Multidimensional mutual signaling between companies and job-seekers on social media and employer review platforms

Kamilla Timerbulatova

April 2026

1 Factors Determining the Need to Develop a Model of Social Media and Review Platforms as a Signaling Channel in the Labor Market

1.1 Review of Labor Market Signaling Models

This section examines the evolution of approaches to analyzing signaling in the labor market from the 1970s to the present. In line with the objectives of this study, particular attention is given to works that account for the use of social connections as signals, as well as empirical studies testing the hypothesis of the signaling function of education and social networks.

Research on signaling in the labor market originates from the seminal work of Spence (1973). Spence proposed that under conditions of asymmetric information—when employers cannot initially distinguish between high- and low-productivity workers—high-productivity workers are at a disadvantage. This is because employers are willing to offer a lower wage to a worker of unknown type than to a worker known to be of a "high" type. Consequently, high-productivity workers invest in additional education at a level such that, for low-type workers, the effort required would entail prohibitively high costs. Thus, a rational employer can interpret high educational effort as a signal of a high-type candidate and offer more favorable contract terms.

Importantly, Spence assumed that additional education does not affect worker productivity, i.e., it is "non-productive."

Contemporary theoretical research considers the possibility of signaling not only through education but also via other channels.

Montgomery (1991) proposed that workers signal high productivity not only through their level of education but also through the quality of their social networks. According to Montgomery, individuals with higher ability are more likely to be connected with other high-productivity individuals.

The "quality" of social ties is also understood (Kim, 2007) as the ability to obtain recommendations from influential individuals. It is typically assumed that, unlike education, social connections do not directly affect a worker's type (productivity). However, the relationship between an individual's cognitive ability and their capacity to form "high-quality" social ties remains an open question.

Hensvik and Skans (2016) test Montgomery's hypothesis using Swedish data over a 20-year period. They find that applicants who are former colleagues of current employees require fewer years of education to be hired compared to candidates without such connections (holding ability test scores constant).

A substantial body of empirical literature (e.g., Wolpin, 1977; Muhlau and Horgan, 2000) tests the hypothesis that education serves as a signal in the labor market, though the results are inconclusive. Outcomes depend on institutional characteristics of specific labor markets, such as the degree of regulation and union bargaining power. For instance, Muhlau and Horgan (2000) show that the signaling role of education is stronger in more competitive labor markets.

Several empirical studies (Wolpin, 1977; Heywood and Wei, 2004) demonstrate that education can function as a signal in competitive labor markets by comparing returns to education for wage-employed individuals and the self-employed. It is assumed that self-employed individuals do not need to use education as a signal. However, most studies indicate that, in addition to its signaling role, education also has a direct effect on worker productivity.

A key empirical challenge lies in distinguishing between education acquired to enhance productivity and "excess" education obtained purely for signaling purposes (Kroch and Sjoblom, 1994; Tyler et al., 2000). Chatterji et al. (2003) address this by comparing required education levels in job descriptions with actual requirements based on employee feedback. Using UK data, they confirm the signaling hypothesis and find that, all else equal, women require stronger signals than men.

Starting with Waldman (1984), the literature has recognized that investment in signaling affects not only wages but also promotion probabilities (Bernhardt, 1995). Later work (Lange, 2007) suggests that education may function as a signal primarily at the beginning of a worker's career.

For experienced workers, promotions in previous jobs may serve as signals when switching firms. More educated workers are more likely to be promoted, as the signaling value of promotions is lower for them compared to less-educated workers. Promotions are typically accompanied by wage increases to incentivize retention and prevent their use as signals. Thus, higher education leads to higher wages both at labor market entry and throughout the worker's career (Waldman, 2016).

In summary, theoretical models should account for the productivity of educational signals, the presence and non-productivity of other signals (such as social ties and promotions), and their interaction. Empirical analyses should recognize that educational signaling is most relevant for early-career workers.

