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ABSTRACT

The Impact of Temporary Agency Work on Trade Union Wage Setting: A Theoretical Analysis*

Focusing on the cost-reducing motive behind the use of temporary agency employment, this paper aims at providing a better theoretical understanding of the effects of temporary agency work on the wage-setting process, trade unions' rents, firms' profits and employment. It is shown that trade unions may find it optimal to accept lower wages to prevent firms from using temporary agency workers. Hence, the firms' option to use agency workers may affect wage setting also in those firms that only employ regular workers. However, if firms decide to employ agency workers, trade union wage claims will increase for the (remaining) regular workers. An intensive use of temporary agency workers in high-wage firms may therefore be the cause and not the consequence of the high wage level in those firms. Even though we assume monopoly unions that ascribe the highest possible wage-setting power to the unions, the economic rents of trade unions decline because of the firms' option to use temporary agency work, whereas firms' profits may increase.

JEL Classification: J51, J31, J23, J42

Keywords: trade unions, temporary agency work, wage-setting process, labour market segmentation, dual labour markets

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1 Introduction

Usually, trade unions put up strong resistance to the employment of temporary agency workers and the perceived weakening of pay and labour standards.[1] However, as pointed out by Böheim & Zweimüller (2013), in a given firm it is not necessarily clear *a priori* whether the trade union will oppose the employment of temporary agency workers. The reason is that cost savings and increases in profits could enable unions to extract higher rents in firms that employ agency workers. The theoretical analysis in this paper sheds more light on the question whether trade unions may profit from the introduction of temporary agency work or not. In more general terms, it will be analysed how trade unions react to the firms' option to employ temporary agency workers and how this change in trade unions' wage-setting behavior affects firms' profits, unions' rents, and employment. As far as we know, this is the first theoretical paper dealing with the impact of temporary agency work on trade union wage setting.

Temporary agency work constitutes a tripartite relationship, in which a temporary agency worker is employed by the temporary work agency and, by means of a commercial contract, is hired out to perform work assignments at a client firm. In return, the client firm has to pay a fee to the temporary work agency. In the following, temporary agency workers are referred to as temporary workers or agency workers. During the past few decades the share of agency workers in the total workforce has significantly increased in almost all OECD countries. Though the great recession starting in 2007 led to a cyclical decline in temporary agency work, in many countries the agency work penetration rate seems to resume its upwards trend. For example, from 1996 to 2011, the agency work penetration rate increased from 0.9 to 1.6 percent in Europe (with a peak of 2 percent in 2007), from 0.5 to 1.5 percent in Japan (with a peak of 2.2 percent in 2008), whereas it remained on the same level of 1.9 percent in the USA (with peaks of 2.2 percent in 2000 and 2005), see Ciett (2013).

[1]See, for example, Heery (2004) for the UK, Coe et al. (2009) for Australia and Olsen & Kalleberg (2004) for Norway and the US.

Various motives are behind the use of temporary agency employment (see, for example, Holst et al., 2010). Some motives have to do with the firm's necessity to react to a changing environment under uncertainty. In this case, temporary agency work is used as a "flexibility buffer". For example, the demand for temporary workers may be induced by the needs to adjust for workforce fluctuations and staff absences or to deal with greater uncertainty about future output levels (see Houseman, 2001 and Ono & Sullivan, 2013). Other motives are more of a strategic nature and have to do with the potential of using temporary agency employment to cut wage costs and increase profits. This strategic motive is well documented in the empirical literature (see, for example, Mitlacher, 2007 and Jahn & Weber, 2012). The focus of our model is on this cost-reduction motive behind the use of temporary agency employment and how this affects the "effective" wage bargaining power of trade unions.

One of our results will be that the option to use agency workers may affect wage setting also in those firms that do not employ temporary agency workers. This is an important result for at least two reasons. First, empirical studies may come to wrong conclusions if they try to identify the wage effects of temporary agency work by comparing wage levels for regular workers in firms with and without temporary agency work. Second, though the share of agency workers in the total workforce is only about two percent in many OECD countries, the impact of temporary agency work on the wage-setting process may be much larger.

From a methodological point of view, our theoretical model is related to papers discussing the impact of international outsourcing on trade union wage-setting. For example, in Koskela & Schöb (2010) and Skaksen (2004) the firms' option to outsource some part of production dampens wage claims of trade unions. Lommerud et al. (2006) analyse how international mergers might restrain the market power of unions in oligopoly markets. In those papers, the outsourcing or merging option imposes a threat to the bargaining power of trade unions, whereas in our paper the "effective" bargaining power of trade unions is eroded by the possibility to replace regular workers by temporary agency workers.

The remainder of the paper is organised as follows. Section 2 outlines the theoretical framework and explains the components of the theoretical model. Section 3 derives the labour demand functions for regular workers for two employment regimes. In one regime only regular workers are used, whereas in the other regime agency workers are employed as well. Section 4 analyses the wage-setting behaviour of trade unions when firms have the option to also employ agency workers. It is shown that three wage-setting regimes can be distinguished. Section 5 compares the levels of wages, employment, trade unions' utilities and firm's profits for the three wage-setting regimes. Whereas the analysis in the main text focuses on a closed economy, Section 6 shows that our results also hold in a small open economy. Section 7 contains a summary and some conclusions.

2 Outline of the model

We analyse the impact of temporary agency work on trade union wage setting using two modelling frameworks: the main variant focuses on the partial equilibrium in a closed economy with monopolistic competition in goods markets, whereas Section 6 explains how the main model equations have to be modified in order to describe the general equilibrium in a small open economy where goods prices are determined by world markets.

The following outline of the model is based on the modelling framework for the closed economy. There are two types of agents in the economy: Besides workers, who supply labour and do not own capital, there are also capitalists, who own the firms and do not supply labour. There also exist two types of firms in the economy: Productive firms produce final goods by using regular workers and possibly also temporary agency workers in production. Temporary work agencies lend temporary workers to productive firms. Between productive firms monopolistic competition prevails in the goods market. Because of barriers to market entry (that are, for simplicity, not explicitly modelled) the number of productive firms is given and monopoly rents are earned in the goods market. Firm-level trade unions determine wages on behalf of employed regular workers and try to appropriate some share of the rents for their members. Agency workers, however, are not covered by trade unions' wage agreements.

Our model belongs to the class of so-called "right-to-manage" models, in which firms retain the right to choose the employment level. In contrast, in an "efficient bargaining" model firms and trade unions bargain over both, wages and employment. Whereas in the first class of models the equilibrium lies on the labour demand curve, in the latter case the bargaining outcome lies on a contract curve which usually is different from the labour demand curve. Since the implications of these model classes may be quite different, our decision to base the analysis on the right-to-manage model is justified in detail in Appendix A.1. Our model consists of the following core elements:

i) Productive firms. The technology of the representative productive firm is described by the following production function

$$Y = S_1^{\alpha} S_2^{\beta} \qquad \alpha + \beta \leq 1, \tag{1}$$

where S_1 denotes the segment (intermediate) that can be solely produced by regular workers L_1, whereas segment S_2 can be produced by regular workers L_2 and/or by temporary workers $\tilde{L}_2$. It is assumed that

$$S_1 = L_1 \tag{2}$$

$$S_2 = L_2 + \delta \tilde{L}_2 \qquad 0 < \delta \leq 1. \tag{3}$$

Temporary workers might be less productive than regular workers, in which case $\delta < 1$ holds. Thus, $\delta \tilde{L}_2$ as well as L_1 and L_2 may be interpreted as labour in "efficiency units", where in the latter cases productivity is normalized to one. Total regular employment is $L = L_1 + L_2$. Notice that, apart from possibly being less productive than regular workers, temporary workers are assumed to be perfect substitutes for regular workers in some areas of production. This is a plausible assumption as temporary agency employment is mainly used in blue collar jobs to replace regular workers doing simple tasks. For example, regularly employed assemblymen or warehouse workers may be (perfectly) substituted by temporary agency workers if the latter group can be employed at lower costs.[2]

[2]This assumption is also in line with Jahn & Weber (2012) showing that regular jobs are substantially substituted by temporary jobs.

