DEPARTMENT OF ECONOMICS

Subsidizing Consumption to Signal Quality of Workers

Bruno De Borger & Amihai Glazer

UNIVERSITY OF ANTWERP
Faculty of Applied Economics

EARNED EXCELLENCE
AACSB ACCREDITED
EST. 1916
THE BEST BUSINESS SCHOOLS IN THE WORLD

Stadscampus
Prinsstraat 13, B.213
BE-2000 Antwerpen
Tel. +32 (0)3 265 40 32
Fax +32 (0)3 265 47 99
http://www.ua.ac.be/tew

FACULTY OF APPLIED ECONOMICS

DEPARTMENT OF ECONOMICS

Subsidizing Consumption to Signal Quality of Workers

Bruno De Borger & Amihai Glazer

RESEARCH PAPER 2010-016
JULY 2010

University of Antwerp, City Campus, Prinsstraat 13, B-2000 Antwerp, Belgium
Research Administration – room B.213
phone: (32) 3 265 40 32
fax: (32) 3 265 47 99
e-mail: joeri.nys@ua.ac.be

D/2010/1169/016

Subsidizing Consumption to Signal Quality of Workers (*)

Bruno De Borger (University of Antwerp)

Amihai Glazer (University of California at Irvine)

Abstract

A firm whose profits increase when outsiders believe that it pays high wages may induce its workers to over-consume goods that signal high compensation. One implication is that firms may lobby for government subsidies when they offer fringe benefits with high signaling value, such as company cars, to their employees. We show that under plausible conditions the provision of fringe benefits indeed can signal the firm's type. Moreover, we demonstrate the existence of multiple equilibria---one equilibrium has no firm providing certain fringe benefits, whereas another equilibrium has fringe signal the firm's type. The paper further shows that a firm that provides the fringe benefit may oppose a government subsidizing it too heavily, because a large subsidy could destroy the signaling value of the benefit. The analysis shows that an employer may even provide a fringe benefit to employees who place no value on it. Our results are consistent with many stylized facts on the provision of fringe benefits by firms.

(*) De Borger: Department of Economics, University of Antwerp, Prinsstraat 13, B-2000 Antwerp, Belgium (bruno.deborger@ua.ac.be); Amihai Glazer: Department of Economics, University of California, Irvine, California 92697, USA (aglazer@uci.edu).

1.Introduction

Firms often provide their employees with fringe benefits instead of cash. Examples include health care benefits, pension plans, subsidized meals, and transport-related benefits. The literature suggests three main reasons why firms provide fringe benefits (see, e.g., Katz and Mankiw (1985)): (i) they may raise the firm's productivity; (ii) the firm may be able to provide the fringe benefit at a cost less than its retail price to workers due to, e.g., economies of scale; (iii) compared to payment in cash, fringe benefits may imply tax advantages to either the firm or the employee.

In Europe, a striking phenomenon is the large number of company cars firms provide to their workers. Company cars are most common in the UK, but also in Belgium, the Netherlands, Denmark, France and other European countries they are widely observed. In 1995, for example, 42 percent of new cars in the UK were company cars (Economist Intelligence Unit (1996)). A large survey among 62,500 Belgian workers found that in 2006 some 21 percent received a company car as part of their compensation package (Wuyts (2009)). For the Netherlands, 15 percent of all employees have a company car (Guttiérez-i-Puigarnau and van Ommeren (2010)). A critical reason for the widespread occurrence of company cars in Europe is their very favourable tax treatment.[1] For the Netherlands, it is estimated that company cars are provided to employees at an effective price that is in the range of 20 to 60 percent lower than the market price of the cars. The welfare cost from the distortionary tax advantages is valued at 600 to 800 euro per car per year. For the whole of Europe, welfare costs are estimated to be some 12 billion euro per year (Guttierez and van Ommeren (2010)).

The question is why governments allow these tax advantages? Why does the government favor compensation in fringe benefits over wages? Several explanations could be offered. For example, as small businesses allow the owner to get private consumption benefits tax-free, the government may want to give the same benefits to corporations to avoid distortions and to prevent shrinking of the corporate sector. Or subsidies to company cars may be a way of subsidizing commuting costs to reduce the inefficiency of the income tax (see

[1] See the references to the Belgian and Dutch cases given above, and reports of the Association of European Car Manufacturers (ACEA). Apart from favourable tax treatment there are other potential explanations for the use of transport-related fringe benefits by firms. For example, search models of imperfectly competitive labour markets can explain compensation for longer commutes (e.g., Burdett and Mortensen (1998), Zax (1991), Manning (2003)). Van Ommeren et al. (2006) empirically find that people with longer commutes indeed receive more transport-related fringe benefits. It is unlikely, however, that search arguments alone justify the very high numbers of company cars observed in some countries. Similarly, both Guttiérez-i-Puigarnau and van Ommeren (2009) and Wuyts (2009) provide convincing evidence that the widespread provision of company cars cannot be explained by their productivity effects.

Van Dender (2003)). Still another argument is that, in an effort to reduce inflation, government subsidizes company cars to allow firms to raise worker utility without raising wages. Of course, it is not obvious in any of these cases that subsidizing fringe benefits is the best policy to attain the corresponding objective.

This paper considers another mechanism that may explain the demand for subsidies by firms that provide fringe benefits such as company cars. The model we develop is based on the argument that a firm may benefit from outsiders believing that it pays high wages. Higher perceived compensation by outsiders can benefit a firm in several ways. In the presence of search costs by job seekers, a firm may attract more applicants of the type that it needs. Consumers may believe that the better the quality of workers at the firm, the better the quality of its product, and thus the more willing would consumers be to buy the firm's goods. Similar effects may arise with suppliers---they may believe that a firm with high-quality workers is less likely to fail, or more likely to process invoices properly, so that a firm with a reputation for hiring high-quality workers may be able to buy inputs at lower cost.

The literature supports the idea that firms may benefit from outsiders' beliefs that wages are high. Literature in social psychology indeed speaks of organization image and of the "perceived external prestige" of an organization, i.e., the views of members about outsiders' beliefs. Evidence suggests that an organization benefits from increased prestige, by enjoying increased organization attachment (Fuller et al. (2006)); moreover, companies can better attract quality applicants if they convey to them a positive image (Turban and Cable (2003), Gatewood et al. (1993), Rynes and Barber (1990)). In turn, consistent with our assumption, increased pay at a firm increases the firm's image (Cable and Graham (2000)).

Outsiders, however, cannot directly observe pay. But they do observe some consumption by current workers. As we will argue below, empirical evidence suggests that, compared to other consumption goods, cars are likely to provide especially good signals of wages. Providing company cars then becomes profitable for firms that benefit from outsiders believing that they hire workers of high quality or produce high-quality products, provided other firms do not give cars as well. The firms providing company cars will therefore lobby for subsidies that induce a separating equilibrium that allows them to signal their type.

To conserve space, we shall not explicitly model political pressures that generate governmental programs subsidizing firms which provide company cars. What is important for our purposes is to show that the signaling argument developed in this paper is a potentially important determinant of a demand for subsidies to company cars that could explain the existence of such subsidies. Our model could easily be embedded in a Grossman-Helpman

(1994) type model of lobbying by special interest groups, in our case the firms benefiting from outsiders' beliefs they pay high wages. In that model, each organized special interest offers monetary contributions to governmental officials who adopt policies the special interest favors. The governmental official maximizes a weighted sum of social welfare and contributions, so that if special interests favor the policy, whereas the taxpayers who pay for the policy are not organized engage in lobbying or monetary contributions, governmental policy will favor the special interest. Empirical evidence consistent with such a model is found in Goldberg and Maggi (1999) and in Gawande and Bandyopadhyay (2000). Most recently, Chirinko and Williams (2010) offer direct empirical evidence that companies indeed directly affect tax policies and to some extent 'buy' favorable tax rates.

The model we consider has two types of workers and two types of firms. One type of firm needs only low-ability workers, and does not benefit from employing high-ability workers, or from having a reputation for hiring such workers. The other firm type hires only high-ability workers, and it gains from outsiders' beliefs that it employs such workers. We then study the incentives of different firms in providing a fringe benefit of a given market value as a function of the net cost to the firm. Depending on the size of the subsidy, we find that both separating equilibria (in which only firms that benefit from outsiders believing it hires high-quality workers provide the fringe benefit) and pooling equilibria (in which all firms provide the fringe) may arise. However, under plausible conditions, the provision of fringe benefits indeed allows to signal a firm's type. It is further shown that a firm that provides the fringe benefit may oppose a government subsidizing it too heavily: a large subsidy could destroy the signaling value of the benefit. Moreover, for a range of subsidy values, we show the existence of multiple equilibria: one equilibrium has no firm providing certain fringe benefits, whereas another equilibrium has fringe benefits provided to signal the firm's type. Lastly, introducing preference variations for the fringe benefit among workers, the analysis shows why firms may offer contracts that let workers self-select between a pure cash option and a compensation package that includes a company car. An employer may even provide a fringe benefit to employees who place no value on it.

Note that the model developed below need not apply only to signaling the quality of workers to outsiders. Similar analysis applies if junior workers wonder what senior employees earn. Evidence suggests that workers at a firm want senior co-workers to have high wages: the expectation of future earnings suggested by their co-workers' high wages more than compensates any jealousy these higher wages may induce (see, Clark, Kristensen and Westergård-Nielsen (2009)). Since in practice wages of co-workers are often unobservable,

firms may then want to signal to junior workers it is paying senior employees well by providing them with fringe benefits such as company cars. This benefits the firm: workers who interpret this signal as future potential earnings may exert higher effort or stay longer with the firm, reducing costly labor turnover.

The predictions of the model are consistent with several stylized facts and, although reliable data on the provision of company cars in different countries and by different types of firms are scarce, with most of the available empirical evidence. Although, conditional on wages, the subsidy is the same for all firms, not all firms offer company cars. In general, the model suggests that we will see more company cars when such cars can be expected to be better signals. We therefore expect more company cars in large than in small firms, because the signal is likely to be more valuable to larger firms. A small firm may gain little from outsiders believing it hires high-ability workers---the number of potential employees, suppliers, and customers it attracts is in any case small. Within firms we expect, conditional on wages, more company cars among senior workers. Both predictions are confirmed in detailed empirical analyses (Guttierez-i-Puigarnau and van Ommeren (2010), Wuyts (2009)).

Moreover, to the extent that firms signal high wages to attract high quality workers, the model implies that one expects more lobbying for subsidies and more company cars in countries with limited long-distance residential mobility and, as a consequence, local or regional rather than nationwide recruiting by firms. High residential mobility and extensive labor markets jointly mean that a person who observes a signal that a firm hires high-ability workers is nevertheless unlikely to apply to a local firm, so signaling by that firm benefits it little. In other words, signaling does not make much sense if firms recruit nationwide and people are willing to move long distances.

Furthermore, the model suggests that firms that offer fringe benefits such as company cars may want to offer pure cash alternatives. This is again consistent with observed firm behavior. Though many firms offering company cars do not give a pure cash option, many others do; they allow workers to self-select the contract type (see Watson Wyatt (2008)).

Lastly, although we develop the model in terms of company car provision for purposes of concreteness, the model is more generally applicable to some other fringe benefits as well. As a general statement, the model suggests that companies will provide fringe benefits that are perceived as good signals of the quality of workers and firms.

The remainder of this paper has the following structure. Section 2 presents some evidence that, among other typical consumer goods, cars may serve as very good signals of high but unobservable wages in firms. The basic model of this paper is presented in Section 3.

In Section 4 we extend the model to capture differences in preferences for cars among workers. A model with fringe benefits of variable quality is developed in Section 5. Conclusions and implications are given towards the end of the paper.