1.2 Characteristics of Information Diffusion in Social Media

This section examines features of social networks that shape how messages—both individual and corporate—are disseminated.

The concept of a "personal brand" originates from Peters (1997), who argued that individuals attempt to control the impressions they create in social contexts, thereby managing their public image. Social media provide unprecedented tools for impression management, including the ability to share exact copies of others' messages (e.g., reposts on X).

Geva et al. (2019), using latent Dirichlet allocation, show that users tend to maintain thematic consistency between original posts and reposts, constructing a coherent and focused personal image. This tendency is particularly strong among professional bloggers.

Users also tend to add new information when sharing content, often reposting messages from weak ties rather than close contacts to maximize informational value.

Thus, any message created or shared by a user can be viewed as a form of marketing communication. Consequently, analytical approaches used for corporate social media content can, with some limitations, be applied to individual users.

The credibility and relevance of social media messages are enhanced by their similarity to word-of-mouth communication (Colliander and Dahlén, 2011), which is considered one of the most influential communication channels in markets (Allsop et al., 2007).

Theoretical models of word-of-mouth marketing (WOMM) have evolved alongside market development. Early models emphasized organic interpersonal influence (Bass, 1969; Engel et al., 1969), assuming that communication occurs naturally without firm intervention.

Later models highlighted the role of opinion leaders, forming a linear influence model where messages are transmitted unchanged. The most recent "network co-creation" model recognizes users as active participants who modify and enrich marketing messages (Kozinets et al., 2010).

Word-of-mouth communication is influenced by:

- archetypal blogger personas,
- community norms,
- campaign characteristics.

These factors transform corporate messages into community-relevant information.

Social media also enable "parasocial interaction" (Horton and Wohl, 1956)—the illusion of personal relationships with public figures. This effect is reinforced through frequent interactions, increasing influencer impact.

High levels of parasocial interaction positively affect attitudes toward brands, though misleading information can severely damage credibility.

Parasocial interaction intensifies with each act of engagement with a public figure (Auter, 1992); consequently, the most active bloggers—those who post multiple times daily—tend to be the most popular and influential. In turn, followers incorporate checking updates from their preferred blogs into their daily routines.

Empirical evidence (Colliander and Dahlén, 2011) indicates that a high level of parasocial interaction with the source of a marketing message has a positive effect on attitudes toward the referenced brand. When reading a product-related article in a magazine, consumers are aware that the author produced it as part of professional obligations. In contrast, in the context of blog publications, parasocial interaction (PSI) impedes an adequate assessment of the blogger's motives and credibility. At the same time, if the information conveyed by a blogger proves to be inaccurate, this results in a significantly stronger negative impact on their reputation (Colliander and Dahlén, 2011).

Therefore, both theoretical modeling and empirical analysis of signaling processes—particularly in the labor market within social media environments—must take into account users' incentives (both individuals in the context of personal branding and official corporate accounts) to maintain a consistent public image, the diffusion of information via electronic word-of-mouth (eWOM), and the phenomenon of parasocial interaction.

1.3 The Impact of Social Media on Worker and Managerial Behavior, as well as Job Seekers' Perceptions

Nowdays, digital platforms enable firms to become more informed. In particular, firms that have been operating in the market for a prolonged period can more accurately assess the "type" of a job applicant due to access to a larger volume of information. In this sense, information asymmetry shifts to the other side of the labor market. Individuals seeking employment—especially those entering the labor market for the first time—are often unable to adequately assess either their own type or that of the employer.

Since traditional labor market signaling models assume that only the agent possesses an unobserved type, it is necessary to clarify that, in this context, the "type" of the firm refers to job characteristics not specified in contracts, such as workplace conditions, organizational culture, and relationships between employees and management.

In addition to this transformation of the labor market, it is also important to consider the specific features of information diffusion on social networking service (SNS) platforms.