The goods demand function for the productive firm is

$$Y = p^{-\eta} Q \qquad \eta > 1, \tag{4}$$

with p denoting the firm's price relative to the aggregate price level and η denoting the price elasticity of the demand for goods (in absolute values).[3] Q is the share of aggregate demand (being equal to aggregate output) that would accrue to the single firm if $p = 1$. Since the focus of the first model variant is on a partial equilibrium model, Q is normalized to one. If a productive firm wants to employ a temporary worker, a fee $\tilde{x}$ must be paid to the temporary work agency. Real profits of the productive firm are

$$\Pi = pY - w(L_1 + L_2) - x\delta\tilde{L}_2, \tag{5}$$

where w denotes the gross real wage rate for regular workers and x denotes the real fee per temporary worker in "efficiency units", i.e.

$$x \equiv \frac{\tilde{x}}{\delta}. \tag{6}$$

In other words, x denotes the costs of producing one unit of S_2 if temporary workers are used for production. Firms compare these costs with the costs w of producing one unit of S_2 using regular workers.

ii) Temporary work agencies. It is assumed that temporary workers are just on the books of the temporary work agency when they are "idle", i.e. agency workers only receive a payment by the temporary work agency when they are assigned to a job at a client firm. This assumption captures quite well the institutional framework for temporary work in the UK, and to some extent the Netherlands or France, to name only some examples. In other countries, such as Germany and Sweden, temporary workers get an employment contract and obtain wage payments by the temporary work agency even when they are

[3]This isoelastic goods demand function of the Blanchard & Kiyotaki (1987) type is often used in the literature and can be derived from Dixit & Stiglitz (1977) preferences.

not assigned to a client firm.[4] However, as pointed out by Kvasnicka (2003), hirings by temporary work agencies occur primarily on-call as a reaction to current client demand to avoid the risk of initial prolonged unproductive employment of workers. In other words, the first assignment of a worker at a client firm almost always coincides with the moment the worker is hired by the temporary work agency, whereas activities such as screening take place prior to hiring. Our assumption therefore seems to be appropriate for the analysis of temporary work in a static model as it is considered in this paper.

It is assumed that the profits of a temporary work agency are equal to $(\tilde{x} - \omega - s)\tilde{L}_2$, where ω denotes the gross real wage rate of the temporary worker and s denotes real screening and search costs implied by the hiring of the temporary worker. Parameter s may also be related to the degree of regulation of temporary agency work. For example, in Germany a temporary worker was only allowed to work for a limited duration at the same client firm before the implementation of the Hartz reforms. Hence, in case the client firm intended to employ a temporary agency worker for a longer duration, the temporary work agency had to find a new temporary worker for the same job, implying higher screening and hiring costs.

Moreover, it is assumed that there is free market entry reflecting the fact that the establishment of a temporary work agency does not imply large irreversible investments as is the case for most productive firms. Since in equilibrium zero profits prevail, it must hold that[5]

$$\tilde{x} = \omega + s. \tag{7}$$

[4] The latter case has been analysed in the matching models of Neugart & Storrie (2006) and Baumann et al. (2011). Alternatively, Neugart & Storrie (2006) also analysed a model variant where workers are just on the books of the temporary work agency, which did not affect their main results (see their footnote 8).

[5] The assumption of free market entry is not appropriate for countries in which the establishment of a temporary work agency is restricted by government regulation. In that case eq. (7) should be interpreted as a simple shortcut to capture the fact that the fee $\tilde{x}$ claimed by the temporary work agency is positively related to screening costs s and the wage rate ω of a temporary worker.

iv) Temporary workers. Following the matching models of Neugart & Storrie (2006) and Baumann et al. (2011), we assume that agencies are able to set the wage ω equal to the reservation wage of workers. The temporary work agency therefore offers a wage making its workers at the margin indifferent to either being hired by the agency or staying unemployed. This assumption captures the fact that in many countries agency workers have a very weak bargaining position.[6] From the aforementioned matching models it is known that the payment of temporary workers may be lower than, equal to or greater than unemployment benefits depending on whether temporary workers find regular jobs more likely than unemployed workers or not (see eqs. (16) and (17) in Baumann et al., 2011). We assume that the temporary work agency offers a gross real wage ω so that the net real wage ω_n equals net unemployment benefits b_n. Implicitly, it is therefore assumed that the job finding probability is the same for unemployed and temporary workers. Net wages and benefits are defined as $\omega_n \equiv (1 - \tau_w)\omega$ and $b_n \equiv (1 - \tau_b)b$, where τ_w and τ_b denote the tax rate for wages and benefits, respectively. Hence, it is taken into account that in many countries unemployment benefits are also subject to income taxation. As in Beissinger & Egger (2004), we consider a situation in which $(1 - \tau_b) = \phi(1 - \tau_w)$, with $\phi \geq 1$. The government often imposes a lower tax burden on unemployment benefits implying $\phi > 1$, whereas if taxes on wages and unemployment benefits are the same, $\phi = 1$. The assumption $\omega_n = b_n$ then implies

$$\omega = \phi b \qquad \text{with} \quad \phi \geq 1. \tag{8}$$

iii) Trade unions. It is assumed that all employed regular workers are union members. Firm-level trade unions determine the wage for regular workers by maximising the rent accruing to their members.[7] The rent of a single union member equals the differential

[6]This is, for example, pointed out in Eurofound (European Foundation for the Improvement of Living and Working Conditions) (2008). According to this study, research findings also suggest that agency workers may have limited knowledge of their rights or the means to apply them.

[7]We consider a monopoly union model instead of a bargaining model in order to keep the analysis as simple as possible.

between the net wage at the respective firm and the net income obtained as outside option. For the determination of the outside option it must be taken into account that a regular worker being dismissed by the firm under consideration may either end up as a unemployed worker or find a job as a temporary worker. However, because of eq. (8), the net wage of a temporary worker equals net unemployment benefits. As a consequence, the outside option of a regular worker simply amounts to net unemployment benefits. The utility function of the representative union is the rent of a single worker times the number of regular workers at the firm under consideration, i.e. $U = L(w_n - b_n)$, where $w_n \equiv (1-\tau_w)w$ denotes the net real wage of regular workers. Because $(1-\tau_b) = \phi(1-\tau_w)$ the trade union utility function can be rewritten as

$$U = L\,(1-\tau_w)\,(w-\phi b), \qquad \text{with} \quad \phi \geq 1. \tag{9}$$

v) Government budget constraint. The tax receipts of the government are solely used to finance unemployment benefits, hence in the case of a balanced budget

$$\tau_w w(L_1 + L_2) + \tau_w \omega \tilde{L}_2 = (1-\tau_b)\,b\,[1 - L_1 - L_2 - \tilde{L}_2]. \tag{10}$$

The government may determine the level of net unemployment benefits by choosing τ_b and b. From the condition for a balanced budget then tax rate τ_w follows.

vi) Solution of the model. In the model, the agents' decisions are taken in two stages. In the first stage, the trade union determines the wage level for regular workers and the temporary work agency determines the fee it claims for the employment of an agency worker at a client firm. Because of the zero profit condition for temporary work agencies in eq. (7), the earnings equation (8) for agency workers, and eq. (6), the fee for an agency worker (in efficiency units) simply is $x = (\phi b + s)/\delta$. In the second stage, the firm decides on whether to use temporary workers or not and also determines the employment levels of regular workers and (possibly) temporary workers. This is taken into account by the trade union in the determination of the wage level. In order to obtain a subgame perfect equilibrium, the two-stage game must be solved by backward induction. Notice that the firm's decision to employ temporary workers can be made quite "spontaneously" and can be easily reversed, since it does not require irreversible investment decisions. Hence, it is quite natural to assume that trade union wages are determined before the firm decides on the use of temporary agency workers and not the other way round.

3 The determination of labour demand

In stage 2, each productive firm chooses the number of regular and temporary workers. The fee x to be paid to the temporary employment agency for a temporary worker (in efficiency units) and the wage rate w for a regular worker are already determined (from stage 1). Inserting eqs. (1) to (4) into eq. (5), the profit maximisation problem of the representative firm is[8]

$$\max_{L_1, L_2, \tilde{L}_2} \pi = L_1^{\alpha\kappa}(L_2 + \delta\tilde{L}_2)^{\beta\kappa} - w(L_1 + L_2) - x\delta\tilde{L}_2 \quad \text{s.t.} \quad \text{Ł}_2 \geq 0, \tilde{L}_2 \geq 0, \tag{11}$$

where the parameter κ is defined as $\kappa \equiv (\eta - 1)/\eta$, with $0 < \kappa < 1$. The lower κ, the higher the monopoly power of firms. The first–order conditions are:

$$\begin{aligned}
\frac{\partial\pi}{\partial L_1} &= \alpha\kappa L_1^{\alpha\kappa-1}(L_2 + \delta\tilde{L}_2)^{\beta\kappa} - w = 0 \\
\frac{\partial\pi}{\partial L_2} &= \beta\kappa L_1^{\alpha\kappa}(L_2 + \delta\tilde{L}_2)^{\beta\kappa-1} - w \leq 0, \qquad L_2 \geq 0, \qquad \frac{\partial\pi}{\partial L_2}L_2 = 0 \\
\frac{\partial\pi}{\partial\tilde{L}_2} &= \beta\kappa L_1^{\alpha\kappa}(L_2 + \delta\tilde{L}_2)^{\beta\kappa-1} - x \leq 0, \qquad \tilde{L}_2 \geq 0, \qquad \frac{\partial\pi}{\partial\tilde{L}_2}\tilde{L}_2 = 0.
\end{aligned}$$

It follows from the first-order conditions that three cases can be distinguished depending on whether the wage rate w for regular workers is lower than, equal to, or higher than the costs x of temporary workers.