2. Fringe benefits as signals

An extensive literature discusses fringe benefits, but it has so far ignored the role of such benefits in signaling unobservable wages. The early literature focused on the role of the tax system in the provision of non-wage compensation (e.g., Long and Scott (1982), Clotfelter (1983), Zax (1988)), and on the related question of whether and how fringe benefits should be taxed (see Katz and Mankiw (1985), Adamache and Sloan (1985)). More recently, several studies analyze the implications of fringe benefits for the outcomes on the labour market, such as the effects on wages, labour turnover and unemployment (see, e.g., Hashimoto and Zhao (2000) and Dale-Olsen (2004)). Moreover, a series of papers concentrate on specific fringe benefits, including health insurance (Olson (2002), Royalty (2000), Gruber (2001), Gruber and Lettau (2004)), pension advantages (Bernstein (2002)), and transport-related benefits such as parking, relocation subsidies and company cars (Shoup (2005), van Ommeren, van der Vlist and Nijkamp (2006), Guttiérez-i-Puigarnau and van Ommeren (2010)). Lastly, some work (e.g., Oyer 2008) also considers how fringe benefits can induce self-selection of workers, to the benefit of the employer.

Unlike the previous literature, the model developed below studies the role of fringe benefits as signals of unobservable wages and of the quality of workers. Casual observations and empirical evidence suggests that cars may serve this purpose very well: nice cars are quite generally associated with status or quality (see the literature on status goods (e.g., Ireland (1994, 1998)), and they are among the most visible consumer goods available. A young job seeker in Belgium told us that his boss preferred that he not park a cheap-looking car in the firm's front parking lot. Fancy restaurants in Orange County, California which offer valet parking are known to park the most expensive cars outside the front entrance. More importantly, empirical evidence presented by Heffetz (2004, 2009) suggests that cars are among the most visible consumer goods. In particular, Heffetz (2004) constructed a telephone survey questionnaire where the main question read:

> Imagine that you meet a new person who lives in a household similar to yours. Imagine that their household is not different from other similar households, except that they like to, and do, spend more than average on [title of category].

> Would you notice this about them, and if so, for how long would you have to have known them, to notice it? Would you notice it almost immediately upon meeting them for the first time, a short while after, a while after, only a long while after, or never?

Based on the responses to the survey, Heffetz (2009) constructs three 'visibility' indices. In all three cases, cars rank in the top three. For example, in one of the rankings it ranks number two, after cigarettes but before clothing, jewelry, furniture, cell phones, etc. For cars, some 27 percent responded ``almost immediately'' to the above question, 71 percent answered "almost immediately" or "a short while after" (by way of comparison, cell phones scored 40 percent), and less than 11 percent indicated that they would never or only a long while after notice a household's above average spending on cars.[2]

Heffetz (2009) uses these results to justify embedding a signaling motive into the utility framework developed by Ireland (1994, 1998). In addition to fundamental consumption utility, consumers are assumed to care also about others' (or society's) beliefs: doing well is no longer enough; individuals also want everybody to know (or at least to believe) that they are doing well. For the purpose of this paper, these visibility results have another important implication: to the extent that firms want to signal to outsiders that they pay high wages, providing workers with company cars may be the most effective signal. Not only is a nice car a reliable status good, it is also the most likely consumer good to be observed by others.

3. The basic model

We consider two types of workers and two types of firms. A worker has either low ability (L) or high ability (H). The reservation utility of a type-*i* worker is u_i. Firms are of type L or type H. An L-type firm needs only low-ability workers, and does not benefit from employing high-ability workers, or from having a reputation for hiring such workers. An H-type firm hires only high-ability workers, and it gains from outsiders' beliefs that it employs such workers. The demand and supply of the two goods produced by the two firms is perfectly elastic, so that all type-H people work at type-H firms, and all type-L people work at

[2] Clothing also scored very high in the visibility index. Our model would suggest that some firms would want to subsidize the purchase of expensive clothing by their workers. Our impression is that such subsidies are much less common than company cars; their signaling value may be reduced because firms have no control over wearing these clothes outside the workplace. Whenever the signaling value can be guaranteed (e.g., by sponsoring clothes of media personalities such as actors, sports champions etc.), firms do indeed subsidize clothes.

type-L firms. The utility of a worker with income *Y* and no car is $u(Y)$. His utility with a car is $u(Y)+v$. Here, *v* is the utility of having the car, assumed to the same for both types of workers. Let the market price of a company car be *F*. To simplify the analysis we assume no worker owns a car if firms provided none; relaxing this assumption does not affect the qualitative results, see below.

To understand the response of different types of firms to the net cost of providing such cars, we allow for the possibility that the government subsidizes company cars. This governmental subsidy per car is called *S*. Depending on the size of the subsidy, different types of equilibria may arise. In a separating equilibrium an L-type firm does not give cars and an H-type does. Alternatively, pooling equilibria may result in which neither or both types of firms give cars.

In what follows, we first study the behavior of firms of type L and H, and we explore the different equilibria that may result. We then briefly consider the sensitivity of the results with respect to the parameters of the model, and discuss the implications of our findings.

3.1. L-type firm

If an L-type firm provides a car, it must offer the employee a wage Y_{FL} such that L-type workers attain their reservation utility, $u_L = u(Y_L)$. So Y_{FL} solves:

$$u(Y_{FL}) + v = u_L = u(Y_L). \qquad (1)$$

Simple algebra shows:

$$\frac{\partial Y_{FL}}{\partial Y_L} = -\frac{u'(Y_L)}{u'(Y_{FL})} < 0; \quad \frac{\partial Y_{FL}}{\partial v} = -\frac{1}{u'} < 0.$$

A higher reservation wage obviously reduces the wage that needs to be offered when a company car is provided to the worker; assuming declining marginal utility of income, the wage reduction declines at higher reservation wages. A higher valuation of a company car reduces the wage the firm offers.

Based on the discussion in the introduction, we ignore the possible productivity effects of company cars. It is assumed that the firm profits from providing a car only if the wage it has to pay in case it does so results in a lower 'net' cost to the firm:

$$Y_{FL} + F - S < Y_L.$$

It does not provide a car otherwise. Let

$$Y_{FL} + F - S_L = Y_L. \quad (2)$$

Then the L-type firm will provide a car if the governmental subsidy is at least S_L .

3.2. H-type firm

An H-type firm wants outsiders to believe that it hires high-quality workers. The benefit to the firm can arise from greater ability to hire high-ability workers, from efficiency wages, from a reputation for providing high-quality products, or from a reputation for having competent workers who will interact well with suppliers. We shall explore how the firm may signal that it hires high-ability workers, by providing workers with company cars. Let the monetary value to the firm of a perfect signal be P_F . It reflects the value to the H-type firm of being considered by outsiders to be of type H rather than of type L.

H-type firm in a separating equilibrium

Consider a separating equilibrium in which the L-type firm does not give cars but the H-type does. If the H-type firm provides a car, it must offer the H-type employee a wage Y_{FH} such that

$$u(Y_{FH}) + v = u_H = u(Y_H) \quad (3)$$

In a separating equilibrium the profitability of the signal is P_F : a firm providing a car will be seen by outsiders as being of type H; a firm that does not will be seen as being of type L. Therefore, any governmental subsidy satisfying

$$Y_{FH} + F - S < Y_H + P_F$$

will sustain a separating equilibrium. Consider the subsidy S_H that makes this inequality an equality:

$$S_H = Y_{FH} - Y_H + F - P_F \quad (4)$$

The subsidy S_H is, therefore, the minimum subsidy that sustains a separating equilibrium. In principle, if a car sends a strong signal, even a zero subsidy may sustain a separating equilibrium. In that case $S_H < 0$.

Declining marginal utility of income implies that, when a car is provided, the salary reduction for the H-type worker will be larger than for the L-type worker:

$$(Y_H - Y_{FH}) > (Y_L - Y_{LF})$$

It follows that:

$$S_L - S_H = (Y_H - Y_{FH}) - (Y_L - Y_{LF}) + P_F > 0 \quad (5)$$

This implies that a range of subsidy values sustains a separating equilibrium. This range rises in the quality of the signal.

H-type firms in a pooling equilibrium with no company cars

In the separating equilibrium, if a firm deviates the public has clear beliefs about what type of firm it is---an H-type firm that provides no company car is viewed as an L-type firm, and an L-type firm that gives company cars is viewed as an H-type firm. But in a pooling equilibrium where no firm gives a company car, we must make some assumptions about what an outsider believes if he does see some firm give a company car. We here make use of the Kreps-Cho Intuitive Criterion---what type of firm would benefit more, or suffer less, from deviating, by giving a company car. Since by assumption a car is a normal good, a firm that hires H-type workers and offers a company car can reduce the wage it pays by more than can a firm which hires the lower-paid L-type workers. That is, even in the absence of any signaling benefits to a firm, an H-type firm suffers less from offering a company car, or benefits more, than does an L-type firm. We therefore suppose that a firm which deviates from the pooling equilibrium in which no firm offers a company car is viewed as being an H-type firm.

Suppose that in a pooling equilibrium where no cars are given outsiders believe an arbitrary firm is of type H with probability *h*. For example, this could be a function of the fraction of H-type firms in the total number of firms. As before, let the monetary value of the signal (i.e., the value of outsiders believing it is an H-type firm) to the H-type firm be P_F. The extra profitability to the H-type firm from deviating from a pooling equilibrium with no cars and signaling its type is then $(1-h)P_F$. If few firms are of type H, the value of deviating from the pooling equilibrium and explicitly signaling that a firm is of type H is large. If almost all firms are H-type, then even in the absence of signaling, an outsider believes the firm is likely an H type, so an H-type firm benefits little from providing a car.

The H-type firm will want to deviate from the pooling equilibrium and provide a car if

$$Y_{FH} + F - S < Y_H + (1-h)P_F.$$

It does not provide a car otherwise. Therefore, an H-type firm will provide a car if $S > S_H^p$ where

$$S_H^p = Y_{FH} - Y_H + F - (1-h)P_F \tag{6}$$

can be interpreted as the minimum subsidy that induces the H-type firm to deviate from a pooling (the superscript 'p' refers to 'pooling') equilibrium with no company cars.

Using the same argument as before, we obtain:

$$S_L - S_H^p = (Y_H - Y_{FH}) - (Y_L - Y_{LF}) + (1-h)P_F > 0 \tag{7}$$

Thus, there is a range of subsidy values that leads the H-type firm to deviate from a pooling equilibrium in which no firm gives a car, inducing a separating equilibrium. Note that this last inequality holds even if the H-type firm gains nothing from signaling its type. The difference rises in the value of the signal and declines in the fraction of H-type firms.

The H-type firm in a pooling equilibrium where both types give cars

When the governmental subsidy exceeds S_L, a dominant strategy for an L-type firm is to provide a car. Of course, the net profit of the H-type firm drops when the L-type firm also provides cars: a company car loses its signaling value that the firm hires high-ability workers. Outsiders will, as when no company cars are provided, believe the firm is of type H with probability *h*. But under our assumptions on marginal utilities it is still also a dominant strategy for an H-type firm to provide a car. Hence, for subsidy levels $S > S_L$ a pooling equilibrium results in which both types of firms provide cars.

3.3. Equilibrium results

Depending on the size of the subsidy, different types of equilibria may result. Moreover, the different values of the critical subsidies S_H and S_H^p can generate multiple equilibria.

Consider first the relation between the size of the subsidy and the type of equilibrium that will result. For low subsidies ($S < S_H^p$), we have a pooling equilibrium with no firms providing company cars. Governmental subsidies

$$S_H^p < S < S_L$$

induce H-type firms to deviate and provide cars. This yields a separating equilibrium that has H-type firms provide cars, but not L-type firms. For subsidy levels $S > S_L$ a pooling equilibrium results in which both types of firms provide cars.