SNS platforms are continuously evolving, becoming increasingly user-friendly; at the same time, users' attitudes toward the presence of corporations on social media are also changing. While early 2000s studies (e.g., Gaffney, 2001; Retie, 2001) documented highly negative attitudes toward corporate content—perceived as intrusive interruptions to regular online activity (especially among users most actively engaged in content creation; Schlosser et al., 1999)—more recent research (Taylor et al., 2011) indicates that such attitudes are no longer predominantly negative. However, excessive commercialization of social networks may lead users to abandon them altogether (as occurred, for example, with MySpace, though this has so far been avoided by Facebook). Another concern is users' anxiety regarding the privacy of personal information and corporate access to it (AdReaction, 2010).

Social media provide a space for strengthening two-way communication between firms and their target audiences, including consumers, employees, shareholders, and the media. A distinctive feature of communication on SNS platforms is that the cost of sending a message is effectively the same—close to zero—whether it is directed to a single recipient, a list of contacts, or tens of thousands of strangers.

Salehan et al. (2017) note that social media have become so essential in the workplace that some individuals create separate accounts exclusively for professional purposes. One reason for this is the need to differentiate between the image an individual presents to their employer (e.g., managers) and the image intended for approval by followers (Creary et al., 2015).

At the same time, social media offer virtually no reliable means of restricting the audience for a given message. Although technological developments provide partial solutions—such as private accounts or disappearing messages—the Internet effectively "never forgets." There is no guarantee that deleted content, potentially harmful to an individual's or a brand's reputation, will not resurface in the form of screenshots. As a result, individuals who maintain connections with colleagues and supervisors on social media often consciously manage their online self-presentation (Ollier-Malaterre et al., 2013).

A number of studies demonstrate that an organization's active presence on social media platforms used by employees positively influences employees' identification with the organization, fosters the development of bonding social capital within the firm, and enhances bridging social capital across its divisions (Sias and Duncan, 2020). In addition, employees become more likely to publish content related to their work. Conversely, monitoring of social media by management is perceived very negatively, particularly by members of Generation Y (Hurrell et al., 2017).

The characteristics of organizational social media accounts also influence how job seekers perceive firms and facilitate the dissemination of information about them via electronic word-of-mouth (eWOM) (Carpentier et al., 2019). Specifically, the "personality" of an organization's social media page positively affects perceived organizational warmth and, consequently, its attractiveness to job seekers, while the informativeness of the page enhances perceived organizational competence and, thus, its attractiveness.

From the perspective of ordinary users, posts by regular employees are perceived as a more credible source of information about working conditions than corporate accounts (Korzinski et al., 2019). Moreover, employee-generated content is typically not controlled by the organization, yet it generates significantly higher levels of engagement among social media users than content published on official corporate pages.

It is also noted (Walsh et al., 2020) that any post made by an employee on social media may potentially damage the firm's reputation. The authors propose evaluating employees' competence in using social media in relation to corporate reputation through the RSMC (reputation-related social media competence) scale, which encompasses five dimensions: technical competence, awareness of the observability of actions, knowledge, impact assessment competence, and communication competence in social media. RSMC is defined as the combination of explicit and tacit knowledge, skills, and behavioral patterns that enable employees to use social media in a manner that does not harm the employer's reputation.

Importantly, the authors focus not on intentional attempts by employees to damage corporate reputation, but rather on everyday social media behavior that contributes to shaping the company's public image. Demonstrat-

ing creativity, intelligence, and engagement with work allows employees to effectively act as brand ambassadors, a role comparable to formal marketing practices. Furthermore, employees may defend their employer's position and protect it from external criticism in social media environments.

At the same time, there are numerous examples of careless social media use by employees harming corporate reputations, including negative impacts on financial performance. The authors therefore emphasize that firms' management should assess employees' social media competence and allocate greater attention and resources to training those employees who lack such competencies to the greatest extent.

Employees of Amazon warehouses regularly post complaints on social media (particularly on Twitter/X) regarding poor working conditions, including 10–12-hour shifts with virtually no breaks—even for basic needs such as using the restroom—low wages, managerial misconduct, and workplace conflicts. For a long time, company representatives denied these claims; however, more recently, a different strategy has been adopted.