[8] Because of eq. (1), both segments are essential for production. The corresponding labour input conditions $L_1 > 0$ and $L_2 + \tilde{L}_2 > 0$ are not explicitly taken into account in eq. (11).

Case I: $w < x$.

If $w < x$, it is cheaper to employ only regular workers, hence $L_2 > 0$ and $\tilde{L}_2 = 0$. From the first-order conditions the following labour demand functions are obtained:

$$L_1 = L_1(w) = A_1 \cdot w^{-1/[1-\kappa(\alpha+\beta)]} \tag{12}$$

$$L_2 = L_2(w) = A_2 \cdot w^{-1/[1-\kappa(\alpha+\beta)]}, \tag{13}$$

with

$$A_1 \equiv \left[(\alpha\kappa)^{1-\beta\kappa} \cdot (\beta\kappa)^{\beta\kappa}\right]^{1/[1-\kappa(\alpha+\beta)]} \quad \text{and} \quad A_2 \equiv \left[(\alpha\kappa)^{\alpha\kappa} \cdot (\beta\kappa)^{1-\alpha\kappa}\right]^{1/[1-\kappa(\alpha+\beta)]}. \tag{14}$$

Therefore, total labour demand L for regular workers is given by

$$L = L_r(w) = (A_1 + A_2)\, w^{-1/[1-\kappa(\alpha+\beta)]}, \tag{15}$$

where the index r denotes the situation in which only regular workers are employed. The wage elasticity of labour demand (in absolute values), denoted as ε_r, is

$$\varepsilon_r = \frac{1}{1-\kappa(\alpha+\beta)}. \tag{16}$$

Case II: $w = x$.

This situation describes the borderline case in which the firm is indifferent between employing regular workers and temporary workers in the production of S_2. The number of regular workers in the production of S_2 could therefore vary between 0 and $L_2(x)$, where $L_2(x)$ denotes the labour demand function $L_2(w)$ from eq. (13) evaluated at $w = x$. For ease of exposition we assume that the firm only employs regular workers if $w = x$.[9] Hence, in case II the same labour demand demand function for regular workers as in eq. (15) (evaluated at $w = x$) results, i.e.

$$L = L_r(x) = (A_1 + A_2)\, x^{-1/[1-\kappa(\alpha+\beta)]}. \tag{17}$$

[9]This behaviour would result if the trade union claimed a wage w that is marginally lower than x.

Case III: $w > x$.

In this case, profits are maximised by using only temporary workers in the production of S_2, hence $L_2 = 0$ and $\tilde{L}_2 > 0$. The labour demand functions are:

$$\begin{aligned} L_1 &= L_1(w, x) = A_1 \left[w^{-(1-\beta\kappa)} \, x^{-\beta\kappa} \right]^{1/[1-\kappa(\alpha+\beta)]} \\ \tilde{L}_2 &= \tilde{L}_2(w, x) = (1/\delta) A_2 \left[w^{-\alpha\kappa} \, x^{-(1-\alpha\kappa)} \right]^{1/[1-\kappa(\alpha+\beta)]} , \end{aligned} \tag{18}$$

with A_1 and A_2 being defined as in case I, see eq. (14). Total labour demand for regular workers in case III equals L_1, i.e.

$$L = L_t(w, x) = A_1 \left[w^{-(1-\beta\kappa)} \, x^{-\beta\kappa} \right]^{1/[1-\kappa(\alpha+\beta)]} , \tag{19}$$

where the index t denotes the situation in which only temporary workers are employed in the production of S_2. In this case, the demand for regular workers also depends on the fee for temporary workers because of the complementarities in production between segments S_1 and S_2. For example, if the number of temporary workers in the production of S_2 is reduced because these workers become more expensive, the demand for regular workers in the production of S_1 is reduced as well. The wage elasticity of labour demand for regular workers (in absolute values) now becomes

$$\varepsilon_t = \frac{(1 - \beta\kappa)}{1 - \kappa(\alpha + \beta)}. \tag{20}$$

Notice that both labour demand elasticities, ε_r and ε_t, are constant and greater than one. Moreover, notice that $\varepsilon_t < \varepsilon_r$ holds. If temporary workers are employed as well, the labour demand elasticity for regular workers gets smaller (in absolute values) because of the decline in the share of regular employment in total costs.

4 Union wage determination for regular workers

In stage 1, trade unions choose the wage that maximises the economic rent for employed regular members, defined in eq. (9), taking into account that employment is determined by firms in stage 2. Whether firms use temporary workers or not depends on the size of the fee for temporary workers relative to the wage that has to be paid to regular workers. Segment S_2 is produced by regular workers if $w \leq x$, whereas it is produced by temporary workers if $w > x$. Since trade unions determine the wage w for regular workers, their actions also affect the employment level chosen by firms.

In the following analysis it will turn out that there exist three wage-setting regimes, denoted as regimes R, X and T, respectively. In regime R, the representative trade union claims the wage w_R, defined as the monopoly wage if the labour demand function is $L_r(w)$, and the corresponding firm chooses the employment level $L_r(w_R)$. In regime X, the trade union finds it optimal to set a wage $w_X = x$ that equals the fee for temporary workers and the employment level is $L_r(x)$. In regime T, the trade union claims the wage w_T, defined as the monopoly wage if the labour demand function is $L_t(w, x)$, and the firm chooses the employment level $L_t(w_T, x)$. Which regime prevails depends on the fee x for temporary workers relative to two threshold values $\underline{x}$ and $\overline{x}$, with $\underline{x} < \overline{x}$, as depicted in Figure 1. If $x \geq \overline{x}$, the trade union will choose the wage-setting regime R. For $x < \underline{x}$, the regime T will be chosen, whereas for intermediate values of the fee, $\underline{x} \leq x < \overline{x}$, the wage-setting regime X will be implemented.[10]

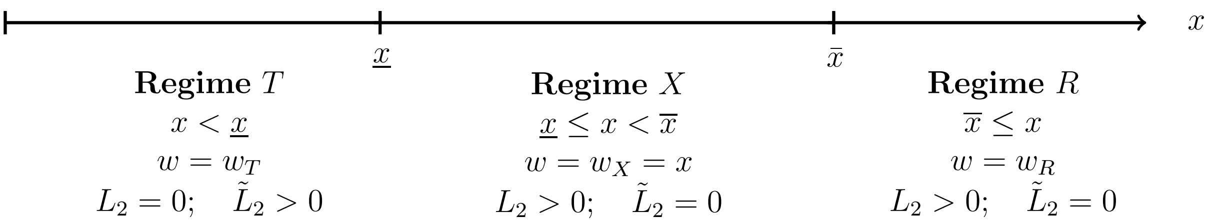

Figure 1: Three wage-setting regimes for regular workers depending on the size of the fee for temporary workers

Before moving on to prove these statements, the monopoly wages and corresponding

[10]Notice that in the wage-setting regimes R and X only regular workers are employed, i.e. the firm chooses the employment level according to the $L_r(w)$ function. The indices r and t just distinguish the labour demand functions and have a different meaning than the indices for the wage-setting regimes R, X and T.

employment and utility levels for the regimes R and T are derived. As shown in Appendix A.2, in these regimes each union sets the wage for regular workers as a mark-up over unemployment benefits, with the mark-up depending negatively on the wage elasticity of labour demand for regular workers. As has been shown in Section 3, the labour demand elasticities differ depending on whether the firm uses only regular workers or also temporary workers in production. In regime R, the rent-maximising wage for regular workers claimed by the trade union is

$$w_R = \frac{1}{(\alpha + \beta)\kappa}\,\phi b, \tag{21}$$

leading to the employment level $L_r(w_R)$ determined by eq. (15). The trade union then achieves the utility level

$$V_R = L_r(w_R)\,(1 - \tau_w)\,(w_R - \phi b). \tag{22}$$

In regime T, the rent-maximising wage for regular workers becomes

$$w_T = \frac{1 - \beta\kappa}{\alpha\kappa}\,\phi b, \tag{23}$$

leading to the employment level $L_t(w_T, x)$ determined by eq. (19). Interestingly, it turns out that $w_T > w_R$. If the firm uses temporary agency work, the union's wage claim for the remaining regular workers is higher than the rent-maximising wage if only regular workers are employed. The reason is that the labour demand elasticity for regular workers is lower (in absolute values) if also temporary workers are employed. In regime T, the trade union achieves the economic rent

$$V_T(x) = L_t(w_T, x)\,(1 - \tau_w)\,(w_T - \phi b). \tag{24}$$

As can be seen from this equation, the monopoly rent in regime T is a function of the fee for temporary workers. While w_T is constant, labour demand $L_t(\cdot)$ for regular workers negatively depends on the fee x. As a consequence, V_T also negatively depends on x.

