preferences affect the maximisation of the Nash-product in two ways: First, the trade union's gain from a higher wage rises because the loss in utility due to a decline in employment becomes smaller. This is the same effect as in a monopoly union model. Second, habit formation, *ceteris paribus*, reduces the level of the union's payoff. Since the Nash solution shares the weighted gains from an agreement, a decline in the union's gain implies that it has to be compensated by an increase in the wage.

The first-order condition for the first-period wage is:

$$\Omega(\beta) := \frac{\partial NP_1}{\partial w_1} = \beta \cdot (U - U^0)' \cdot (\pi - \pi^0) + (1 - \beta) \cdot (\pi - \pi^0)' \cdot (U - U^0) = 0 \quad (24)$$

where

$$U - U^0 = N(w_1)[\ln(w_1) - \ln(\bar{w}_1)] + N(w_2(w_1))\left[\ln\left(\frac{w_2(w_1)}{w_1^\alpha}\right) - \ln(\bar{w}_2)\right] \quad (25)$$

$$\begin{aligned} (U - U^0)' &= N'(w_1)[\ln(w_1) - \ln(\bar{w}_1)] + N(w_1)\frac{1}{w_1} + N'(w_2(w_1))w_2'(w_1) \\ &\quad \cdot \left[\ln\left(\frac{w_2(w_1)}{w_1^\alpha}\right) - \ln(\bar{w}_2)\right] + N(w_2)\left[\frac{w_2'(w_1)}{w_2(w_1)} - \frac{\alpha}{w_1}\right] \end{aligned} \quad (26)$$

$$\pi - \pi^0 = R(N(w_1)) - w_1N(w_1) + R(N(w_2(w_1))) - w_2(w_1)N(w_2(w_1)) \quad (27)$$

and

$$(\pi - \pi^0)' = -N(w_1) - w_2'(w_1)N(w_2(w_1)) \quad (28)$$

We assume that the second-order derivative is negative and the second-order condition for a maximum is fulfilled. In contrast to a monopoly union setting, the impact of habit formation on the first period wage cannot be determined in a bargaining framework without imposing further restrictions. The reason is that the rise in the optimal second period wage due to a higher period one wage raises the trade union's incentives to bargain for a higher period one wage. Consequently, the union has greater incentives to increase the period one wage in a bargaining framework than if it set wages. The strength of this effect

can only be compared to the wage-reducing incentives owing to the positive impact of the period one wage on the employees' habit stock if additional assumptions are imposed.

We summarise these insights in:

Proposition 3. *Assume that*

- a) *individuals have logarithmic preferences which*
 - b) *depend on the ratio of current income to the (value of the) habit stock, while*
 - c) *the habit stock of unemployed individuals is normalised to unity.*
 - d) *Moreover, there is Nash-bargaining over wages and wages in the absence of trade union bargaining power equal $w_1^H(\beta = 0) = \bar{w} = w_2^H(\beta = 0)$.*
- (i) *For any positive value of trade union bargaining power ($\beta > 0$), there is an equilibrium in the presence of habit formation which is characterised by a wage in period one which is less than the wage paid in the absence of such preferences ($w_1^H(\beta) < w^w(\beta)$), if the increase in period one wages due to higher union bargaining power is weakly less in the presence of habit formation than in their absence ($\frac{dw_1^H(\beta)}{d\beta} \leq \frac{dw^w(\beta)}{d\beta}$).*
- (ii) *In this equilibrium, period two wages will be higher in the presence of habit formation than in their absence ($w_2^H(\beta) > w^w(\beta)$).*
- (iii) *This implies that wages rise over time ($w_1^H(\beta) < w^w(\beta) < w_2^H(\beta)$), while the reverse will be true with respect to employment ($N(w_1^H(\beta)) > N(w^w(\beta)) > N(w_2^H(\beta))$).*

Proof: Given the assumption imposed above, wages in the absence of union bargaining power equal \bar{w} in both periods, irrespective of whether individuals exhibit habit preferences or not. We have shown above (see Proposition 1) that a monopoly union ($\beta = 1$) will set wages such that $w_2^H(\beta = 1) > w^w(\beta = 1) > w_1^H(\beta = 1)$. Moreover, we know from inspection of equation (22) that the second period wage in the presence of habit formation will exceed the respective wage in the absence of such preferences for any value of the union's bargaining power ($w_2^H(\beta) > w^w(\beta)$). This establishes part ii) of the Proposition.