On X, a number of highly similar accounts—purportedly belonging to Amazon employees—have emerged, publishing content describing positive work experiences within the company. In addition to regularly posting work-related messages, these accounts actively engage in conversations initiated by other users whenever the company is mentioned in a negative context.

The uniformity of phrasing across these accounts has generated suspicion and irritation among users: the content appears either to be produced by employees paid (modestly) to disseminate pre-formulated messages or by low-quality automated bots. In either case, this represents an attempt to influence the perceived "type" of the corporation through social media. However, the attempt proved unsuccessful—likely due to insufficient investment (i.e., insufficient "effort" in the terminology of signaling models)—and instead functioned as a counter-signal.

A substantial body of economic literature examines the impact of both corporate social media activity and employees' personal online behavior on corporate reputation and, consequently, on job seekers' perceptions of firm "quality" as a potential employer.

It is also noted (Turban, 2001) that employer attractiveness plays a decisive role at the earliest stage of the job search process—namely, in individuals' decisions about whether to apply for a position. This study focuses on identifying the determinants of employer attractiveness among university students entering the labor market for the first time. The author hypothesizes that students interpret familiarity with a firm as a signal of its high quality, analogous to how consumers attribute positive characteristics to well-known brands. Furthermore, it is suggested that students rely on aggregated social perceptions shaped by information exchange networks when making application decisions. The empirical analysis is based on survey data from senior students at nine universities where the focal firm conducted recruitment activities over several years. Regression models of employer attractiveness—including firm characteristics, recruitment intensity, brand awareness, and social context—support all proposed hypotheses. Notably, a binary variable indicating whether a student had participated in a job interview with the firm does not significantly affect perceived attractiveness, although it is correlated with awareness. The author concludes that firms attracting more qualified candidates ultimately benefit from a larger applicant pool, increasing their overall utility.

In a subsequent study (Turban and Cable, 2003), the authors investigate whether stronger corporate reputation leads to a larger and more capable applicant pool. They argue that firms attracting more talented and qualified candidates derive greater benefits from selection processes and may gain a competitive advantage. Reputation—defined as a firm's evaluation relative to competitors—is assumed to function as a signal of working conditions. The authors hypothesize that reputation positively affects both the quality of applicants responding to vacancies and the quality of candidates invited for interviews. The study consists of two empirical analyses. The first focuses on undergraduate students without prior full-time work experience, who applied for jobs through university career centers using standardized resumes. Firms subsequently selected candidates for interviews. Applicant quality was measured through academic performance, work experience, and extracurricular involvement. Employer reputation was proxied by inclusion in "best places to work" rankings published in four business periodicals. The results indicate that reputation positively influences both the number of applications received and the average quality of candidates invited for interviews.

The second study examines MBA students (class of 2000–2001) with an average of five years of work experience. Reputation was measured based on a survey of over 2,700 MBA graduates, who identified five firms they considered ideal employers. Firms most frequently selected received higher reputation scores. Applicant quality was measured using GMAT scores. Students were allocated 500 points, which they could use as bids to secure interview opportunities; unsuccessful bids were lost, representing opportunity costs. The findings show that firms with stronger reputations attract more candidates, though not exclusively those with the highest GMAT scores. Thus, the hypothesis that lower-quality candidates avoid applying to high-reputation firms is not supported. However, reputable firms are able to be more selective in hiring.