An intuition for the determination of the threshold values $\underline{x}$ and $\overline{x}$ and the separation of the different wage-setting regimes is most easily obtained by looking at Figure 2 that describes the labour market for regular workers. The curve $L_r(w)$ represents labour demand in case only regular workers are employed in the production of both segments, whereas $L_t(w,x)$ is the labour demand curve (for regular workers) if temporary workers are used for the production of the S_2-segment. Notice that a decline in x leads to a rightward shift of the L_t-curve.

If $x \geq w_R$, i.e. the fee for temporary workers is higher than or equal to the wage w_R, the trade union chooses the wage $w = w_R$ that maximises its economic rent if only regular workers are employed, and the firm decides to employ only regular workers (point A). The upper threshold for x therefore is

$$\overline{x} \equiv w_R = \frac{1}{(\alpha+\beta)\kappa}\,\phi b. \tag{25}$$

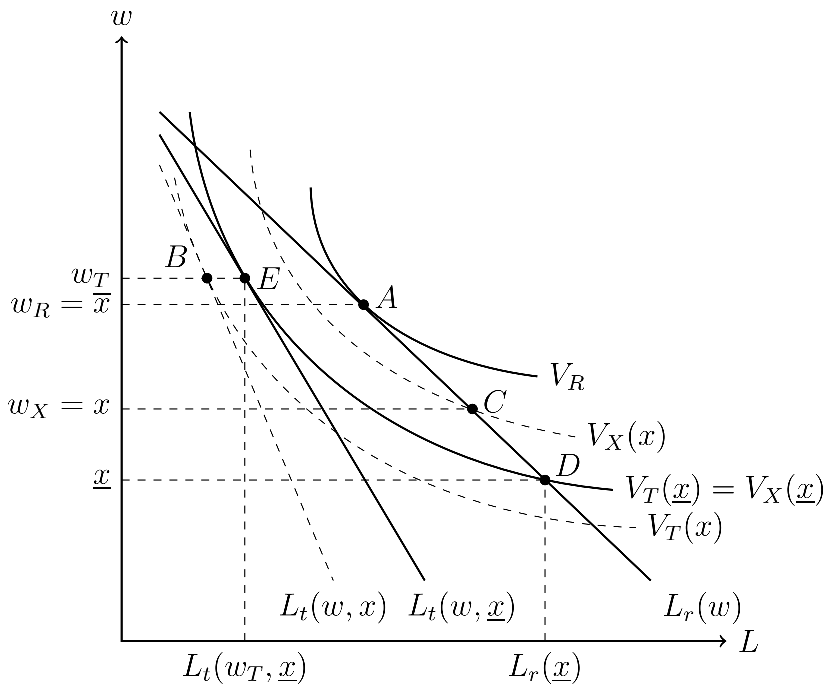

Figure 2: The determination of the threshold values $\underline{x}$ and $\overline{x}$

Now suppose that the fee x for temporary workers is somewhat below $\overline{x}$. If the trade union still claimed the wage w_R, the firm would decide to employ temporary workers for the production of S_2, because $x < w_R$. In Figure 2, the corresponding labour demand curve (for regular workers) is depicted as the dashed line $L_t(w, x)$. If the trade union chooses a wage rate $w > x$, the firm chooses employment according to this $L_t(w, x)$–curve. Along this curve, the rent-maximising wage is given by w_T, leading to the employment level $L_t(w_T, x)$ (point B). As is evident from the figure, in this situation the trade union would be better off by instead choosing a wage $w_X = x$ that makes the firm to employ only regular workers (point C). The reason is that the corresponding economic rent

$$V_X(x) = L_r(x)(1 - \tau_w)(x - \phi b) \tag{26}$$

is higher than the utility level $V_T(x)$ corresponding to the indifference curve tangent to the $L_t(w, x)$-curve in point B.

If the fee for temporary workers further declines, the $L_t(w, x)$-curve and the indifference curve representing the maximum level of economic rent in regime T shift to the right due to the complementarities in production mentioned in Section 3. Simultaneously, with decreasing x the economic rent achievable in regime X declines and the corresponding indifference curve shifts to the left. As depicted in Figure 2, there has to exist a lower threshold $\underline{x}$ defined as the wage level for regular workers that renders the trade union indifferent between the situation in which only regular workers are used (point D) and the situation in which temporary workers replace regular workers in the production of segment S_2 (point E). The labour demand curve in the latter situation is given by $L_t(w, \underline{x})$. Hence, $\underline{x}$ is implicitly defined by the condition

$$V_T(\underline{x}) = V_X(\underline{x}). \tag{27}$$

If $x < \underline{x}$, the $L_t(w, x)$-curve lies to the right of the $L_t(w, \underline{x})$-curve. Hence, it no longer pays off for the trade union to prevent the employment of temporary workers because in this case $V_X(x) < V_T(x)$.

The graphical analysis using Figure 2 suggests that a lower threshold $\underline{x} < \overline{x}$ exists, where $\overline{x} = w_R$. Since the graphical results depend on the position of the $L_t(w, x)$-curves relative to the $L_r(w)$-curve, we have to make sure that the graphical intuition is correct. The formal proof, outlined in more detail in Appendix A.3, is based on the following reasoning:

1. To determine the upper threshold $\overline{x}$, it is shown that for all values of the fee x with $x \geq w_R$ it is optimal for the trade union to claim the wage $w = w_R$. The alternative strategy of choosing a wage $w > x$, thereby inducing the firm to employ temporary workers for the production of segment S_2, is not in the interest of the trade union.[11] This is demonstrated by noting that for $x = w_R$ it holds that $V_R > V_T(w_R)$. In other words, the wage-employment combination $(w_R, L_r(w_R))$ leads to a higher economic rent than the combination $(w_T, L_t(w_T, x = w_R))$. Moreover, because $\partial V_T(x)/\partial x < 0$, it must also hold that $V_R > V_T(x)$ for all $x > w_R$. It can be concluded that for $x \geq w_R$, the R-regime prevails in which it is the best strategy for the trade union to claim the wage w_R, and for the firm to employ only regular workers.

2. It has already been noted in step 1 that $V_R > V_T(w_R)$. Because of eqs. (22) and (26), it also holds that $V_R = V_X(w_R)$. It can therefore be concluded that $V_X(w_R) - V_T(w_R) > 0$. Moreover, it can be shown that $\partial[V_X(x) - V_T(x)]/\partial x > 0$ for $x \leq w_R$. In other words, the difference between the economic rents in regimes X and T declines with a decline in x. However, at least for marginal declines in x, it still holds that $V_X(x) > V_T(x)$. This means that if x (marginally) declines below w_R, it is better to set the wage equal to the fee of temporary workers (X-regime) in order to prevent temporary agency employment (T-regime). From points 1. and 2. it follows that $\overline{x} = w_R$ indeed constitutes the upper threshold for the fee x. For $x \geq \overline{x}$ the R-regime prevails, whereas for (at least marginally) lower values than $\overline{x}$ the X-regime is chosen.

3. Since $V_X(w_R) - V_T(w_R) > 0$ and $\partial[V_X(x) - V_T(x)]/\partial x > 0$ for $x \leq w_R$, with declining x eventually a level $\underline{x}$ is reached where $V_X(\underline{x}) = V_T(\underline{x})$. If $\underline{x}$ were lower than the lowest admissible value of fee x, denoted $x_{\min}$ and defined as $x_{\min} = \phi b$, regime T would never occur.[12] However, it is shown that $x_{\min} < \underline{x}$ and $V_X(x) - V_T(x) < 0$ for all x with $x_{\min} \leq x < \underline{x}$. Hence, $\underline{x}$ constitutes the lower threshold separating regimes X and T.

[11] Note that for fees $x > w_R$ it can never be optimal to choose a wage w with $w_R < w < x$, because w_R is the rent-maximising wage if only regular workers are employed.