But note that, as argued before, in a separating equilibrium, the signaling value of providing a car does not depend on the fraction of firms that are H-types---a firm that

provides a company car is viewed as an H-type, whereas a firm that does not provide a company car is viewed as an L-type. Therefore, the critical subsidy that sustains a separating equilibrium is smaller than the critical subsidy that induces an H-type firm to deviate from a pooling equilibrium with no company cars. Direct comparison shows (using (4) and (6)):

$$S_H < S_H^p$$

This may imply multiple equilibria: the governmental subsidy to firms that provide company cars may be sufficiently low and the fraction of H-type firms may be sufficiently high so that no firm wants to deviate from the pooling equilibrium with no company cars. But the same subsidy may be sufficiently high that no firm wants to deviate from a separating equilibrium in which all H-type firms do provide company cars.

Figure 1 illustrates the above results. The curve labeled ($Y_{FL} + F - S$) gives the 'net' cost (i.e., correcting for the subsidy) to the L-type firm of employing a worker if the worker is provided with a company car. The subsidy S_L is defined at the intersection of this net labor cost and the wage Y_L paid when the company provides no car. Similarly, the curve labeled ($Y_{FH} + F - S - P_F$) gives the net cost per worker to the H-type firm of providing a car in a separating equilibrium, taking account of the value of the signal. It intersects Y_H at S_H. Lastly, the curve ($Y_{FH} + F - S - (1-h)P_F$) gives, for a given value of *h*, the net cost of providing a car to the H-type firm when it deviates from a pooling equilibrium with no cars given by any of the firms. Note that it shifts down when there are fewer H-type firms (lower *h*) or the signal is of better quality (higher P_F). It is clear that the range of subsidy values that induces a separating equilibrium is larger when outsiders believe there are fewer H-type firms and providing the fringe benefit is a better signal of quality.

INSERT FIGURE 1

Note that, depending on the quality of the signal and the number of H-type firms (the value of *h*), a given subsidy may or may not suffice to induce a separating equilibrium. Moreover, the possibility of multiple equilibria is illustrated by a subsidy like S_H^*, see Figure 1. This subsidy is insufficient to induce an H-type firm to deviate from a pooling equilibrium with no cars, but is sufficiently large to sustain a separating equilibrium. This subsidy may therefore be consistent with both a pooling and a separating equilibrium.

The model suggests that a wide range of values of the subsidy ($S_H^p < S < S_L$) generate a separating equilibrium for the H-type firm, allowing it to signal quality by providing company cars to its workers. From the viewpoint of this type of firm, the 'optimal' subsidy the government should introduce is a subsidy just below S_L. This is the largest subsidy that allows the firm to signal its type. Unless the subsidy becomes unrealistically large (for subsidies exceeding $F + Y_{FL} - Y_F + P_F$, which for a high quality signal may easily exceed the cost of the car) an H-type firm's profit in a pooling equilibrium where both types of firms give cars is less than when the governmental subsidy is just below S_L. This is, therefore, the subsidy that maximizes a type-H firm's profit.

3.4. Sensitivity to parameters

We briefly discuss how the reservation utility of workers, their preference for cars, and the strength of the signal to the H-type firm affect the equilibrium outcomes. Moreover, we consider how the interpretation applies if we account for car ownership when firms provide none.

First, higher reservation income (both for L-type and H-type workers) implies that higher wages need to be paid, both when a firm provides a company car and when it does not. But, assuming declining marginal utility of income, the critical subsidy declines. Both S_H, S_L shift to the left.

Second, suppose the general preference for cars rises, that is, let the value of *v* increase (the effect of differences in preferences between workers will be discussed separately below, see Section 4). An increase in *v* allows a firm which provides a car to reduce the wage it pays; consequently smaller governmental subsidies are required to induce firms to give a company car. Both S_H, S_L shift to the left. If H-type workers more highly value cars than do L-type workers, then the range of subsidy values for which a separating equilibrium appears becomes larger: it becomes more attractive for H-type firms to lobby for a subsidy that still generates a separating equilibrium.

Third, the role of the number of H-type firms and the value of the signal, P_F , to an H-type firm was discussed above. An increase in the value of the signal to the H-type firm reduces the minimum subsidy the firm needs to make offering a company car beneficial: S_H will be smaller. This increases the range of subsidy values that allows a separating

equilibrium for the H-type firm. The same holds when the fraction of H-type firms becomes smaller.

Lastly, note that we assumed throughout the analysis that neither L-type nor H-type workers owned a when firms provide none. Let us relax this obviously unrealistic assumption. Consider the L-type firm, and assume L-type workers have a car already when paid only in cash. The wage the firm must offer if it gives workers a car must then satisfy

$$u(Y_{FL}) + v = u_L = u(Y_L - F) + v.$$

Consequently, any positive subsidy induces the firm to offer a car, and $S_L = 0$. A type-H firm would then get no signaling value from offering cars to its employees. But our analysis continues to apply if we interpret the company car as being of superior quality (providing more utility than the cars owned by workers when the firms provide none). To see this, denote the market value and utility associated with the currently owned car and the company car by superscripts *0* and *1*, respectively. Then the company car and the wage offered, if a company car is given, must satisfy

$$u(Y_{FL}) + v^1 = u_L = u(Y_L - F^0) + v^0$$

Provided that $F^1 > F^0$ we have

$$S_L = Y_{FL} - Y_L + F^1 > 0$$

and the earlier analysis applies. Alternatively, assume that L-type workers do not have cars but H-type workers do. Then our earlier analysis applies, with one qualification. Because in that case we have $S_H < 0, S_L > 0$, the H-type firm provides cars even in the absence of subsidies.

3.5. Implications of the model

The analysis shows that, given that cars signal a worker's pay and that not all firms are of type H, an H-type firm favors a separating equilibrium. It prefers the highest governmental subsidy that induces such equilibrium, but it benefits from any governmental subsidy that leads to a separating equilibrium. Lobbying efforts may then result in subsidy levels that induce such equilibrium. Of course, firms will lobby more when providing company cars has higher signaling value, and we would expect that more company cars are provided in situations where there are good reasons to believe that signaling is likely to work.

First, the value of the signal may depend on the size of the firm. A small firm may gain little from outsiders believing it hires high-ability workers, but for a large firm the number of potential employees, suppliers, and customers it attracts may be substantial. Moreover, in large firms the cost per car provided will also be lower due to scale effects when leasing cars.

Second, the value of the signal is likely to differ between countries or sectors depending on population mobility and the size and structure of the labor market. For example, signaling does not benefit a firm very much in a labor market characterized by nationwide recruiting and high residential mobility. In that case a person who observes that a firm hires high-ability workers is nevertheless unlikely to apply to a local firm. We expect more company cars in sectors or countries where a person seeking a job incurs high search costs, in labor markets with less job mobility, in countries where wages are not easily 'observable,' and in densely populated areas with more social interaction so that the signal is more widely observable. To the extent that the firm signals quality to attract customers we expect more company cars in firms that sell locally.

Third, the model shows that a firm that provides the fringe benefit may oppose a government subsidizing it too heavily: a large subsidy could destroy the signaling value of the benefit. Fourth, the possibility of multiple equilibria suggests that a given subsidy may be consistent with some H-type firms offering cars while others don't.

Lastly, as argued in the introduction, note that the model applies not just to firms but can, with minor modification, be re-interpreted in terms of different types of workers within a firm. It then predicts that not all workers within a firm will get a company car, but only those for whom providing a car has significant signaling value to others. For example, providing company cars to employees higher up in the firm's hierarchy signals to lower staff that they will be rewarded well if they stay with the firm.

Although no extensive data set is available on company cars or similar fringe benefits in different countries, and firm-specific evidence is equally scarce, the model seems consistent with some stylized facts. Although in a given country the subsidy is roughly the same for all firms, not all firms provide workers with company cars. We see more company cars in large firms and, within firms, employees with higher wages (unobserved to others) are more likely to get a company car. Both issues are carefully documented in Guttierez-i-Puigarnau and van Ommeren (2010) and Wuyts (2009)) for Belgium and the Netherlands. As argued above, this is consistent with the model. Although many other reasons for this difference may exist, differences in mobility and the size of the labor market may partially

explain why the US does not subsidize company cars whereas in Europe such subsidies are widespread. As argued before, signaling makes little sense if firms recruit nationwide and people are willing to move long distances. Vandenbrande et al. (2006) document residential and labor mobility in Europe. Residential mobility in Europe is in general short-distance mobility: only 18% have moved outside their region, while the percentage for cross-border migration is especially low, at only 4%. This contrasts with the higher mobility rates found for short-distance moves: 32% of Europeans have moved within their own town or city, and almost a quarter (24%) have moved outside their town or city, but remaining within the region. These European figures can be compared with those from the US. Data collected by the US Census Bureau in 2000 show that almost a third of US citizens live outside the state in which they were born.

We expect the provision of company cars to differ across countries depending on wages and car preferences, although the relation is not unambiguous. Consider differences in average wages. If wages are low, a firm which offers a car enjoys only a small decrease in the wage it must pay. Conditional on car ownership, we expect more company cars in high income countries. But if incomes are so high that almost any person would buy a car of good quality, then it makes little sense to offer company cars. The role of car preferences is equally ambiguous.

To conclude this section, note that it is often argued that company cars (and some other fringe benefits) in Europe have been introduced on a large scale in the eighties partly in response to restrictions on wage increases, in an effort to reduce inflation and improve international competitiveness of European firms. Wage restrictions raise the demand for fringe benefits by workers; but compared to cash, an equal increase in utility for the worker is more costly to the firm when providing in-kind compensation compared to cash. This raises the demand by firms for government subsidies to fringe benefits. This is not inconsistent with our model. But the model offers important extra insights. It explains why company cars are the preferred fringe benefit to provide, it explains why not all firms offer company cars, and it identifies a number of relevant characteristics that determine company car provision by firms. Finally, as we show in the next section, it explains why firms may want to offer workers a choice between the fringe benefit and a cash option.

4. Differences in preferences towards cars

In this section, we allow workers to differ in their preferences for cars. Let some people value cars ($v>0$) and some not ($v=0$). Assume for simplicity that they are equally distributed over H-type and L-type workers. Call the fraction of workers for whom $v>0$ (or who benefit from a car) as n. As mentioned previously, a separating equilibrium can be sustained when the governmental subsidy is above a critical value, and a pooling equilibrium can be sustained when the governmental subsidy is below a critical value. These two critical values will differ. But for brevity, in this section we shall discuss only the first governmental subsidy value, a value which sustains a separating equilibrium. Nothing is gained by also considering the second critical value.

4.1. The L-type firm when workers differ in preferences for cars

Reconsider the behavior of the L-type firm. If the subsidy covers less than the full cost of the car, it never makes sense for the firm to give a car to a worker who places no value on a car. These workers are paid Y_L .

It may make sense to give a car to workers with a strong preference for cars. Such workers have to be paid a wage Y_{FL}^1 that solves

$$u(Y_{FL}^1) + v = u_L = u(Y_L) \tag{8}$$

The firm will give a car if the governmental subsidy exceeds S_L^1 , where

$$Y_{FL}^1 + F - S_L^1 = Y_L \tag{9}$$

An L-type firm which gives cars to workers with strong car preferences can let workers sort themselves out by offering two contract types: a contract which pays a wage Y_L and gives no car, and a contract which pays the lower wage Y_{FL}^1 but gives a car. Workers with $v=0$ will prefer the first contract; workers with $v>0$ will prefer the second.