If there is no habit formation, wages rise with greater union bargaining power, as the derivatives of (22) or equation (24) for $\alpha = 0$ with respect to β clarify (cf. [Nickell and Andrews \(1983\)](#)). The change in the first period wage owing to an increase in union bargaining power is ambiguous, as the derivatives of (22) and (24) with respect to β cannot be signed. The condition stated in part a) thus ensures that even if period one wages in the presence of habit formation rise with trade union bargaining power, this increase is never too sufficient to raise the period one wage in the presence of habit formation to above a level obtained by the trade union in the absence of such preferences. Part c) of the proposition follows from a) and b). The proof is illustrated in [Figure A.3](#) in [Appendix A.3](#). ■

Our above analysis clarifies that the effect of habit formation on collectively bargained

wages and the resulting employment outcomes are not restricted to a setting in which the trade union has full bargaining power and sets the wage.

4 Consequences of Habit Formation

Thus far, we have established the impact of habit formation on wages and employment in a unionised setting and considered the robustness of our findings. We next have a look at the consequences of changes in exogenous parameters. In particular, we analyse whether predictions which hold for time-separable preferences continue to apply in the presence of habit concerns. The list of changes in parameters which could impact union behaviour is long: One could, for example, enquire whether the impact of taxes and subsidies or of employment protection legislation on union behaviour is affected by habit formation. Moreover, the one may extend the model and let the trade union or the firm determine more than one variable, in order to incorporate issues of working hours, union membership or capital usage. In the subsequent sub-sections, we instead focus on parameters already contained in the model, namely unemployment benefits, \bar{w}_t , and the product price, p_t .

4.1 Variations in Unemployment Benefits

In one-period models of collective bargaining, higher unemployment benefits are predicted to raise the wage (Oswald, 1985, Ulph and Ulph, 1989). To examine how changes of unemployment benefits affect wages in a setting with habit formation, we consider alterations of \bar{w}_1 and \bar{w}_2 separately. Suppose, therefore, that unemployment benefits only rise at the beginning of period one. The derivative of the first-order conditions (5) and (8) with regard to \bar{w}_1 are zero and $\Omega_{\bar{w}_1}^R = -N'(w_1)\frac{1}{w_1} > 0$, respectively. The consequences of higher unemployment benefits in period one, taking into account $Z_{w_1}^R > 0$ from (39) (in Appendix A.1) and $Z_{w_2}^R < 0$ from (6), are therefore given by:

$$\frac{dw_1}{d\bar{w}_1} = -\frac{\Omega_{\bar{w}_1}^R Z_{w_2}^R}{D} > 0 \quad (29)$$

$$\frac{dw_2}{d\bar{w}_1} = \frac{\Omega_{\bar{w}_1}^R Z_{w_1}^R}{D} > 0 \quad (30)$$

The positive change in the first period wage is a standard finding (Oswald, 1985). The second period wage is predicted to rise because higher unemployment benefits in period one effectively raise the habit stock in period two. As a consequence, the utility loss due to habit formation rises and the union has an incentive to set a higher wage also in period

two. This means that a one-off rise (or a reduction) in unemployment benefits in period t will have longer lasting wage effects.

Next, we investigate an increase in unemployment benefits in period two, which is anticipated by the union in period one. In this case, the derivative of equation (8) with respect to \bar{w}_2 is zero and the derivative of the first-order condition (5) is given by $Z_{\bar{w}_2}^R = -N'(w_2)\frac{1}{\bar{w}_2} > 0$.¹⁰ Hence, the wage rises in both periods. The reason is that the increase in period two wages decreases contemporaneous labour demand. Hence, fewer employees are affected by the utility loss due to habit formation. Therefore, the costs of an increase in period one wages are reduced, and the union sets a higher period one wage.

While we have derived the impact of unemployment benefits for the case of logarithmic preferences and assuming the habit stock of unemployed to be constant, it is straightforward to show that the signs of the derivatives of the first-order conditions are not affected by incorporating habit formation by unemployed (see Section 3.2.1) or modifying preferences (see Section 3.2.3). Hence, we can summarise the results of this sub-section in:

Proposition 4. *Assume that individuals exhibit habit formation.*

If unemployment benefits rise in one period, the monopoly trade union will raise wages in both periods.