[12] As has been outlined in Section 2, $x = (\phi\, b + s)/\delta$. The minimum value for x is obtained for $\delta = 1$ and $s = 0$, leading to $x_{\min} = \phi b$.

5 Comparison of the different wage setting regimes

This section compares the levels of wages, employment, trade union's utilities and firm's profits for the three wage-setting regimes defined in Section 4. Starting with the comparison of wage levels, it immediately follows from the discussion in Section 4 that

$$w_T > w_R > w_X, \tag{28}$$

where w_X represents all wages $w_X = x$ for $x \in [\underline{x}, \overline{x})$. The first inequality is due the lower wage elasticity of labour demand for regular workers in regime T in comparison to regime R. Hence, in the employment regime with temporary workers, the optimal wage w_T is higher than the monopoly wage w_R when only regular workers are employed. The second inequality results from unions' incentive to undercut the wage w_R to prevent temporary agency employment if $\underline{x} \leq x < \overline{x}$.

Regarding trade union utility, it follows from the determination of the threshold values $\underline{x}$ and $\overline{x}$ in Section 4 that

$$V_R > V_X(x) > V_T(x) \qquad \text{for } x > \underline{x}. \tag{29}$$

From that discussion it is also evident that $V_T(x) > V_X(x)$ if $x < \underline{x}$ and that $V_T(x)$ increases with declining x. An interesting question left to answer is whether for values of x with $x_{\min} < x < \underline{x}$ it could be possible that $V_T(x) > V_R$. This would mean that trade unions profit from the employment of (relatively cheap) temporary workers because of higher economic rents. However, in Appendix A.4 it is shown that, at least in our model, this result cannot occur. Instead, we conclude that

$$V_R > V_T(x) \qquad \text{for } x \geq x_{\min} = \phi\, b. \tag{30}$$

Hence, trade unions are always harmed by the employment of temporary workers.

Since in regimes R and X the same labour demand function is relevant and $w_X < w_R$, it immediately follows that employment in regime X is higher than employment in regime R. Moreover, it also holds that employment in regime R is higher than employment in regime T. If this were not the case, we would get a situation in which both wages and employment of regular workers are higher in regime T than in regime R. This, however, would contradict the inequality in eq. (30). Therefore,

$$L_r(w_X) > L_r(w_R) > L_t(w_T, x), \tag{31}$$

where w_X again refers to wages $w_X = x$ in the interval $x \in [\underline{x}, \overline{x})$ that are chosen in regime X. Note that the second inequality not only holds for $x \in [x_{\min}, \underline{x})$, but for all $x \geq x_{\min}$. In Appendix A.5 it is explicitly shown that inequality (31) holds.

Finally, the firm's profits in the different regimes are considered (for details see Appendix A.5). It can easily be derived that $\pi_X(x) > \pi_T(x)$ and $\pi_X(x) > \pi_R$ for all $x \geq x_{\min}$. However, whether profits in regime T exceed profits in regime R or vice versa, depends on the values of the exogenous parameters α, β, and κ. In Appendix A.5 it is shown that there exists a value $x > x_{\min}$, denoted x_{indiff}, for which $\pi_R = \pi_T(x_{\text{indiff}})$. The location of x_{indiff} depends on the parameter values of α, β, and κ. If $x_{\text{indiff}} \in [\underline{x}, \overline{x})$, profits in regime T are higher than in regime R, i.e. it then holds that $\pi_T(x) > \pi_R$ for $x \in [x_{\min}, \underline{x})$. It can be shown that the probability for this situation is the higher, the smaller κ and the higher β relative to α. In other words, the larger the share of segment S_2 in production and the higher its share in total labour costs, the higher is the incentive of firms to hire temporary agency workers in the production of that segment to reduce labour costs and increase profits. However, if $x_{\text{indiff}} \in [x_{\min}, \underline{x})$, there is a range of fees for temporary workers $(x_{\text{indiff}}, \underline{x})$ for which $\pi_T(x) < \pi_R$. It may seem puzzling that firms would employ temporary workers in such a situation though this implies lower profits than in the regime where only regular workers are employed (at the monopoly wage w_R). The explanation is as follows:

According to our analysis, the trade union finds it no longer profitable to prevent temporary agency employment if $x < \underline{x}$. The trade union therefore demands a wage w_T for the remaining regular workers and the firm finds it optimal to replace regular workers in segment S_2 by temporary workers. Both, the firm and the trade union, would be better off if the firm would only employ regular workers in both segments at the monopoly wage w_R. However, if the trade union claims the wage w_R, the firm still has the incentive to deviate from such an agreement and to replace the regular workers in segment S_2 by temporary workers, since $x < \underline{x} < w_R$. In such a case, the trade union would be even worse off than in a situation in which it claims the higher wage w_T for the remaining regular workers.

6 A model variant for a small open economy

The model outlined above also describes the general equilibrium for a small open economy. In a small open economy goods prices are determined in world markets. Since the representative firm faces an infinitely elastic demand curve at world prices, the parameter κ introduced in eq. (11) equals 1. To obtain well defined labour demand functions it must be assumed that $\alpha + \beta < 1$ in eq. (1). Instead of eqs. (16) and (20), the labour demand elasticities now become

$$\varepsilon_r = \frac{1}{1-(\alpha+\beta)} \qquad \text{and} \qquad \varepsilon_t = \frac{1-\beta}{1-(\alpha+\beta)}$$

With these labour demand elasticities, the monopoly wages in regimes R and T can be computed as

$$w_R = \frac{1}{\alpha+\beta}\,\phi b \qquad \text{and} \qquad w_T = \frac{1-\beta}{\alpha}\,\phi b, \tag{32}$$

where again $w_T > w_R$ holds. The rest of the analysis remains unchanged, i.e. there exist again the three regimes R, X and T separated by the threshold values $\underline{x}$ and $\overline{x}$ as outlined in the closed economy version of the model. Therefore, our conclusions also hold in a general equilibrium setting for a small open economy.

7 Summary and conclusions

This paper develops a theoretical model to analyse how the firms' option to employ temporary agency workers affects the wage-setting behaviour of trade unions. In the model, the motive behind employing temporary agency workers is the reduction in costs when the fee for temporary workers is lower than the wage for regular workers. The theoretical predictions are derived using two modelling frameworks: the partial equilibrium in a closed economy with monopolistic competition in goods markets and the general equilibrium in a small open economy where goods prices are determined by world markets. For simplicity, in our model monopoly unions are assumed that by their very nature have the highest wage-setting power.

It is shown that, depending on the fee for temporary workers, unions may try to prevent the implementation of temporary agency work by deviating from the monopoly wage and accepting lower wages. In this case, firms are able to use the option to replace regular workers by temporary workers as a threat against unions, thereby lowering wage demands and increasing profits. Unions then only claim wages that are equal to the fee the firm would have to pay for temporary workers. As a consequence, the firms' option to use agency workers may affect wage setting also in those firms that do not employ temporary agency workers. This is an important result for at least two reasons. First, empirical studies may come to wrong conclusions if they try to identify the wage effects of temporary agency work by comparing wage levels for regular workers in firms with and without temporary agency work. Second, though the share of agency workers in the total workforce is relatively small in many OECD countries, the impact of temporary agency work on the wage-setting process may be much larger.

It is also shown that if the fee for temporary workers is below a specific lower threshold, it is no longer the optimal strategy for trade unions to prevent the employment of temporary agency workers. Interestingly, since firms reduce the number of regular workers, it now is the best strategy for unions to claim wages that are even higher than the wage demands when the firms' threat to replace regular workers is not credible. Hence, according to our model, the intensive use of temporary agency workers in high-wage firms may be the cause and not the consequence of the high wage level in those firms.

In the literature it is sometimes argued that the use of temporary agency work may also benefit trade unions because they would be able to appropriate higher economic rents. It would then be in the interest of unions not to resist the employment of agency workers. However, at least in our theoretical model, trade unions are always harmed by the firms' option to employ temporary workers.

A Appendix

A.1 Right to manage versus efficient bargaining

Empirical studies lack a clear answer about whether the right-to-manage model or the efficient bargaining model is more relevant. If managers are asked about the issues covered in bargains with trade unions, the answers seem to unambiguously back up the right-to-manage model (Booth, 1995). This can be most clearly seen in the USA, where many collective agreements explicitly stipulate that employers retain the right to determine the level of employment. Even in countries where such a stipulation is not explicitly found in employment contracts, one gets the impression that trade unions typically do not bargain over employment.