Studies focusing on the role of social media in shaping employer reputation also address the signaling hypothesis in the context of reverse signaling (from firms to applicants). For example, Da Motta Veiga et al. (2019) examine whether the presence of corporate social media pages affects employer reputation and whether mere presence suffices or active communication is required. The authors argue that if only active content generation

(rather than mere presence) influences reputation, this would support the signaling hypothesis, as maintaining activity is costlier and thus a potentially credible signal. Employer reputation is defined as employees' evaluation of communication quality, managerial competence, and HR practices. The sample includes firms listed in Fortune's "100 Best Companies to Work For" (2008–2016). Regression analysis using the Arellano–Bond generalized method of moments shows that neither the presence nor activity of corporate accounts on general-purpose platforms (Twitter and Facebook) significantly affects reputation, whereas the presence of a LinkedIn page is significant. The authors conclude that the signaling hypothesis is not supported; however, they acknowledge limitations due to lack of data on LinkedIn activity.

Employer reputation—defined as the image perceived by current and potential employees—affects a firm's ability to attract, hire, and retain talent (Benitez et al., 2020). Firms with weaker reputations face higher hiring costs, as they must compensate candidates for perceived risks. Demonstrating corporate social responsibility (CSR) may enhance reputation; however, when communicated via social media, it may also produce adverse effects due to skepticism and phenomena such as "greenwashing," where cost-reduction measures are presented as environmental initiatives. At the same time, the absence of CSR practices may also harm reputation. Under asymmetric information, firms may use social media communication about CSR as a signal of broader working conditions, including corporate values and strategic orientation.

Empirical findings suggest that job seekers interpret CSR-related messages as signals of higher employer quality. Moreover, social media provide a fast, accessible, and cost-efficient channel for such communication, enhancing firms' signaling capabilities and the perceived credibility of their messages.

When employees use real identities on social media and disclose their employer, any content they publish—regardless of whether it directly relates to the firm—may be interpreted as reflecting not only the individual but also the organization as a whole. Schaarschmidt and Walsh (2020) argue that adherence to social norms within online communities is the most effective way to mitigate reputational risks. This does not require active defense of the employer but implies appropriate and norm-consistent expression of personal opinions. The concept of awareness of impact on corporate reputation (AICR) captures the extent to which employees recognize their influence on organizational reputation. It is important to distinguish between perceived employer reputation (how employees believe outsiders view the firm) and perceived organizational identity (how employees themselves define the organization). When employees perceive their firm as having a strong external reputation, they develop a sense of "pride in membership," which reduces turnover and increases willingness to engage in discretionary effort. This pride also enhances awareness of reputational impact and compliance with social norms. Interestingly, the effect of AICR on norm compliance is most pronounced among moderate users of social media.

In summary, social media provide a unique environment for signaling in both directions: from job applicants to firms and from firms to potential employees, consumers, and shareholders. These mechanisms are still in the process of being fully understood and utilized by both sides of the labor market.

Existing theoretical models of labor market signaling do not adequately account for key features of social media, including the influence of parasocial interaction, the interpretation of all user-generated content as a form of marketing communication (particularly in the context of personal branding), the diffusion of information via electronic word-of-mouth, and the low cost of signal transmission. Moreover, the literature traditionally focuses on signaling from workers to firms, whereas social media enable reverse signaling—from firms to workers—regarding working conditions, promotion opportunities, managerial practices, and other characteristics of employment that are often not specified in formal contracts.

2 Game-Theoretic Modeling of Social Networks as a Signaling Channel in the Labor Market

2.1 Prerequisites for a Model of Two-Sided Signaling in the Labor Market Where Both Parties Possess Private Information

This section presents a model developed by the author for the use of social networks as a channel for signaling unobservable characteristics by participants on both sides of the labor market. In contrast to existing signaling models in the labor market, where only workers possess private information about their individual characteristics (specifically, labor productivity), in this model, the hiring firm also possesses unobservable characteristics that matter to job-seeking individuals and influence their utility.The firm's private information concerns working conditions (non-contractible and unobservable), while the worker's private information pertains to labor productivity ("talent"). Signals are transmitted sequentially and mutually: first from the firm to job seekers, then from the applicant to the firm, culminating in contract formation.