Proof: See above. ■

The above findings have a number of important consequences. First, a policy change, such as a variation in unemployment benefits, which is reversed after some time, will continue to affect wage setting even after the reversal, because of the change in the habit stock. Second, if a policy change can be anticipated, the consequences of this policy variation can occur prior to the actual policy change. This has interesting implications for empirical work. Suppose, the consequences of a policy change on wage outcomes are investigated by a DiD-approach in which the change in a policy measure for a group of treated employees is evaluated by calculating the change in wages at a date prior to the reform, relative to the wage paid after the reform. Our findings suggest that the anticipated policy change will also be reflected in pre-reform wages.

4.2 Changes of the Product Price

In a one-period model with standard preferences, an increase in the product price has no effect on the unions's desired wage if the labour demand elasticity is constant (Oswald,

¹⁰If the rise were not anticipated, the variation in period two wages could not be foreseen such that period one wages could not be affected.

1985, Ulph and Ulph, 1989). Below we investigate whether this finding also holds if we allow for habit preferences.

The change in employment owing to a higher product price in period t is given by $\frac{\partial N(w_t, p_t)}{\partial p_t} = -\frac{f'(N_t)}{p_t f''(N_t)} > 0$. Furthermore, the price elasticity of labour demand is characterised by $\varepsilon = \frac{-1}{p_t f''(N_t)} \frac{p_t f'(N_t)}{N(w_t, p_t)} = \frac{-f'(N_t)}{f''(N_t) N_t} > 0$. The first-order conditions for the first and the second period wage, assuming a constant price elasticity of labour demand, ε , are given by:

$$Z^{R,P} = \varepsilon \left(\ln \left(\frac{w_2}{w_1^\alpha} \right) - \ln(\bar{w}_2) \right) + 1 = 0 \quad (31)$$

$$\Omega^{R,P} = \varepsilon (\ln(w_1) - \ln(\bar{w}_1)) + 1 - \alpha \frac{N(w_2, p_2)}{N(w_1, p_1)} = 0 \quad (32)$$

The derivative of equation (31) with respect to p_1 , $Z_{p_1}^{R,P}$, is zero and the respective derivative of equation (32), $\Omega_{p_1}^{R,P}$, is positive. The wage changes arising from a higher product price in period one, taking into account that $Z_{w_1}^{R,P} > 0$ and $Z_{w_2}^{R,P} < 0$, are given by:

$$\frac{dw_1}{dp_1} = -\frac{\Omega_{p_1}^{R,P} Z_{w_2}^{R,P}}{D} > 0 \quad (33)$$

$$\frac{dw_2}{dp_1} = -\frac{\Omega_{p_1}^{R,P} Z_{w_1}^{R,P}}{D} > 0 \quad (34)$$

Consequently, we find that a rise in the first period product price increases wages in both periods. In a standard monopoly union model with time-separable preferences, a change in the product price will affect the trade union's gains and losses from changing the wage equally if the price elasticity of labour demand is constant. If individuals exhibit habit formation, costs of a wage increase do not only arise because of a loss in employment, but also because the habit stock rises for those employees who retain their job in period two. Their number, however, is unaffected by the rise in the product price in period one. In consequence, the costs of a wage increase in period one decline. A higher period one wage makes the habit component more distinct in the second period. This causes the trade union to set a higher wage in the second period as well.

Next, we assume that the product price only rises in period two, which is anticipated by the union in period one. The derivative of equation (31) with respect to p_2 , $Z_{p_2}^{R,P}$, is again zero and the respective derivative of equation (32), $\Omega_{p_2}^{R,P}$, is negative. Therefore, the wage

effects of an exogenous change in the product price in period two are given by:

$$\frac{dw_1}{dp_2} = -\frac{\Omega_{p_2}^{R,P} Z_{w_2}^{R,P}}{D} < 0 \quad (35)$$

$$\frac{dw_2}{dp_2} = -\frac{\Omega_{p_2}^{R,P} Z_{w_1}^{R,P}}{D} < 0 \quad (36)$$