Some economists argued that bargaining over employment implicitly occurs through firm-union agreements on "manning" levels (by which capital-to-labour or labour-to-output ratios are meant).[13] However, it is not clear why agreements on manning levels should be interpreted as contracts which implicitly determine the employment level. The reason is that, for instance, a fixed capital-labour ratio does not prevent firms from adjusting both capital and employment, or changing the number of shifts per machine (Layard et al., 1991, p. 96).

It is sometimes claimed that empirical studies which do not rely on survey data but focus on market outcomes would support the hypothesis that efficient bargains do, at least implicitly, occur (see, for example, Brown & Ashenfelter, 1986). However, Booth (1995, chap. 5) convincingly argues that the tests applied in these studies in order to distinguish between the right-to-manage model and the efficient bargaining model are flawed and therefore not credible. Empirical studies trying to identify the appropriate bargaining model from observed market outcomes are confronted with almost unsurmountable difficulties. In principle, each study has to make assumptions about trade unions' preferences, technologies, other labour market imperfections, and the market structure. The

[13]For this discussion see, for instance, McDonald & Solow (1981), Johnson (1990) and Clark (1990).

empirical tests then are joint tests of these assumptions. For example, the shape of the contract curve depends on the preferences of union members and may even coincide with the labour demand curve.[14] Hence, even if one focuses on the efficient bargaining model, different results are possible depending on trade union's preferences. The critique goes farther than that, since empirical studies have failed to significantly improve our knowledge about trade unions' preferences (see, for example, Pencavel, 1991).

The fact that efficient bargains are not observed more frequently may be due to the fact that something important is missing in theoretical considerations which claim the superiority of wage-employment bargains. For instance, efficient bargains may not be enforceable. Since the bargaining outcome usually lies off the labour demand curve, the firm has an incentive to cheat and may try to increase profits at the bargained wage level by choosing employment according to its labour demand curve. If trade unions are unable to enforce the labour contract, they may prefer higher wages and lower employment as predicted by the right-to-manage model.[15] For all these reasons, we consider the right-to-manage model to be a plausible framework for studying the impact of trade unions on labour market outcomes.

A.2 Utility maximisation of the trade union

In the wage-setting regimes R and T, the representative trade union chooses the optimal wage w_R and w_T by maximising its objective function (9) subject to the labour demand function $L_r(w)$ or $L_t(w, x)$ defined in eqs. (15) and (19), respectively. From the first-order condition it follows that

$$-\frac{\partial L_r}{\partial w}\frac{w_R}{L_r} = \frac{w_R}{w_R - \phi\, b} \quad \text{and} \quad -\frac{\partial L_t}{\partial w}\frac{w_T}{L_t} = \frac{w_T}{w_T - \phi\, b}$$

[14]See, for example, the "insider model" of Carruth & Oswald (1987) and the "seniority wage model" of Oswald (1993).

[15]If uncertainty and asymmetric information with respect to the future level of the firm's goods demand are taken into account, the scope of incentive-compatible contracts may be severely limited due to the costs of information gathering and the problems associated with moral hazard.

for the R-regime and T-regime, respectively. Therefore,

$$w_R = \frac{\varepsilon_r}{\varepsilon_r - 1}\phi\, b \quad \text{and} \quad w_T = \frac{\varepsilon_t}{\varepsilon_t - 1}\phi\, b,$$

where ε_r and ε_t are defined in eqs. (16) and (20), respectively. If the tax rate for unemployment benefits is lower than that for wages, $\phi > 1$ holds, whereas $\phi = 1$ if the tax rate for unemployment benefits and wages is the same. In the case of the R-regime, the second-order condition for a utility maximum is

$$(1-\tau_w)\left[(w_R - \phi\, b)\cdot \left.\frac{\partial^2 L_r}{\partial w^2}\right|_{w=w_R} + 2\cdot \left.\frac{\partial L_r}{\partial w}\right|_{w=w_R}\right] < 0.$$

Since

$$\left.\frac{\partial L_r}{\partial w}\right|_{w=w_R} = -\varepsilon_r \cdot \frac{L_r(w_R)}{w_R}, \qquad \text{and} \qquad \left.\frac{\partial^2 L_r}{\partial w^2}\right|_{w=w_R} = \frac{\varepsilon_r}{w_R^2}\cdot L_r(w_R)\cdot(1+\varepsilon_r),$$

it can be shown that the second-order condition for a the utility maximum holds because

$$-L_r \cdot \frac{\varepsilon_r}{w_R^2}\cdot \phi\, b < 0.$$

A similar reasoning applies to the second-order condition in the T-regime.

A.3 Determination of the wage-setting regimes

This appendix provides the details for the proof outlined in Section 4.

1. It is first shown that $V_R > V_T(w_R)$. Inserting the labour demand function $L_r(\cdot)$ from eq. (15) into the expression for V_R in eq. (22), one obtains

$$V_R = (A_1 + A_2)\, w_R^{\frac{-1}{1-\kappa(\alpha+\beta)}}(1-\tau_w)(w_R - \phi b).$$

Similarly, inserting $L_t(\cdot)$ from eq. (19) into the expression for V_T in eq. (24) for $x = w_R$ leads to

$$V_T(w_T) = A_1[w_T^{-(1-\beta\kappa)} w_R^{-\beta\kappa}]^{\frac{1}{1-\kappa(\alpha+\beta)}}(1-\tau_w)(w_T - \phi b).$$

Hence, for $V_R > V_T(w_R)$ it must hold that

$$\frac{A_1}{A_1 + A_2}\cdot\frac{w_T - \phi b}{w_R - \phi b} < \left[\frac{w_R^{-1}}{w_T^{-(1-\beta\kappa)} w_R^{-\beta\kappa}}\right]^{\frac{1}{1-\kappa(\alpha+\beta)}}. \tag{33}$$

Because of the definition of A_1 and A_2 in eq. (14) and the definitions of w_R and w_T in eqs. (21) and (23), the LHS of this inequality is

$$\frac{A_1}{A_1 + A_2} \cdot \frac{w_T - \phi b}{w_R - \phi b} = \frac{\alpha}{\alpha + \beta} \cdot \frac{\alpha + \beta}{\alpha} = 1. \tag{34}$$

Hence, inequality (33) becomes

$$1 < \left[\frac{w_T}{w_R}\right]^{\frac{1-\beta\kappa}{1-\kappa(\alpha+\beta)}},$$

leading to $w_T > w_R$. Since the last inequality is true, also $V_R > V_T(w_R)$ holds.

As next step the derivative of $V_T(x)$ is computed. One obtains

$$\frac{\partial V_T(x)}{\partial x} = -\frac{\beta\kappa}{1 - \kappa(\alpha + \beta)} \frac{V_T(x)}{x} < 0$$

If these results are taken together, it can be concluded that for all fees $x \geq w_R$, the R-regime prevails in which it is the best strategy for the trade union to claim the wage w_R, and for the firm to employ only regular workers.

2. Using eqs. (24) and (26) for V_T and V_X, respectively, and taking account of the labour demand functions (17) and (19), the difference in the rents achievable in regimes X and T is

$$\begin{aligned} V_X(x) - V_T(x) = (1 - \tau_w)\cdot \\ \left[(A_1 + A_2)\, x^{-\frac{1}{1-\kappa(\alpha+\beta)}}\, (x - \phi b) - A_1\, [x^{-\beta\kappa} w_T^{-(1-\beta\kappa)}]^{\frac{1}{1-\kappa(\alpha+\beta)}}\, (w_T - \phi b)\right], \end{aligned}$$

and its derivative with respect to fee x is

$$\begin{aligned} \frac{\partial[V_X(x) - V_T(x)]}{\partial x} = (1 - \tau_w)\cdot \\ \Bigg[(A_1 + A_2) x^{-\frac{1}{1-\kappa(\alpha+\beta)}} \underbrace{\left(1 - \frac{1}{1 - \kappa(\alpha + \beta)} \frac{x - \phi b}{x}\right)}_{\equiv C} \\ + \frac{\beta\kappa}{1 - \kappa(\alpha + \beta)} A_1\, (x^{-\beta\kappa} w_T^{-(1-\beta\kappa)})^{\frac{1}{1-\kappa(\alpha+\beta)}} x^{-1} (w_T - \phi b)\Bigg] \end{aligned}$$

The term C is positive if

$$x < \frac{1}{\kappa(\alpha + \beta)} \phi b = w_R,$$

and it is zero if $x = w_R$. Hence, $x \leq w_R$ is sufficient for $\partial[V_X(x) - V_T(x)]/\partial x > 0$ to hold.