4.2. The H-type firm when workers differ in preferences for cars

Employees of type H with a high preference for a car receive a company car; they must be paid a wage that solves:

$$u(Y_{FH}^1) + v = u_H = u(Y_H) \tag{10}$$

To sustain a separating equilibrium, the subsidy must exceed S_H^1 , where

$$Y_{FH}^1 + F - S_H^1 = Y_H + P_F \tag{11}$$

As before, P_F is the value of the signal (the value to the firm of having outsiders believe it is of type H). By the same arguments as in Section 3, we have

$$S_H^1 < S_L^1 \tag{12}$$

Of course, if the signaling value is high and the governmental subsidy is large, an equilibrium may result in which the H-type firm profits from giving cars to all workers, even to those that do not benefit from a car. Such workers have to be paid Y_H, whether they get a car or not. But giving them a car has implications for wages to other workers. Two possible scenarios appear. First, the firm can pay Y_H to all workers (the maximum of the two wages Y_H, Y_{FH}^1) to attract workers with either high and low preference for a car. Then a worker with a high car preference is better off in equilibrium than a worker who does not value a car. Second, the firm could pay workers of each type the wage needed to attract them, so it pays Y_H, Y_{FH}^1 to the two groups. But then a worker with a positive value of *v* has an incentive to misrepresent his type, pretending that for him *v=0*. He would get a car anyway and receive the higher income. In both cases, therefore, the ultimate outcome is likely to be the same: the firm pays Y_H to all workers, which is what we assume.

4.3. Equilibria when workers differ in preferences for cars

As before, a firm's incentive to provide a company car to a worker varies with the cost of the car to the firm, captured by the size of the governmental subsidy. The average 'net' cost (net means, as before, that we take account of governmental subsidies and the possible value of the signal when a car is given) to the H-type firm of employing a worker now depends on whether the firm gives (i) no cars, (ii) cars only to employees who value cars, (iii) cars to all employees, even those who do not value it. Moreover, the net cost also depends on whether the L-type firm gives a company car. If it does not, providing a car allows the H-type firm to signal its type. If the L-type firm provides cars to workers with *v>0*, then for the H-type firm giving a company car only to workers with *v>0* has no more signaling value. However, some signaling value remains if the H-type firm provides a company car to all its employees: anyone with a company car is more likely to work for an H-type firm than for an L-type firm, and this difference in probability implies the signal has value to the H-type firm.

Appendix 1 explicitly analyzes the possible equilibria. It is shown there that, depending on the strength of the signal and the level of the governmental subsidy, many different equilibria may result: several pooling equilibria (e.g., no cars are given at all, or both types of firms provide cars only to people with a high preference for cars) and separating

equilibria (e.g., L-type firms give no cars and H-type firms give cars to workers for whom *v>0*, L-type firms give no cars and H-type firms give cars to all workers) are possible. It is shown that, if the signal is weak, the H-type firm will never give cars to all employees when the L-type firm gives no cars. It only does so when the L-type firm also gives cars, and the subsidy is very large (much larger than S_L^1). For intermediate signal strength, the H-type firm will never give cars to all employees when the L-type firm gives no cars; however, if the L-type firm does give cars, the H-type automatically gives cars to all. Lastly, for a very strong signal, the H-type firm may give cars to all workers even if the L-type gives no cars; this happens even at relatively low subsidies.

Table 1 summarizes the main findings derived in Appendix 1. In this table, S_H^2 is the minimum governmental subsidy that sustains an equilibrium in which the H-type firm gives company cars to all workers (even those with low preference for having one), provided the L-type firm does not give its employees a car. Similarly, $S_H^{2,L}$ is the minimum subsidy that makes giving cars to all workers profitable for the H-type firm, even if the L-type firm gives cars.

Two major conclusions follow from the analysis. First, if the signal is sufficiently strong, an equilibrium may result in which the H-type firm gives a car to all workers, even those that do not care for having one. Second, from the perspective of the H-type firm, a separating equilibrium in which the L-type firm does not provide cars is always optimal. For low values of the signal, the H-type firm prefers a separating equilibrium in which it provides cars only to workers that value receiving one (*v>0*). High signaling values may yield a separating equilibrium where the firm gives cars to all workers.

Strength signal p_F	**Relative position** S_L^1	**Preferred equilibrium H-type firm**	**Which H-type workers get car at preferred equilibrium?**
$p_F < (1-n^2)\left[\left(Y_L - Y_{FL}^1\right) + \frac{n}{1-n}(Y_H - Y_{FH}^1)\right]$	$S_L^1 < S_H^{L,2}$	Separating	Only high car preference workers
$p_F > (1-n^2)\left[\left(Y_L - Y_{FL}^1\right) + \frac{n}{1-n}(Y_H - Y_{FH}^1)\right]$ $p_F < \left[\left(Y_L - Y_{FL}^1\right) + \frac{n}{1-n}(Y_H - Y_{FH}^1)\right]$	$S_H^{L,2} < S_L^1 < S_H^2$	Separating	Only high car preference workers
$p_F > \left[\left(Y_L - Y_{FL}^1\right) + \frac{n}{1-n}(Y_H - Y_{FH}^1)\right]$	$S_H^2 < S_L^1$	Separating	All workers

Table 1: signal strength and preferred equilibrium H-type firm

4.4. Implications

Unless it can obtain unrealistically large governmental subsidies, the H-type firm prefers a subsidy that is just below S_L^1, the largest value that sustains a separating equilibrium. Depending on the strength of the signal, the number of workers that value a car and the intensity of their preference for a car, the H-type firm will provide all workers or only some of its workers with a company car.

Equilibria in which firms provide company cars only to workers with a strong preference for a car are consistent with practice by many European firms. Many firms offering company cars indeed provide employees with a pure cash option and allow them to self-select the contract type (see Watson/Wyatt (2008)). In the UK, for example, over 70% of firms offering company cars provide employees with a pure cash option. In Belgium and the Netherlands, it amounts to 25-30%. Based on our model, one expects firms not to offer a cash option only if the signaling value is very high and large subsidies can be obtained.

5. Continuous car values

This section briefly considers the case where the fringe benefit is continuous, say, cars of various qualities can be offered. To study this case, we return to the situation without preference differences between workers. Quality is measured by the market price of a car. We

therefore interpret *F* as a continuous choice variable. Worker utility of a car that costs *F* is given by:

$$v(F); \quad v' > 0, v'' < 0$$

We allow the government to subsidize a fraction *s* of the cost of the car. Initially we will assume that any car value is available on the car market, i.e., no restrictions will be placed on the car value F a firm can provide. An extension with minimum restrictions on available car values is briefly discussed in Appendix 2.

5.1. L-type firm with continuous car values

Consider the option for an L-type firm of providing a company car to its workers. The wage an L-type firm must offer then depends on the quality of the car it provides. Let F_L be the market price of the car offered by the L-type firm, and let Y_{FL} be the wage offered when the firm provides a car. For any given car quality, the wage the firm needs to pay will satisfy:

$$u(Y_{FL}) + v(F_L) = u_L = u(Y_L)$$

An infinite number of wage and car value combinations satisfy this expression. By the implicit function theorem, the higher the quality of the car, the lower the wage:

$$\frac{\partial Y_{FL}(F_L)}{\partial F_L} = -\frac{v'(F_L)}{u'(Y_{FL})} < 0$$

Moreover, declining marginal utility implies $\frac{\partial^2 Y_{FL}}{\partial F_L^{\,2}} > 0$.

Our assumption that the fringe benefit does not affect worker productivity implies that the firm determines the car value to be offered to minimize the cost of employing a worker:

$$\underset{F_L}{Min} \quad Y_{FL}(F_L) + (1-s)F_L \quad \text{subject to } F_L \geq 0$$

The L-type firm provides a positive value of the fringe benefit if the unconstrained optimum of this problem is positive. We denote the optimal car value of the unconstrained problem, conditional on a given subsidy *s*, as $F_L^*(s)$. The minimum governmental subsidy that induces the L-type firm to offer a positive value of the fringe benefit (the minimum subsidy that gives $F_L^*(s) > 0$) is denoted s_L.

We know that $F_L^*(s)$ satisfies the first-order condition:

$$\frac{\partial Y_{FL}}{\partial F_L} + (1-s) = 0 \qquad (13)$$

Moreover, it increases with the subsidy, since:

$$\frac{\partial F_L^*(s)}{\partial s} = \frac{1}{\frac{\partial^2 Y_{FL}}{\partial F_L^{\,2}}} > 0$$

A larger subsidy leads to better cars.

If the optimal value $F_L^*(s)$ of the fringe is nonzero, then it must be the case that:

$$Y_{FL}\left(F_L^*(s)\right) + (1-s)\left(F_L^*(s)\right) < Y_L.$$

To see this, note that for *F=0* the inequality above becomes an equality, and since $F_L^*(s)$ is the cost minimizing value of the fringe benefit, it yields lower cost than at *F=0.* The minimum subsidy that induces the firm to offer a positive fringe satisfies

$$Y_{FL}\left(F_L^*(s_L)\right) + (1-s_L)\left(F_L^*(s_L)\right) = Y_L. \tag{14}$$

One easily shows that the left-hand side of this expression declines with *s* at a decreasing rate.

5.2. H-type firm with continuous car values

An H-type firm which provides a company car may benefit from signaling that it hires high -quality workers. This benefit, as before, is called P_F . If the H-type firm provides cars of lower or equal quality than does an L-type firm then there is no signaling value. Let us denote the value of the car offered by the H-type firm as F_H .Thus, if an H-type firm offers a car with $F_H > F_L$, its 'net' employment cost per worker is:

$$\left(Y_{FH} + (1-s)F_H\right) - p_F. \tag{15}$$

Otherwise, this cost is

$$\left(Y_{FH} + (1-s)F_H\right). \tag{16}$$

Combinations Y_{FH}, F_H must satisfy:

$$u(Y_{FH}) + v(F_H) = u_H = u(Y_H)$$

Let $F_H^*(s)$ be the solution to the problem

$$\underset{F_H}{Min} \quad Y_{FH}(F_H) + (1-s)F_H - p_F$$

As before, higher subsidies lead to better cars. Note that the optimal value depends on the governmental subsidy *s*, but it is independent of the quality of the signal. The latter does affect the minimum subsidy that will induce the H-type firm to provide cars, see below.

Assuming that cars are normal goods and given declining marginal utility of income, it is easy to show that:

$$F_H^*(s) > F_L^*(s)$$

If a given subsidy leads the L-type firm to provide cars, the H-type firm will necessarily provide a car of higher quality to its employees. Moreover, if it provides cars, we have

$$Y_{FH}\left(F_H^*(s)\right) + (1-s)\left(F_H^*(s)\right) - p_F < Y_H$$

We denote the minimum governmental subsidy that induces the H-type firm to offer a car in a separating equilibrium as s_H. Any value of *s* which induces an *L*-type firm to provide a car makes it profitable for an *H*-type firm to give a more expensive car. As this also holds at s_L, and the cost minimizing car value increases with *s*, it follows that $s_L > s_H$.

5.3. Equilibrium results with continuous car values

We illustrate the results on Figure 2. The upper panel shows the optimal values of the fringe for L-type and H-type firms, respectively, as functions of the subsidy. The lower panel depicts the net labor cost per worker, again as function of the subsidy level.

At low subsidy levels, no cars are provided. For levels $s_H < s < s_L$ a separating equilibrium has the H-type firm provide cars but not the L-type firm. If, for a given governmental subsidy *s*, the *L*-type firm provides cars to its employees ($s > s_L$), then the *H*-type firm will also provide cars, and these will be more expensive than those offered by the L-type firm.

INSERT FIGURE 2

With continuous values of fringe benefits the governmental subsidy which maximizes an H-type firm's profit is, unlike in the fixed cost case, the largest possible subsidy. Of course, this follows from our assumption that the signal has full force once the quality offered by the H-type exceeds that of the L-type. Different assumptions (for example, making the strength of the signal a function of the deviation between both qualities offered) may lead to different conclusions.

In Appendix 2, we relax the assumption that all qualities are available on the market by imposing a minimum quality that has to be offered. As is shown there, this has no impact on the qualitative results.