In contrast to the product price in the first period, a rise in the second period price leads to lower wages in both periods. The intuition is as follows: A rise in the second period product price has no impact on the second period wage on account of the assumption of a constant price elasticity of labour demand, for a given wage in period one. Therefore, the higher output price induces an expansion in period two employment. More employment in period two raises the trade union's cost of a wage increase in period one because more of those employed in the first period incur a utility reduction in period two due to habit concerns. In consequence, the period one wage is lowered. A reduction in the first period wage, in turn, shrinks the habit stock. Therefore, the trade union can set a lower period two wage than it would have done had the output price in period two remained the same. In consequence, in the presence of habit concerns an anticipated output price increase in period two induces a wage adjustment in both periods which strengthens the immediate, positive employment impact in the second period.

Next, we assume that the product price rises in both periods by the same amount. In this case, the wage changes are the sum of both aforementioned effects. The change of the first period wage is then given by the sum of equation (33) and (35), the change of the second period wage by the sum of equation (34) and (36).

$$\frac{dw_1}{dp} = \frac{dw_1}{dp_1} + \frac{dw_1}{dp_2} = -\frac{Z_{w_2}^{R,P}}{D}(\Omega_{p_1}^{R,P} + \Omega_{p_2}^{R,P}) \quad (37)$$

$$\frac{dw_2}{dp} = \frac{dw_2}{dp_1} + \frac{dw_2}{dp_2} = \frac{Z_{w_1}^{R,P}}{D}(\Omega_{p_1}^{R,P} + \Omega_{p_2}^{R,P}) \quad (38)$$

Since $\Omega_{p_1}^{R,P} + \Omega_{p_2}^{R,P} = \frac{\alpha N(w_2, p_2)}{N(w_1, p_1)} \left[\frac{\varepsilon}{p_2} - \frac{\varepsilon}{p_1} \right]$, a price increase in both periods has no impact on wages if, for one thing, the product price is equal in both periods and, for another thing, the price increase has the same magnitude in both periods. We capture the results of this sub-section in:

Proposition 5. *Assume that*

- a) *individuals have logarithmic preferences which*
- b) *depend on the ratio of current income to the (value of the) habit stock, while*

- c) the habit stock of unemployed individuals is normalised to unity, and*
- d) the price elasticity of labour demand is constant.*

If the product price rises in period one (two), the monopoly trade union will raise (reduce) wages in both periods, which changes employment in the opposite direction. In contrast, the monopoly trade union has no incentive to adjust wages if prices are equal and increase or decrease in both periods equally.

Proof: See above. ■

5 Conclusion

In this paper, we examine how habit preferences affect the wage determination of a firm-specific, utilitarian trade union. We show that the trade union will have an incentive to increase wages over time once it takes habit preferences of its members into account. This holds relative to wages chosen in the absence of habit concerns and also in absolute terms, if unemployment benefits are constant over time. Interestingly, in the case of unemployed union members ascribing more importance to habit concerns than employed ones, our calculation shows contrary results. Focusing on a setting in which habit formation is relevant for employed union members only, we moreover show that results hold regardless whether we express such preferences by the ratio of or the difference between current and past wages. In addition, our findings are true for a monopoly trade union as well as for a setting in which the trade union and the firm Nash-bargain over wages. They also apply in a stationary and a growing economy.

Using a simple specification for labour demand and preferences, we show that habit formation can be quantitatively important in that such preferences raise later wages by substantially more than they lower them in early periods. In consequence, habit concerns can be shown to reduce employment.

What is more, our results suggest that changes in exogenous parameters, for example due to policy changes, can affect collective bargaining outcomes outside of their respective periods due to habit formation. To be more precise, these policy changes that are not yet or no longer in effect at a given period have the ability to alter the habit stock and thus influence union behaviour. We illustrated this based on variations in unemployment benefits and changes in the product price.