As has been explained in Section 4, it follows from points 1 and 2 that $\overline{x} = w_R$ indeed constitutes the upper threshold for the fee x. For $x \geq \overline{x}$ the R-regime prevails, whereas for (at least marginally) lower values than $\overline{x}$, the X-regime is chosen.

3. Since $V_X(w_R) - V_T(w_R) > 0$ and $\partial[V_X(x) - V_T(x)]/\partial x > 0$ for $x \leq w_R$, with declining x eventually a level $\underline{x}$ is reached where $V_X(\underline{x}) = V_T(\underline{x})$, implying

$$(A_1 + A_2)\underline{x}^{\frac{-1}{1-\kappa(\alpha+\beta)}}(\underline{x} - \phi\, b) = A_1\left[w_T^{-(1-\beta\kappa)}\underline{x}^{-\beta\kappa}\right]^{\frac{1}{1-\kappa(\alpha+\beta)}}(w_T - \phi\, b).$$

Rearrangement leads to the following expression which implicitly defines $\underline{x}$:

$$\frac{\alpha}{\alpha+\beta}\left(\frac{w_T}{\underline{x}}\right)^{\frac{-(1-\beta\kappa)}{1-\kappa(\alpha+\beta)}} = \frac{\underline{x} - \phi\, b}{w_T - \phi\, b}.$$

Theoretically, it may be possible that $\underline{x}$ is lower than the lowest admissible value of fee x, denoted $x_{\min}$, where $x_{\min} = \phi b$. This would mean regime T never to occur. However, it can be shown that for $x_{\min}$ the difference in the utilities in regimes X and T is negative:

$$\begin{aligned} V_X(x_{\min}) - V_T(x_{\min}) &= L_r(x_{\min})(1-\tau_w)(\phi\, b - \phi\, b) - L_t(x_{\min})(1-\tau_w)(w_T - \phi\, b) \\ &= -L_t(x_{\min})(1-\tau_w)(w_T - \phi\, b) < 0. \end{aligned}$$

As $\partial[V_X(x) - V_T(x)]/\partial x > 0$ and $V_X(\underline{x}) - V_T(\underline{x}) = 0$, it holds that $x_{\min} < \underline{x}$. Hence, regime T is a possible outcome of the model and $\underline{x}$ constitutes the lower threshold separating regimes X and T.

A.4 Proof for $V_R > V_T(x)$ for $x > x_{\min}$

Since $V_T(x)$ increases with declining x, it could be the case that for very low x the inequality $V_T(x) > V_R$ holds. In terms of Figure 2 this would mean that for a very low fee x the $L_T(x)$-curve may lie far enough to the right that the corresponding economic rent in regime T is higher than the economic rent achievable in regime R. However, it can be shown that in our model such a case cannot occur. To do so, it has to be shown that the highest achievable economic rent in regime T is lower than the rent achievable in regime R. Since $\partial V_T(x)/\partial x < 0$, the highest value of V_T is obtained at $V_T(x_{\min})$, where $x_{\min} = \phi\, b$. In the following, we will show that

$$V_T(x_{min}) < V_R \tag{35}$$

holds. Taking account of the definition of the utility functions in eqs. (22) and (24) and the labour demand functions in eqs. (15) and (19), this condition is met if

$$\frac{A_1}{A_1 + A_2} \cdot \frac{w_T - \phi b}{w_R - \phi b} < \left[\frac{w_T^{(1-\beta\kappa)}(\phi\, b)^{\beta\kappa}}{w_R}\right]^{\frac{1}{1-\kappa(\alpha+\beta)}}. \tag{36}$$

Because of eq. (34), the LHS of this inequality is equal to one. Taking account of the definitions of w_R and w_T in eqs. (21) and (23), rearrangement of inequality (36) leads to

$$\kappa(\alpha+\beta)\left(\frac{1-\beta\kappa}{\alpha\kappa}\right)^{(1-\beta\kappa)} > 1. \tag{37}$$

To show that this inequality is fulfilled, we set $\alpha + \beta = z$ with $z \leq 1$. In the following, the cases $z = 1$ and $z < 1$ are considered separately.

Case 1: $z = 1$. Since in this case $\alpha = 1 - \beta$, the LHS of inequality (37) becomes

$$f := \kappa\left(\frac{1-\beta\kappa}{(1-\beta)\kappa}\right)^{1-\beta\kappa} \tag{38}$$

It must be shown that f is greater than one for all admissible values of β and κ. Because of the sign of the partial derivatives,[16]

$$\frac{\partial f}{\partial \beta} = \kappa^2\left(\frac{1-\beta\kappa}{(1-\beta)\kappa}\right)^{1-\beta\kappa}\left[\frac{1-\beta\kappa}{(1-\beta)\kappa} - \ln\left(\frac{1-\beta\kappa}{(1-\beta)\kappa}\right) - 1\right] > 0,$$
$$\frac{\partial f}{\partial \kappa} = -\left(\frac{1-\beta\kappa}{(1-\beta)\kappa}\right)^{1-\beta\kappa}\left[1 + \beta\kappa\ln\left(\frac{1-\beta\kappa}{(1-\beta)\kappa}\right)\right] < 0,$$

the lowest admissible values of β and the highest admissible values of κ must be considered. Since it holds that $\lim_{\kappa\to 1} f = 1$ and $\lim_{\beta\to 0} f = 1$, f is indeed greater than one for all admissible values of κ and β. Hence, $V_R > V_T(x)$ for all admissible values of the fee for temporary workers ($x \geq x_{\min}$) in the case $\alpha + \beta = 1$.

[16]For the first derivative to be positive, the term in corner brackets has to be positive. In general it holds that $y - \ln(y) > 1$ for expression y being positive and unequal to one. As expression $(1-\beta\kappa)/((1-\beta)\kappa) > 1$, the term in brackets is indeed positive.

Case 2: $z < 1$. Since in this case $\alpha = z - \beta$, the LHS of inequality (37) becomes

$$h := z\,\kappa \left(\frac{1 - \beta\kappa}{(z - \beta)\kappa} \right)^{1-\beta\kappa} \tag{39}$$

It must be shown that h is greater than one for all admissible values of β and κ. Because of the sign of the partial derivatives,

$$\frac{\partial h}{\partial \kappa} = -\kappa z \beta \left(\frac{1 - \beta\kappa}{(z - \beta)\kappa} \right)^{1-\beta\kappa} \ln \left(\frac{1 - \beta\kappa}{(z - \beta)\kappa} \right) < 0,$$
$$\frac{\partial h}{\partial \beta} = z\kappa^2 \left(\frac{1 - \beta\kappa}{(z - \beta)\kappa} \right)^{1-\beta\kappa} \left[\frac{1 - \beta\kappa}{(z - \beta)\kappa} - \ln \left(\frac{1 - \beta\kappa}{(z - \beta)\kappa} \right) - 1 \right] > 0,$$

the lowest admissible values of β and the highest admissible values of κ must be considered. It holds that

$$\lim_{\kappa \to 1} h = z \left(\frac{1 - \beta}{z - \beta} \right)^{1-\beta}.$$

In order to check whether this expression is still greater than one if β gets very small, we compute

$$\lim_{\beta \to 0} \left(\lim_{\kappa \to 1} h \right) = \frac{1}{z} \cdot z = 1.$$

Therefore, h is indeed greater than one for all admissible values of κ and β. Hence, $V_R > V_T(x)$ for all admissible values of the fee for temporary workers ($x \geq x_{\min}$) in the case $\alpha + \beta < 1$.

Taken together, $V_R > V_T(x)$ for all admissible parameter values and $x \geq x_{\min}$.

A.5 Comparison of labour demand and profits in the different regimes

As has been explained in Section 5, employment in regime X is greater than employment in regime R because $w_X < w_R$. It is now shown that employment in regime R is greater than employment in regime T. Using eqs. (15), (19), (21), and (23), it turns out that employment in regime R is greater than that in regime T if

$$\left(\frac{\alpha}{\alpha + \beta} \right)^{1-\kappa(\alpha+\beta)} < \kappa(\alpha + \beta) \left(\frac{1 - \beta\kappa}{\alpha\kappa} \right)^{(1-\beta\kappa)}. \tag{40}$$

The RHS of this inequality is greater than one because of inequality (37). Since the LHS is smaller than one, the condition is met.