6. Conclusion

It is generally believed that firms provide some fringe benefits such as company cars mainly because of the favorable tax treatment of such benefits. In this paper we develop a simple model that may partially explain why governments allow these implicit subsidies. It is based on the argument that for some firms company cars can signal information about what compensation the firm pays or about what types of workers the firms attracts. Firms that benefit from outsiders believing that they pay high wages may then find it profitable to lobby for subsidies when it gives company cars to employees. Alternatively, firms may benefit when junior workers believe that senior workers are well paid and offer fringe benefits to senior workers as signals of high but unobservable wages. Junior workers may believe that they too will be rewarded for staying with that employer; the firm benefits due to higher effort and lower turnover costs. In both cases, subsidies for company cars may then be the result of government policy responding to lobbying by firms.

The central idea of this paper is straightforward--- an employer may provide some fringe benefits for the purpose of signaling to outsiders what type of workers it employs. One contribution of the paper is to show that under plausible conditions the provision of fringe benefits indeed can signal the firm's type. But the analysis does more. It demonstrates the existence of multiple equilibria---one equilibrium has no firm providing certain fringe benefits, whereas another equilibrium has fringe benefits provided to signal the firm's type. The paper shows why a firm that provides the fringe benefit may oppose a government subsidizing it too heavily: a heavy subsidy could destroy the signaling value of the benefit. The analysis further shows that an employer may even provide a fringe benefit to employees who place no value on it. More generally, the model predicts that firms will want to provide fringe benefits that have a signaling value and, therefore, they want fringe benefits that are easily observable by others. Company cars fulfill this objective well. This, together with most households having one or at most two cars, may explain the popularity of company cars as a fringe benefit versus other consumer goods. Moreover, by sticking the name of the firm on the car (which is much more difficult for, for example, jewelry or clothing), the signaling value is large.

Similar analysis can apply to other choices made by the firm. A firm may locate in an expensive, prestigious, location---a person who works in Manhattan likely lives in or near Manhattan, where housing is expensive, and so suggesting that he earns a high income. A

firm which has its workers travel in business class and stay in plush hotels likely pays its workers well, so that they value such amenities rather than preferring more cash.

The qualitative results are surprisingly robust. They appear when workers differ in their valuations of cars, when the quality of a car is variable or fixed, when a minimum quality of car exists and when it does not. A firm may find it profitable to signal its type by offering a company car both when other firms adopts the same signaling strategy, and when they do not but a firm may deviate from a pooling equilibrium. The model can explain what governmental subsidy level for fringe benefits a firm may prefer---if government is constrained to treat all firms the same, then some firms in the industry (perhaps even most) may prefer that government offer a low subsidy rather than a high one, and that preference holds even if firms pay none of the taxes required to finance the subsidy.

The model seems consistent with many stylized facts. Although the subsidy is the same for all firms, not all firms provide workers with company cars. We see more company cars in large than in small firms, because the quality of the signal is likely to be better for larger firms. A small firm may gain little from outsiders believing it hires high-ability workers---the number of potential employees, suppliers, customers it attracts is in any case small. Within firms we expect more company cars among senior workers. Both predictions are confirmed in detailed empirical analyses (Guttierez-i-Puigarnau and van Ommeren (2010), Wuyts (2009)). The model further suggests that firms that offer fringe benefits such as company cars may want to offer pure cash alternatives. This is again consistent with observed firm behavior (see Watson Wyatt (2008)). Although many other reasons for this difference may exist, differences in mobility and the size of the labor market may partially explain why the US does not subsidize company cars whereas in Europe such subsidies are widespread. As argued in the paper, signaling does not make much sense if firms recruit nationwide and people are willing to move long distances. Lastly, as a more general statement the model suggests that companies will provide fringe benefits that are perceived as good signals of the quality of workers and firms.

Our approach does not explain all fringe benefits offered to workers; it will not apply, for example, to health benefits. But though we spoke of company cars as the fringe benefits under consideration, the approach can apply to other visible benefits, such as membership in golf courses, stays at expensive hotels or flights in the first-class cabin about which the worker can brag, meals at expensive restaurants which the worker can describe to others, or more generally consumption of luxury goods.

References

Bernstein, David (2002) "Fringe benefits and small businesses: Evidence from the Federal Reserve Board small business survey." *Applied Economics*, 34(16), 2063-2068.

Burdett, Kenneth and Dale Mortensen (1998) "Wage differentials, employer size, and unemployment." *International Economic Review*, 39(2): 257-73.

Cable, Daniel M. and Mary E. Graham (2000) "The determinants of job seekers' reputation perceptions." *Journal of Organizational Behavior*, 21(8): 929-947

Chirinko, R.S. and D.S Wilson (2010) "Can lower tax rates be bought? Business rent seeking and tax competition among US states", Institut d'Economia de Barcelona, IEB working paper 2010/2.

Clark, Andrew,Kristensen, Nikolai and Niels Westergård-Nielsen (2009) "Job satisfaction and co-worker wages: Status or signal?" *Economic Journal*, 119 (536), 430-447.

Clotfelter, Charles T. (1983) "Tax-induced distortions and the business-pleasure borderline: The case of travel and entertainment." *American Economic Review*, 73 (5), 1053–65.

Dale-Olsen, Harald (2004) "Wages, fringe benefits and worker turnover." *Labour Economics*, 13(1): 87-105.

De Borger, Bruno and Bart Wuyts (2010) "The tax treatment of company cars, commuting, and optimal congestion tolls." Working Paper, University of Antwerp.

Fuller, J. Bryan et al. (2006) "Perceived organizational support and perceived external prestige: Predicting organizational attachment for university faculty, staff, and administrators." *Journal of Social Psychology*, 146(3): 327-347.

Economist Intelligence Unit (1996). Motor Business Europe, London.

Gatewood , Robert D., Mary A. Gowan , and Gary J. Lautenschlager (1993) "Corporate image, recruitment image, and initial job choice decisions." *Academy of Management Journal*, 36: 414-427.

Gawande, Kishore, and Usree Bandyopadhyay (2000) "Is protection for sale? A test of the Grossman-Helpman theory of endogenous protection." *Review of Economics and Statistics*, 82(1): 139-52.

Goldberg, Pinelopi K., and Giovanni Maggi (1999) "Protection for sale: An empirical investigation." *American Economic Review*, 89(5): 1135-55.

Grossman, Gene M., and Elhanan Helpman (1994) "Protection for sale."*American Economic Review*, 84(4): 833-50.

Guttierez-i-Puigarnau, E., and J. van Ommeren (2010) "Welfare effects of distortionary company car taxation." Tinbergen Institute Discussion Paper, TI 2007-060/3, forthcoming *International Economic Review*

Hashimoto, Masanori and Jingang Zhao (2000) “The labor market effects of non-wage compensations.” *Labour Economics*, 7(1): 55-78.

Heffetz, Ori (2004) “Conspicuous consumption and the visibility of consumer expenditures." Mimeo, Department of Economics Princeton University.

Heffetz, Ori (forthcoming), “A test of conspicuous consumption: Visibility and income Elasticities.” *Review of Economics and Statistics*.

Ireland, Norman J. (1994) “On limiting the market for status signals.” *Journal of Public Economics*, 53(1): 91-110.

Ireland, Norman J. (1998) “Status-seeking, income taxation and efficiency.” *Journal of Public Economics*, 70(1): 99-113.

Katz, Avery, and Gregory Mankiw (1985) “How should fringe benefits be taxed?” *National Tax Journal*, 38(1): 37-46.

Long, James E., and Frank A. Scott (1982) “The income tax and nonwage compensation.” *The Review of Economics and Statistics*, 64(2): 211-219.

Olson, Craig A. (2002) “Do workers accept lower wages in exchange for health benefits?” *Journal of Labor Economics*, 20(2): S91-S114.

Oyer, Paul (2008) “Salary or benefits?” *Research in Labor Economics*, 28: 429-467.

Royalty, Anne B. (2000) “Tax preferences for fringe benefits and workers eligibility for employer health insurance.” *Journal of Public Economics*, 75(2): 209-227.

Rynes Sara L. and Alison E. Barber (1990) “Applicant attraction strategies: An organizational perspective.” *Academy of Management Review*, 15: 286-310.

Turban, Daniel B. and Daniel M. Cable (2003) “Firm reputation and applicant pool characteristics.” *Journal of Organizational Behavior*, 24(6): 733-751.

Vandenbrande, Tom (Ed.) (2006) *Mobility in Europe, European Foundation for the Improvement of Living and Working Conditions*, Office for Official Publications of the European Commission, Luxembourg.

Van Dender, Kurt (2003 “Transport tax reform with multiple trip purposes.” *Scandinavian Journal of Economics*, 105(2): 295-310.

van Ommeren, Jos, Arno van der Vlist, and Peter Nijkamp, P. (2006) “Transport-related fringe benefits: Implications for moving and the journey to work.” *Journal of Regional Science*, 46(3): 493-506.

Watson Wyatt’s, 2008, Company car/cash allowance report.

Wuyts, Bart (2009) “Essays on congestion and the labour market.” PhD thesis, University of Antwerp.

Zax, Jeffrey S (1988) “Fringe benefits, income tax exemptions, and implicit subsidies.” *Journal of Public Economics*, 37: 171-183.

Zax, Jeffrey S. (1991) “Compensation for commutes in labor and housing markets.” *Journal of Urban Economics*, 30: 192-207.

Appendix 1: Equilibria when workers differ in their valuations of cars

This appendix extends the basic model to consider variation in preferences for cars among workers. We suppose that a fraction, *n*, of workers place a positive value on a car (v>0); a fraction (*1-n*) gains no utility from having a car (*v=0*).

The incentives for an H-type firm to provide a company car to a worker varies with the size of the subsidy. We consider the average 'net' cost (net in the sense that we take account of subsidies and the possible value of the signal when a car is given) to the H-type firm of employing a worker. This cost depends on whether the firm gives (i) no cars, (ii) cars only to employees who value cars; (iii) cars to all employees, even those who do not value it. Moreover, the net cost depends on whether the L-type firm gives a company car. If it does not, providing a car allows the H-type firm to signal its type. If the L-type firm provides cars to workers with *v=0*, then there is no more signaling value for the H-type firm when it gives cars only to workers with positive *v*, because to an outsider a company car then provides no information about the firm's type.

However, some signaling value remains if the H-type firm provides a company car to all its employees: anyone with a company car is more likely to work for an H-type firm than for an L-type firm, and this difference in probability implies the signal has value to the H-type firm. Suppose that the L-type firm provides cars to workers for whom *v>0*, and that the H-type firm provides cars to all workers. To simplify the analysis, suppose that the number of workers at H-type firms is the same as the number of workers at L-type firms. Under these assumptions, it is easily shown that the probability that a worker with a company car works for an H-type firm is *1/(1+n)*. If in the solution described an H-type firm provided no cars, outsiders would believe that the firm is an L-type. If the H-type firm does provide a car to all its workers, then the value of the signal it gives is

$$\left(\frac{1}{1+n}\right)p_F < p_F$$

In Table A1 we report the average net cost of a worker to the H-type firm depending on whether the L-type firm gives cars and whether the H-type firm gives a car to a fraction or to all its employees. Using this information we now proceed to study the different possible equilibria.