Our derivations are based on the assumption that individuals do not save in order to smooth disposable income over time. This is without impact on results if habit formation relates to income. If habit concerns focus on consumption, it is straightforward to show that individuals' savings decisions will never be such that the trade union sets constant

wages, implying that the wage and employment consequences of habit formation derived above are neutralised. The reason for this outcome is that optimal savings would equalise the marginal utility from consumption in both periods if employment were constant. This, however, does not imply that the utility levels in both periods are the same if there are habit concerns. Since the trade union's incentives to raise wages depend both on the utility level and the marginal utility, they are affected differently in periods one and two. Hence, a situation in which savings were chosen optimally and wages remained constant over time cannot maximise the trade union's payoff in both periods.¹¹ Consequently, habit formation would affect the wage setting also in the presence of savings. However, in our simple setting it is not straightforward to characterise optimal wage demands in the presence of savings. This is the case because changes in wages over time entail employment variations. Thus, optimal savings are also affected by precautionary motives as individuals can use them to insure against income variations due to unemployment. Savings then depend on the position and slope of the labour demand curve and the level of unemployment benefits and cannot easily be determined. Therefore, also the trade union's optimal wage demands can no longer be derived explicitly. In consequence, the impact of savings on our finding of an increasing wage profile over time is a topic for future research. It has to be emphasised, though, that the main result according to which changes in exogenous parameters in one period can affect collective bargaining outcomes in other periods due to habit formation continues to hold in the presence of savings. This is because the linkage between wages from one period to the next due to habit formation exists in the presence of savings opportunities, as well.

¹¹A proof of this assertion is available upon request.

A Appendix

A.1 Second-order Conditions for Monopoly Union Model

Declining employment:

The second-order derivatives of the trade union's objectives in period one and two are given by (6) and (9) and by:

$$Z_{w_1}^R = -N'(w_2) \frac{\alpha}{w_1} > 0 \quad (39)$$

$$\Omega_{w_2}^R = -N'(w_2) \frac{\delta \alpha}{w_1} = \delta Z_{w_1}^R > 0 \quad (40)$$

The determinant of the system originating from the two optimality conditions $Z^R = 0$ and $\Omega^R = 0$ is given by:

$$\begin{aligned} D^R &= \Omega_{w_1}^R Z_{w_2}^R - (Z_{w_1}^R)^2 \delta \\ &= N''(w_1) \ln\left(\frac{w_1}{\bar{w}_1}\right) Z_{w_2} + 2N'(w_1) \frac{1}{w_1} \left(N''(w_2) \left[\ln\left(\frac{w_2}{w_1^\alpha}\right) - \ln(\bar{w}_2) \right] - N(w_2) \frac{1}{w_2^2} \right) \\ &\quad + \frac{1}{w_1^2} [N(w_2) \delta \alpha - N(w_1)] \left(N''(w_2) \left[\ln\left(\frac{w_2}{w_1^\alpha}\right) - \ln(\bar{w}_2) \right] - N(w_2) \frac{1}{w_2^2} \right) \\ &\quad + \frac{N'(w_2)}{w_1^2 w_2} \underbrace{(4N'(w_1)w_1 + 2N(w_2)\delta\alpha - 2N(w_1) - N'(w_2)w_2\alpha^2\delta)}_{\tilde{A}} \end{aligned} \quad (41)$$

$$\tilde{A} = N(w_1)[-4\varepsilon(w_1) - 2] + N(w_2)\delta\alpha[2 + \alpha\varepsilon(w_2)] \quad (42)$$

where $\varepsilon(w) = -\frac{N'(w)w}{N(w)} > 0$ is increasing in the wage, such that $\varepsilon(w_2) > \varepsilon(w_1)$. Since $N(w_1) > N(w_2)\delta\alpha$ if wages rise over time, we have:

$$\begin{aligned} \tilde{A} &< N(w_2)\delta\alpha[-4\varepsilon(w_1) - 2] + N(w_2)\delta\alpha[2 + \alpha\varepsilon(w_2)] \\ &= N(w_2)\delta\alpha[-4\varepsilon(w_1) + \alpha\varepsilon(w_2)] \end{aligned} \quad (43)$$

If $4\varepsilon(w_1) > \alpha\varepsilon(w_2)$ holds, \tilde{A} is negative and $D^R > 0$.

Increasing employment:

The second-order derivatives of the trade union's objectives in period one and two are given by (11) and (6), with w_1 being replaced by \bar{w}_1 and by $Z_{w_1}^D = \Omega_{w_2}^D = 0$. The determinant of the system originating from the two optimality conditions $Z^D = 0$ and

$\Omega^D = 0$ is given by $D^D = \Omega_{w_1}^D Z_{w_2}^D > 0$.