Using eqs. (11), (12), (13), (17), (18), and (19), maximum profits in the different regimes are

$$\pi_R = [A_1^{\alpha\kappa} A_2^{\beta\kappa} - (A_1 + A_2)] \cdot w_R^{-\frac{\kappa(\alpha+\beta)}{1-\kappa(\alpha+\beta)}} \tag{41}$$

$$\pi_T(x) = [A_1^{\alpha\kappa} A_2^{\beta\kappa} - (A_1 + A_2)] \cdot [w_T^{-\alpha\kappa} x^{-\beta\kappa}]^{\frac{1}{1-\kappa(\alpha+\beta)}} \tag{42}$$

$$\pi_X(x) = [A_1^{\alpha\kappa} A_2^{\beta\kappa} - (A_1 + A_2)] \cdot x^{-\frac{\kappa(\alpha+\beta)}{1-\kappa(\alpha+\beta)}} \tag{43}$$

It is easy to verify that $\pi_X(x) > \pi_T(x)$ and $\pi_X(x) > \pi_R$ for all $x \in [x_{\min}, \overline{x}]$ as for this range of x it holds that $w_T > x$ and $w_R > x$, respectively. However, it is left to show whether in regime T firms earn higher profits than in regime R. Using eqs. (41) and (42), the value of x that renders the firm indifferent between both regimes, i.e. for which $\pi_R = \pi_T(x_{\text{indiff}})$, is

$$x_{\text{indiff}} = w_R \left(\frac{w_R}{w_T} \right)^{\frac{\alpha}{\beta}} \tag{44}$$

Obviously $x_{\text{indiff}} < w_R$, because $w_R/w_T < 1$. Furthermore, it can be shown that x_{indiff} is greater than $x_{\min}$. For this, using eq. (44) and $x_{\min} = \phi\, b$, it has to hold that

$$\kappa(\alpha+\beta) \left[\kappa(\alpha+\beta) \frac{1-\beta\kappa}{\alpha\kappa} \right]^{\frac{\alpha}{\beta}} < 1. \tag{45}$$

Setting $\alpha + \beta = z$ with $z \leq 1$, the LHS of inequality (45) becomes

$$l := z\,\kappa \left(z \frac{1-\beta\kappa}{z-\beta} \right)^{\frac{z-\beta}{\beta}}. \tag{46}$$

It must be shown that l is smaller than one for all admissible values of β and κ. The partial derivatives of l are

$$\frac{\partial l}{\partial \kappa} = z \left(z \frac{1-\beta\kappa}{z-\beta} \right)^{\frac{z-\beta}{\beta}} \cdot \left[1 - \frac{\kappa(z-\beta)}{1-\beta\kappa} \right] > 0$$

and

$$\frac{\partial l}{\partial \beta} = z\,\kappa \left(z \frac{1-\beta\kappa}{z-\beta} \right)^{\frac{z-\beta}{\beta}} \cdot \left[-\frac{z}{\beta^2} \ln\left(\frac{(1-\beta\kappa)z}{z-\beta} \right) + \frac{(1-\beta\kappa) - \kappa(z-\beta)}{\beta(1-\beta\kappa)} \right]$$

It will turn out that l decreases in β. For this to be the case, the expression in corner brackets has to be negative, or, alternatively written,

$$\ln\left(\frac{(1-\beta\kappa)z}{z-\beta}\right)-\frac{\beta(1-\beta\kappa)-\beta\kappa(z-\beta)}{(1-\beta\kappa)z}>0.$$

Expanding the second term of the LHS, the inequality can be written as

$$\ln\left(\frac{(1-\beta\kappa)z}{z-\beta}\right)+\frac{z-\beta}{(1-\beta\kappa)z}>1,$$

which is fulfilled because $(\ln y+1/y)>1$ for $y\neq 1$.

As l increases in κ and decreases in β, the highest admissible value of κ and the lowest admissible value of β must be considered to make sure that inequality (45) is fulfilled. Since the limits are[17]

$$\lim_{\kappa\to 1} l = z\left(z\,\frac{1-\beta}{z-\beta}\right)^{\frac{z-\beta}{\beta}}<1 \quad \text{and} \quad \lim_{\beta\to 0} l=\frac{e\,\kappa\,z}{e^{\kappa\,z}}<1, \tag{47}$$

function l is indeed smaller than one for all admissible values of κ and β and, hence, x_{indiff} is greater than $x_{\min}$.

It is still left to show where x_{indiff} is located compared to $\underline{x}$, i.e. whether x_{indiff} is smaller than, equal to, or greater than $\underline{x}$. This question cannot be answered by just comparing x_{indiff} and $\underline{x}$ directly, because $\underline{x}$ is only implicitly defined. However, Section 4 discussed that for $x\in[x_{\min},\underline{x})$ the economic rent $V_T(x)$ exceeds $V_X(x)$ whereas for $x\in[\underline{x},\overline{x})$ the opposite holds. This information can be used to identify the location of x_{indiff}. If for $V_T(x)$ and $V_X(x)$ evaluated at x_{indiff} the economic rent in regime T exceeds the rent in regime X, x_{indiff} lies in the interval $[x_{\min},\underline{x})$. In the opposite case x_{indiff} lies in the interval $[\underline{x},\overline{x})$. With the definitions of V_T and V_X in eqs. (24) and (26) and the corresponding labour demand functions (17) and (19), the utility levels are

$$V_X(x_{\text{indiff}})=(A_1+A_2)\left[\left(\frac{w_R}{w_T}\right)^{\frac{\alpha}{\beta}}w_R\right]^{-\frac{1}{1-\kappa(\alpha+\beta)}}(1-\tau_w)\left[\left(\frac{w_R}{w_T}\right)^{\frac{\alpha}{\beta}}w_R-\phi b\right] \tag{48}$$

$$V_T(x_{\text{indiff}})=A_1\left[w_T^{1-\beta\kappa}\left(\frac{w_R}{w_T}\right)^{\alpha\kappa}w_R^{\beta\kappa}\right]^{-\frac{1}{1-\kappa(\alpha+\beta)}}(1-\tau_w)\left[w_T-\phi b\right] \tag{49}$$

[17]Note that for $z=1$, $\lim_{\kappa\to 1} l=1$. For $z<1$, $\lim_{\kappa\to 1} l\leq 1$ as $\lim_{\beta\to 0}\left(\lim_{\kappa\to 1} l\right)=e\,z/e^{z}\leq 1$.

Using these equations, it turns out that $x_{\text{indiff}} \in [\underline{x}, \overline{x})$ or rather $V_X(x_{\text{indiff}}) > V_T(x_{\text{indiff}})$ if

$$\left[\frac{\left(\frac{w_R}{w_T}\right)^{\frac{\alpha}{\beta}} w_R}{w_T^{(1-\beta\kappa)}\left(\frac{w_R}{w_T}\right)^{\alpha\kappa} w_R^{\beta\kappa}}\right]^{-\frac{1}{1-\kappa(\alpha+\beta)}} > \frac{A_1}{A_1+A_2} \cdot \frac{w_T - \phi b}{\left(\frac{w_R}{w_T}\right)^{\frac{\alpha}{\beta}} w_R - \phi b}. \tag{50}$$

Because of eq. (34) it holds that $A_1/(A_1 + A_2) = \alpha/(\alpha + \beta)$ and $w_T - \phi b = (w_R - \phi b) \cdot (\alpha + \beta)/\alpha$. Therefore, eq. (50) becomes

$$\left(\frac{w_T}{w_R}\right)^{\frac{[1-\kappa(\alpha+\beta)]\beta\kappa+\alpha\kappa}{[1-\kappa(\alpha+\beta)]\beta\kappa}} > \frac{w_R - \phi b}{\left(\frac{w_R}{w_T}\right)^{\frac{\alpha\kappa}{\beta\kappa}} w_R - \phi b}. \tag{51}$$

However, calibration of inequality (51) shows that there are combinations of admissible parameter values possible for which this inequality is violated. This means that for some admissible combinations of α, β, and κ it holds that $x_{\text{indiff}} < \underline{x}$, whereas for other parameter combinations $x_{\text{indiff}} > \underline{x}$. Setting $\alpha + \beta = z$ with $z \leq 1$, it turns out that the smaller κ and the higher β compared to α, the higher is the probability that $x_{\text{indiff}} \in [\underline{x}, \overline{x})$.

Whether firms benefit from using temporary agency employment compared to using regular workers only, depends on the location of x_{indiff}. For $x \in [x_{\min}, \underline{x})$, trade unions claim wage w_T and regime T occurs. If, additionally, $x_{\text{indiff}} \in [\underline{x}, \overline{x})$, then the firm's profit in regime T unambiguously exceeds the profit achievable in regime R. If, however, $x_{\text{indiff}} \in [x_{\min}, \underline{x})$, there is a range of fees for temporary workers $(x_{\text{indiff}}, \underline{x})$ for which $\pi_T(x) < \pi_R$.

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