	Average net cost H-type firm, L-type firm gives no cars	Average net cost H-type firm, L-type firm gives cars
H-type firm gives no car	Y_H	Y_H
H-type firm gives car to fraction $n<1$ of employees	$(1-n)Y_H + n(Y_{FH}^1 + F - S - p_F)$	$(1-n)Y_H + n(Y_{FH}^1 + F - S)$
H-type firm gives car to all employees	$Y_H + F - S - p_F$	$Y_H + F - S - \left(\frac{1}{1+n}\right)p_F$

Table A1: employment costs H-type firm

L-type firm does not provide cars

Suppose an L-type firm provides none of its workers with a car. Then an H-type firm will provide a car to the fraction *n* workers that care for cars but not to others if this leads to the lowest cost. From Table 1 it follows that this implies two inequalities:

$$\left[(1-n)Y_H + n(Y_{FH}^1 + F - S - p_F)\right] < Y_H$$

$$\left[(1-n)Y_H + n(Y_{FH}^1 + F - S - p_F)\right] < \left[Y_H + F - S - p_F\right]$$

Denote the cutoff value of the subsidy that makes the first and the second inequality both equalities by, respectively

$$S_H^1, S_H^2$$

These values are easily determined. They are given by:

$$S_H^1 = F - p_F + Y_{FH}^1 - Y_H \tag{A1.1}$$

$$S_H^2 = F - p_F - \frac{n}{1-n}(Y_{FH}^1 - Y_H) \tag{A1.2}$$

This implies the H-type firm given the fringe benefit to part of the employees only (viz. to those with $v>0$) if the subsidy satisfies:

$$S_H^1 < S < S_H^2 \tag{A1.3}$$

But of course, it may be even more profitable for the H-type firm, given that the L-type does not give its employees a car, to provide a car to all employees, including those that don't particularly care for having one. This will be the case if the subsidy is so large that:

$$S > S_H^2$$

A large subsidy and a strong signal may make it profitable to provide cars to all its employees, though doing so increases the cost to a firm of hiring a worker. The cutoff subsidy level, as expected, will be lower for a high-quality signal; it is higher if more people care about cars.

L-type firm provides cars to workers with *v>0*.

If *v* is sufficiently large and for a sufficiently large subsidy, then an L-type firm will provide cars to its workers with *v>0*. An H-type firm which behaved in the same way could then not signal that it hires H-type workers---an observer would know that a worker with a company car has *v>0*, but by assumption such a worker is equally likely to be an H-type as an L-type. Nevertheless, if an L-type firm finds it profitable to provide company cars to workers with *v>0*, then an H-type firm also finds it profitable to do so. This is easily shown, using $(Y_H - Y_{FH}^1) > (Y_L - Y_{FL}^1)$.

Moreover, the H-type firm will provide a car to all employees if (see Table A1):

$$(1-n)Y_H + n(Y_{FH}^1 + F - S) > Y_H + F - S - \left(\frac{1}{1+n}\right)p_F$$

This can be reformulated as:

$$n\left(Y_{FH}^1 - Y_H + F - S\right) > F - S - \left(\frac{1}{1+n}\right)p_F$$

Or, provided the L-type gives cars to people with *v>0* the H-type firm gives a car to all employees if:

$$S > S_H^{2,L}$$

where the cutoff value is that subsidy that makes the earlier inequality an equality:

$$S_H^{2,L} = F - \frac{1}{1-n^2}p_F + \frac{n}{1-n}(Y_H - Y_{FH}^1) \qquad \text{(A1.4)}$$

Obviously, this subsidy is only realistic if the signal is very strong. If the signal is weak, it actually exceeds the cost of the car (because $(Y_H - Y_{FH}^1) > 0$). Moreover, note that direct comparison shows (using (A1.2) and (A1.4)):

$$S_H^2 > S_H^{2,L} \qquad \text{(A1.5)}$$

The minimum subsidy that induces the H-type firm to give cars to all employees is lower when the L-type firm also gives cars. The reason is that the H-type firm in that case has more of an incentive to give cars to all workers because this provides signaling value; giving cars only to workers that have *v>0* does not.

Analysis of equilibria

An H-type firm now faces two related problems. First, how does the net average cost of employing workers vary with the level of the subsidy? Second, given this relation, if the firm could set the subsidy (which would apply to both types of firms), what subsidy maximizes the firm's profit? In other words, for what level of subsidy should the firm lobby? To study these issues, note that the subsidy at which the L-type firm gives cars is independent of the signal; the latter does determine the different cutoff subsidies ($S_H^1, S_H^2, S_H^{2,L}$) for the H-type firm. Moreover, we know from the previous analysis that the following inequalities necessarily hold

$$S_H^1 < S_L^1$$
$$S_H^1 < S_H^2$$
$$S_H^{2,L} < S_H^2$$

Based on this information there are three relevant cases to be considered, depending on the positions of $S_H^2, S_H^{2,L}$ (the critical subsidies for the H-type firm to give cars to all employees, conditional on whether the L-type firm gives cars or not) relative to S_L^1 (the critical subsidy for the L-type firm to give cars). Note that S_H^2 is only relevant when it is below S_L^1; similarly, $S_H^{2,L}$ matters only when it exceeds S_L^1. As we will see, each case can be expressed in terms of the strength of the signal P_F.

Case 1: $S_L^1 < S_H^{2,L} < S_H^2$ (relevant is only $S_L^1 < S_H^{2,L}$)

The last inequality always holds under our assumptions. Using the information given in Table 1, the condition $S_L^1 < S_H^{2,L}$ can be reformulated as a condition on the strength of the signal; using the definitions of the two subsidy levels, we find that it is equivalent to

$$p_F < (1-n^2)\left[\left(Y_L - Y_{FL}^1\right) + \frac{n}{1-n}(Y_H - Y_{FH}^1)\right] \qquad \text{(A1.6)}$$

This case is depicted on Figure A1. The figure has the subsidy level on the horizontal axis and measures the net cost per worker, as defined in Table A1 above, on the vertical axis.

INSERT FIGURE A1

At low subsidy levels ($S < S_H^1$) no cars are provided by neither of the firms. For subsidy levels $S_H^1 < S < S_L^1$ a separating equilibrium results where the H-type firm gives cars to its workers with a strong preference for cars, and the L-type firm does not give cars. Subsidies $S_L^1 < S < S_H^{2,L}$ imply loss of the signaling value for the H-type firm if only cars are given to people for whom *v>0*, but given our assumptions it is still profitable to provide a car to the same fraction *n* of workers as before, because the high subsidy implies that the average cost of labor is less than when not giving cars. To see this, the cost marginally above S_L^1 is

$$(1-n)Y_H + n(Y_{FH}^1 + F - S_L^1)$$

Using (9) and substituting the result gives

$$Y_H + n\left[\left(Y_{FH}^1 - Y_H\right) - \left(Y_{FL}^1 - Y_L\right)\right]$$

This is necessarily smaller than Y_H. So $S_L^1 < S < S_H^{2,L}$ yields a pooling equilibrium in which both firms give cars to people that care for getting one. Finally, $S > S_H^{2,L}$ implies the H-type firm benefits from giving cars to all workers, yielding an equilibrium where the L-type gives cars to people with *v>0* and the H-type gives cars to all workers.

What is the H-type firm's most preferred subsidy that it realistically may be able to get through lobbying? It is a subsidy just below S_L^1; this implies a separating equilibrium where the H-type firm gives a car to people caring for cars, and the L-type does not give cars. Although very high subsidies lead to even lower cost per employee, such subsidies are unrealistic as they require values close to or above the full cost of the car. In sum, the H-type firm benefits from any subsidy that induces a separating equilibrium, but its most preferred subsidy is just below S_L^1.

Case 2: $S_H^{2,L} < S_L^1 < S_H^2$

Again, the relevant conditions can be translated as restrictions on the value of the signal. Using the definitions given above (see (9), (A1.2) and (A1.4)), we easily show that $S_H^{2,L} < S_L^1 < S_H^2$ is equivalent to:

$$(1-n^2)\left[\left(Y_L - Y_{FL}^1\right) + \frac{n}{1-n}(Y_H - Y_{FH}^1)\right] < P_F < \left[\left(Y_L - Y_{FL}^1\right) + \frac{n}{1-n}(Y_H - Y_{FH}^1)\right] \qquad \text{(A1.7)}$$

This situation, which reflects a stronger signal (compare (A1.7) and (A1.6)) is illustrated on Figure A2. Note that the position of S_H^1 relative to $S_H^{2,L}$ is irrelevant since the latter only matters to the extent it exceeds S_L^1, which is not the case.

INSERT FIGURE A2

At low subsidies, nothing changes compared to the previous case: no firm provides cars when the subsidy is less than S_H^1. For subsidies $S_H^1 < S < S_L^1$ we have a separating equilibrium where the H-type firm provides a car only to employees with a strong preference for cars; the L-type does not give cars. Subsidies in the range $S > S_L^1$ yield an equilibrium where the L-type does given cars to people with a preference for having one; the H-type firm now finds it profitable to provide cars to all employees.

Interestingly, for this case of intermediately strong signals small changes in subsidy (from just below to above S_L^1) may have dramatic effects on the number of cars provided. Just below this value only the H-type gives cars, and it does so only to part of the employees; just above this value, the L-type gives cars and the H-type gives cars to all employees.

However, the most desirable subsidy the H-type firm can realistically obtain is again likely to be a subsidy just below S_L^1, generating a separating equilibrium. Providing cars to all might imply a lower cost per worker, but it is easily shown that this requires the subsidy to be at least

$$F - n\left[(Y_{FL}^1 - Y_L) - (Y_{FH}^1 - Y_H)\right] - \left(\frac{1-n(1+n)}{1+n}\right)P_F$$

Given our assumptions the term $\left[(Y_{FL}^1 - Y_L) - (Y_{FH}^1 - Y_H)\right] < 0$ so that for reasonable values of *n* the required subsidy is again close to or even above the cost of the car.

Case 3: $S_H^1 < S_H^2 < S_L^1$ (relevant is only last inequality, the first one always holds)

Lastly, consider the situation $S_H^2 < S_L^1$. This implies, using the definitions (see (9) and (A1.2)), that the signal satisfies

$$p_F > \left[\left(Y_L - Y_{FL}^1\right) + \frac{n}{1-n}(Y_H - Y_{FH}^1)\right] \qquad \text{(A1.8)}$$

This case is illustrated on Figure A3.

INSERT FIGURE A3

At low subsidies $S < S_H^1$ no firm provides company cars. For subsidies $S_H^1 < S < S_H^2$ a separating equilibrium results where the H-type firm provides cars to only high preference people, for $S_H^2 < S < S_L^1$ all H-firm employees get a car. Beyond this level the signaling value is partially lost, but the signal is so strong that it still pays to give all people a car, despite the L-type also giving cars.

Again, the H-type firm prefers subsidies just below the cutoff where the L-type firm also gives cars, unless the subsidy grows unrealistically large. Providing cars to all might imply a lower cost per worker, but as before the subsidy has to be at least

$$F - n\left[(Y_{FL}^1 - Y_L) - (Y_{FH}^1 - Y_H)\right] - \left(\frac{1-n(1+n)}{1+n}\right)P_F$$

In sum, the H-type firm benefits from subsidies that induce a separating equilibrium. Especially if the signaling value of a car is strong it will be quite satisfied with lower subsidies, but the 'optimal' subsidy is likely to be one that just prevents the L-type firm from giving cars.

The role of the strength of the signal

Summarizing our findings of Appendix 1 is easiest when considering the role of the strength of the signal. The summarizing results are in Table A2.

If the signal is weak (case 1), the H-type firm will never give cars to all employees when the L-type firm gives no cars. It only does so when the L-type firm gives also cars and the subsidy is very large (much larger than S_L^1). If the signal is medium strong (case 2), the H-type firm will never give cars to all employees when the L-type firm gives no cars; however, if the L-type firm does give cars, the H-type firm gives cars to all. Hence from a subsidy equal to S_L^1 it gives cars to all. Finally, for a very strong signal (case 3), the H-type firm may give cars to all workers even if the L-type gives no cars, hence at relatively low subsidies well below S_L^1.