A.2 Section 3.2.3 - First-order Conditions

If preferences are given by a power utility function, $u(c_t, H_t^\alpha) = \frac{(c_t/H_t^\alpha)^{1-\gamma}}{1-\gamma}$, the first-order condition for the choice of the first period wage is:

$$\Omega^{R,P} = N'(w_1) \left[\frac{w_1^{1-\gamma}}{1-\gamma} - \frac{\bar{w}_1^{1-\gamma}}{1-\gamma} \right] + N(w_1)w_1^{-\gamma} - N(w_2) \left(\frac{w_2}{w_1^\alpha} \right)^{-\gamma} \frac{\alpha w_2}{w_1^{\alpha+1}} = 0 \quad (44)$$

Since α affects only the last term $-N(w_2) \left(\frac{w_2}{w_1^\alpha} \right)^{-\gamma} \frac{\alpha w_2}{w_1^{\alpha+1}} < 0$, $w_1^H < w^w$.

If preferences are described by the more general formulation $u = u\left(\frac{c_t}{H_t^\alpha}\right)$, $u' > 0 > u''$, the first-order condition for the choice of the first period wage is:

$$\Omega^{R,G} = N'(w_1) [u(w_1) - u(\bar{w}_1)] + N(w_1)u'(w_1) - N(w_2)u' \left(\frac{w_2}{w_1^\alpha} \right) \left(\frac{w_2 \alpha}{w_1^{\alpha+1}} \right) = 0, \quad (45)$$

where we indicate the more general specification by the superscript G. The negative term $-N(w_2)u' \left(\frac{w_2}{w_1^\alpha} \right) \left(\frac{w_2 \alpha}{w_1^{\alpha+1}} \right)$ vanishes in a setting without habit formation. As a consequence, $w_1^H < w^w$.

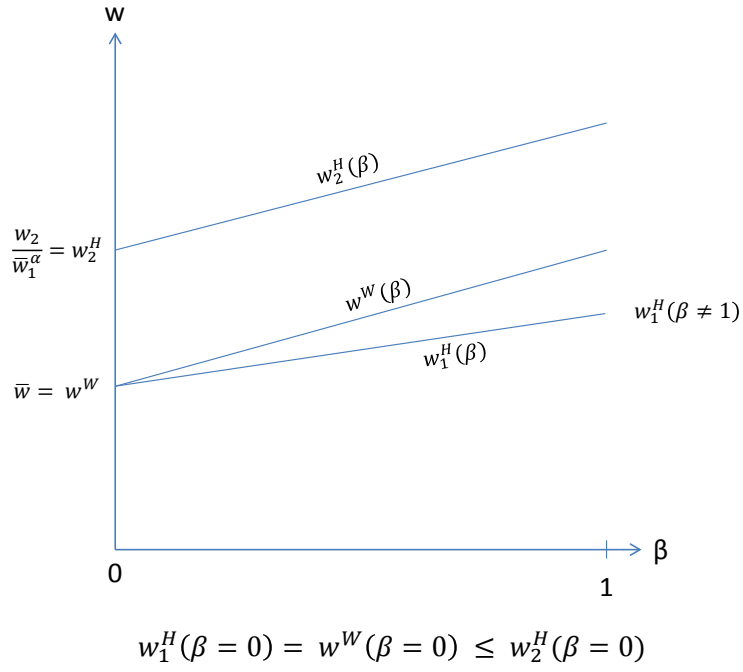
If preferences can be expressed by a general utility function which depends on the difference between the current income and the habit stock, multiplied by the weight α of habit formation, $u(c_t - \alpha H_t)$, the first-order condition for the first period wage is indexed by the superscript Sum and is:

$$\frac{\partial \Omega^{R,Sum}(w_1)}{\partial w_1} = N'(w_1)[u(w_1) - u(\bar{w}_1)] + N(w_1)u'(w_1) - N(w_2)u'(w_2 - \alpha w_1)\alpha = 0 \quad (46)$$

Since $N(w_2)u'(w_2 - \alpha w_1)\alpha > 0$ for $\alpha > 0$, the derivative is negative at $w_1 = w^w$ and $w_1 < w^w$ holds.

A.3 Proof of Proposition 3 - Figure

Figure 3: Wages effects of habit formation (Nash)



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