Strength signal P_F	**Relative position** S_L^1	**Preferred equilibrium H-type firm**	**Which H-type workers get car at preferred equilibrium?**
$P_F < (1-n^2)\left[\left(Y_L - Y_{FL}^1\right) + \frac{n}{1-n}(Y_H - Y_{FH}^1)\right]$	$S_L^1 < S_H^{L,2}$	Separating	Only high car preference workers
$P_F > (1-n^2)\left[\left(Y_L - Y_{FL}^1\right) + \frac{n}{1-n}(Y_H - Y_{FH}^1)\right]$ $P_F < \left[\left(Y_L - Y_{FL}^1\right) + \frac{n}{1-n}(Y_H - Y_{FH}^1)\right]$	$S_H^{L,2} < S_L^1 < S_H^2$	Separating	Only high car preference workers
$P_F > \left[\left(Y_L - Y_{FL}^1\right) + \frac{n}{1-n}(Y_H - Y_{FH}^1)\right]$	$S_H^2 < S_L^1$	Separating	All workers

Table A2: signal strength and preferred equilibrium H-type firm

Appendix 2: The case of continuous car quality with a lower bound on quality

Suppose the lowest quality car available is F_0. The analysis must then be slightly modified. Consider the following problem (looking at the L-type firm):

$$\underset{F_L}{Min} \quad Y_{FL}(F_L) + (1-s)F_L \qquad s.t.\ F_L \geq F_0$$

Let, as before, the solution to the unconstrained problem be given by $F_L^*(s)$. This is rising in *s*. If $F_L^*(s) \geq F_0$ the firm provides a company car with value equal to $F_L^*(s)$. Define the subsidy that implies $F_L^*(s) = F_0$ as s_L^0. Now if $F_L^*(s) < F_0$ the firm will still provide a car of value F_0 provided this yields a lower labor cost per worker than not providing a car. This will be the case if

$$Y_{FL}\left(F_0\right) + (1-s)\left(F_0\right) < Y_L$$

If the opposite holds providing no car is better than providing the lowest value car available on the market and no cars are provided at all. Let the solution to

$$Y_{FL}\left(F_0\right) + (1-s)\left(F_0\right) = Y_L$$

be denoted $\overline{s}_L^0$.

We then have the following. For $s < \overline{s}_L^0$ the firm gives no company cars. For $\overline{s}_L^0 < s < s_L^0$ the firm provides cars of the minimum value F_0 available on the market. For $s > s_L^0$ it provides cars of better than minimal value $F_L^*(s)$. See Figure A4 for illustration.

INSERT FIGURE A4

For the H-type firm a similar story holds. The argument used in the main body of the paper holds here as well: an H-type firm provides a better car than does an L-type firm. And using the same argument as before, it still holds that $s_L^0 > s_H^0$.

All qualitative results remain unchanged with one minor qualification. Since for the range where both H- and L-types would provide the minimum quality of cars (both constraints binding), the signaling value would be lost for the H-type firm. It will be optimal to provide marginally more that the minimum quality.

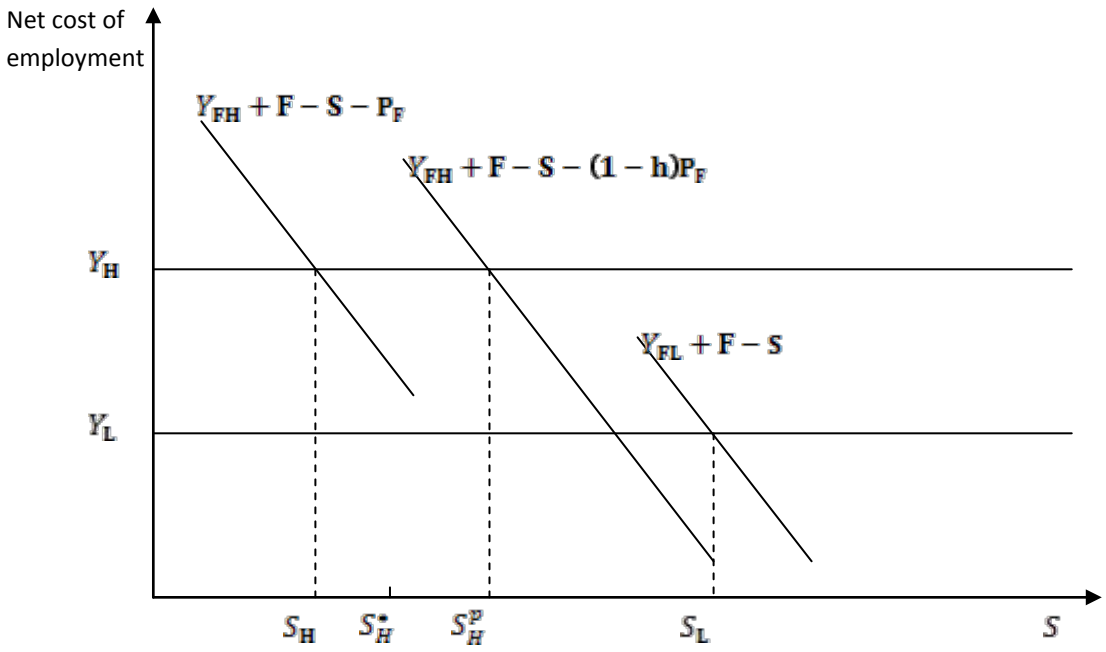

Figure 1: Subsidies to fringe benefit and the net cost of employment

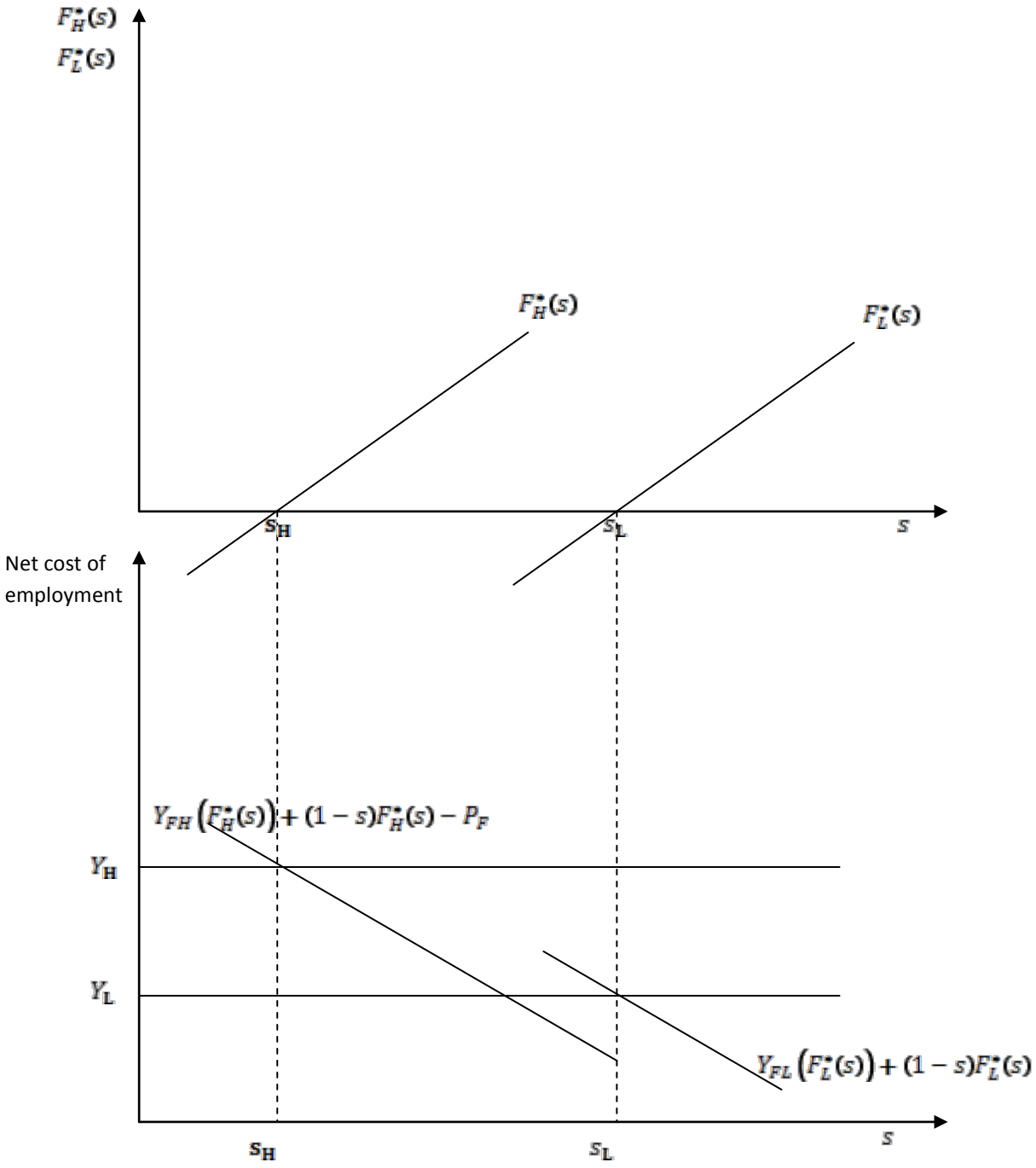

Figure 2: Subsidies to fringe benefit and quality

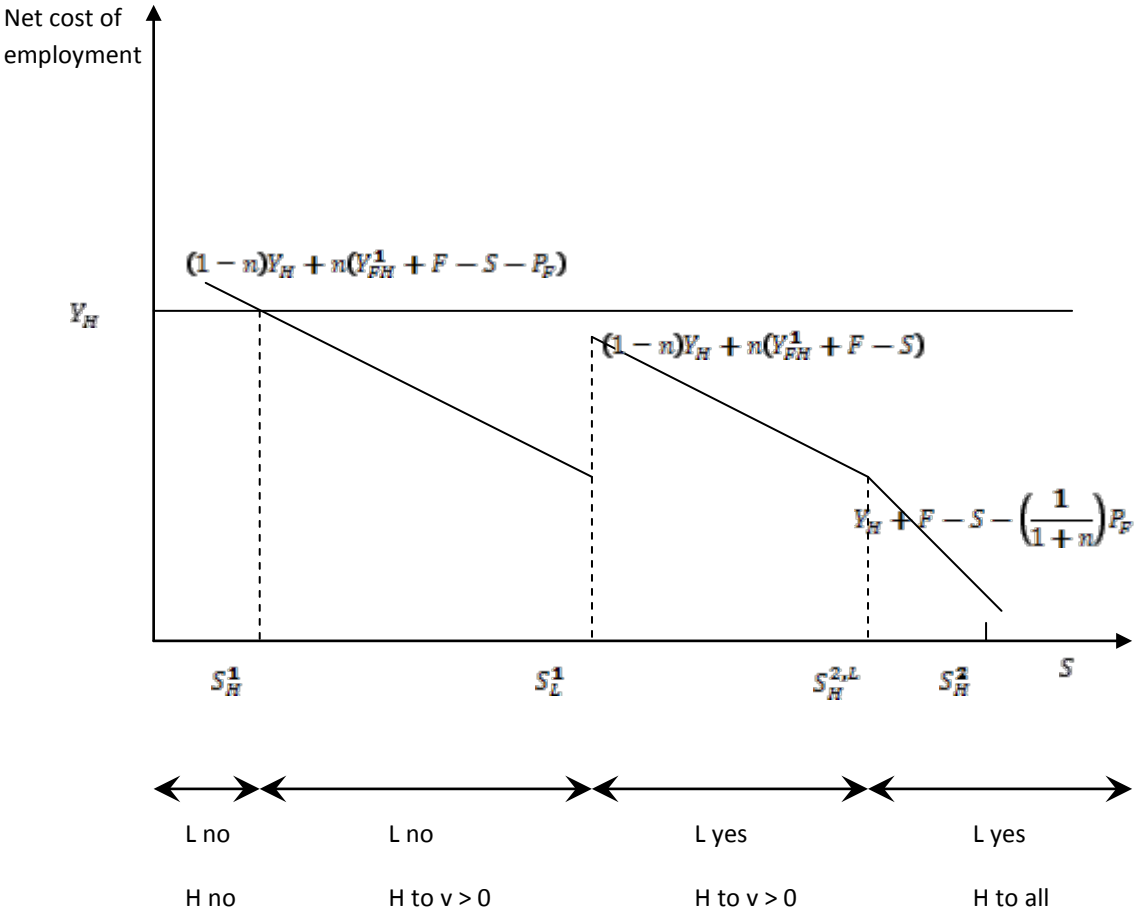

Figure A1: Weak signal (case 1)

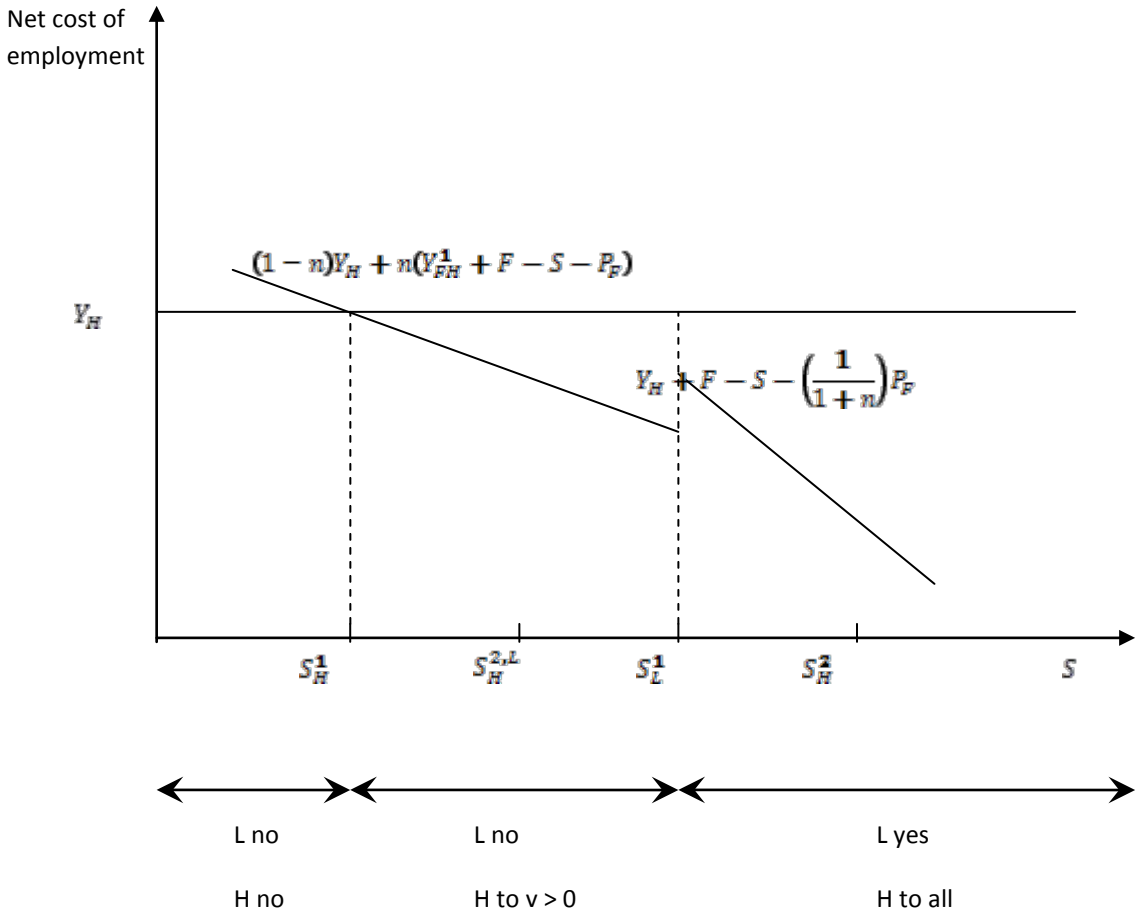

Figure A2: Moderate signal (case 2)

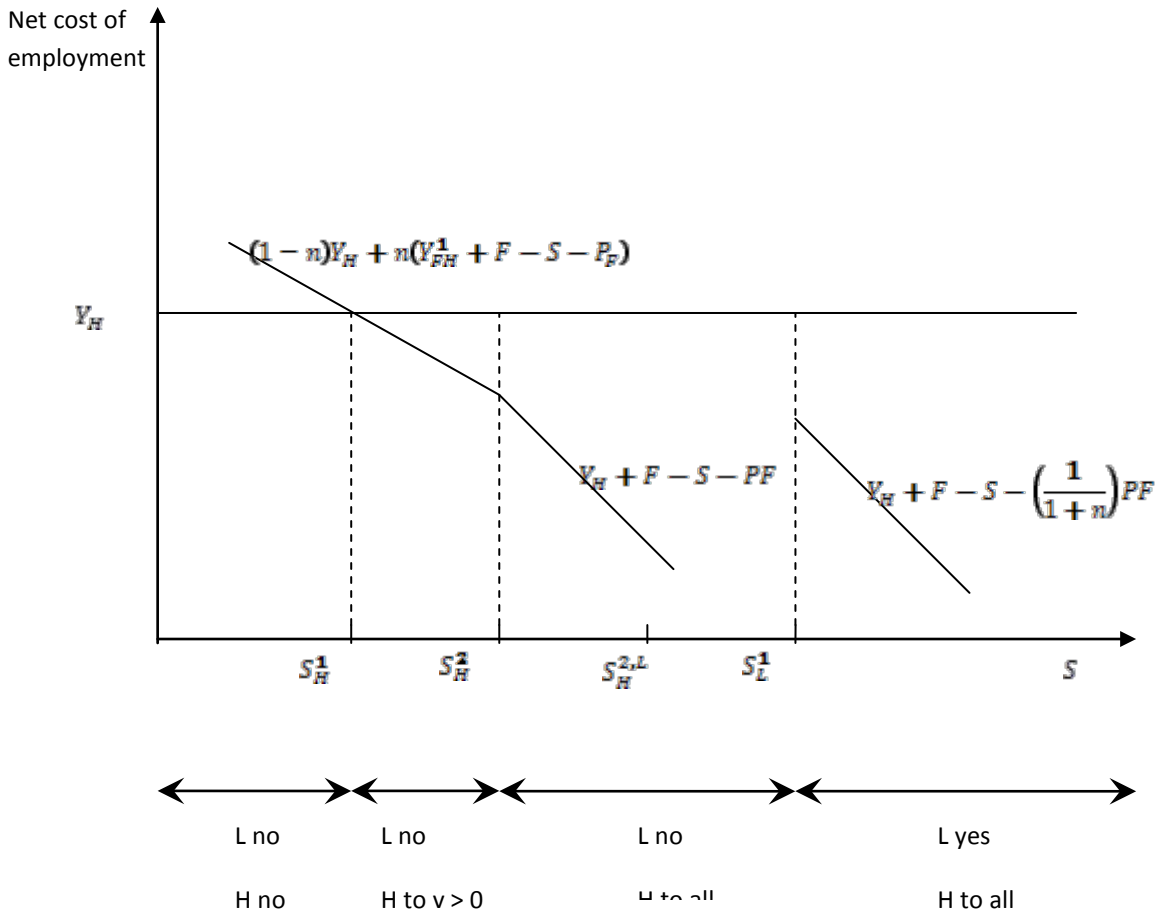

Figure A3: Strong signal (case 3)

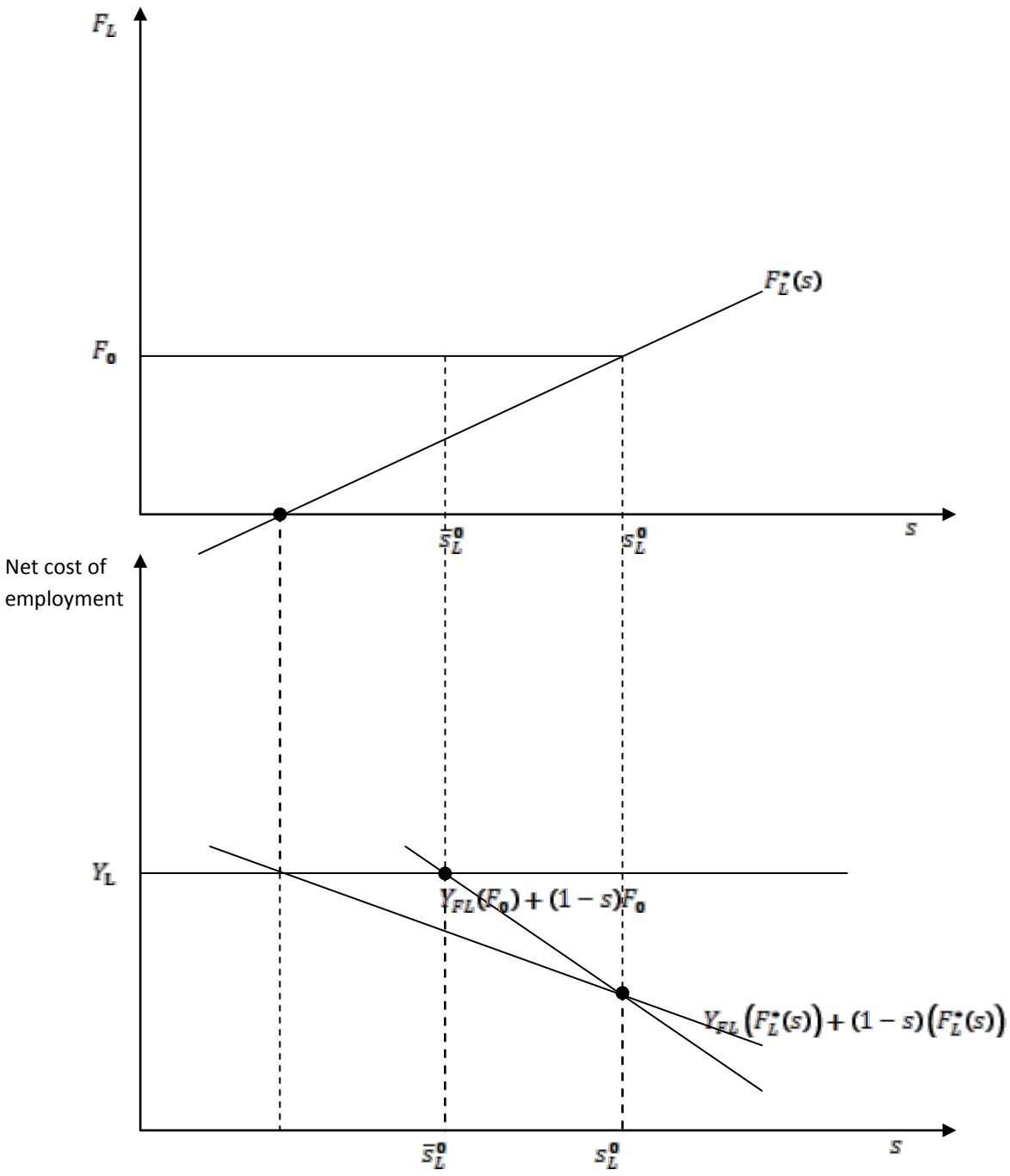

Figure A4: Minimum quality restrictions

Notation

Y_{FH} cash wage paid by H-type firm when it offers a car at cost F

Y_{FL} cash wage paid by L-type firm when it offers a car at cost F

P_F Benefit to H-type firm of belief by outsiders that it hires H-type workers.

n fraction of workers for whom $v>0$.

s_L Critical value of subsidy which induces an L-type firm to offer a company car

s_H Critical value of subsidy which induces an L-type firm to offer a company car

v Utility of a worker from a car