We begin with a description of the players in this model: The Hiring Firm – operates in a competitive labor market and pays the hired worker a "fair" wage commensurate with their productivity. It is characterized by one of two types—"high" and "low" ($\tau \in \{h;\ l\}$), determined by Nature at the start of the game. The firm's

types correspond to workplace characteristics, relationships with management, and organizational culture that are not reflected in contracts. The firm's type is unknown to the other players. The firm's management decides whether to invest in a social media campaign (a signal) to present the firm as type h.

The Worker (a job-seeking individual) – possesses unobservable individual characteristics that influence their labor productivity. These characteristics are expressed in their type, also determined by Nature ($t \in \{H;\ L\}$). Workers observe whether the firm conducts a media campaign and, based on their beliefs about the firm's type, decide on exerting effort (a signal) in one of two ways:

- Effort to obtain additional education e affects the worker's productivity ("productive signal");
- Effort to present themselves on social media s does not affect the worker's productivity ("unproductive signal").

Workers may also refrain from investing in either type of signal.

"Nature" determines the types of the firm and the worker. With probability $p > 0$, the firm is type h; with probability $q > 0$, the worker is type H. Firm and worker types are independent of each other.

At the outset, the firm chooses investment in self-promotion via social media as an employer (e.g., corporate career pages on social networks with active updates and monitoring of review platforms), accounting for the fact that this hiring round's workers may represent different types with corresponding prior probabilities and differential responses to the firm's social media presence.

The worker selects educational and social signaling efforts $(e_{t_i}; s_{t_i})$. The social signal follows Kim (2007). We initially impose no constraint on total effort, though such a constraint may be introduced later. Cost functions satisfy the Spence-Mirrlees single-crossing condition, with social signaling cheaper than educational signaling.

The following model prerequisites must also be stated:

- The cost of any signal is higher for low-type players than for "high-type" players.
- The cost for any worker type of the educational signal is greater than the cost of the social signal.
- The return on effort exerted for additional education by a worker differs depending on the type of firm that hires them.
- Type H workers are characterized by higher labor productivity than type L workers at the same effort level, regardless of the type of firm that hires them.

We are interested in separating equilibria in the model, where the "high" type firm and worker invest in the signal, while the "low" type firm and worker do not signal.

A type h firm receives additional utility if the type H worker it hires exerts effort in presenting themselves on social networks (this will help attract more capable candidates in future "rounds" of hiring, thereby reducing the costs of future media campaigns).

2.2 Full Information Benchmark

Wages for the worker type T_i employed by the firm type t_i. After signal observation, the firm sets "fair" wages to compensate for observed efforts.

$$w_h^H = \alpha_h^H e + \beta_h^H s \tag{1}$$
$$w_h^L = \alpha_h^L e + \beta_h^L s \tag{2}$$
$$w_l^H = \alpha_l^H e \tag{3}$$
$$w_l^L = \alpha_l^L e \tag{4}$$

Low-type firms do not reward social activity to avoid dissemination of information about themselves as employers.

2.2.1 High-Productivity Worker (Type H)

observes a High-Quality Firm (Type h):

$$u_h^H = \alpha_h^H e + \beta_h^H s - \frac{e^2}{2k^H} - \frac{s^2}{2q^H} \to \max_{e,s} \tag{5}$$

First-order conditions (FOC):

$$\begin{cases} (e_h^H)^* = \alpha_h^H k^H \\ (s_h^H)^* = \beta_h^H q^H \end{cases} \tag{6}$$

observes a Low-Quality Firm (Type l):

$$u_l^H = \alpha_l^H e - \frac{e^2}{2k^H} - \frac{s^2}{2q^H} \to \max_{e,s} \tag{7}$$

First-order conditions (FOC):

$$\begin{cases} (e_l^H)^* = \alpha_l^H k^H \\ (s_l^H)^* = 0 \end{cases} \tag{8}$$

2.2.2 Low-Productivity Worker (Type L)

observes a High-Quality Firm (Type h):

$$u_h^L = \alpha_h^L e + \beta_h^L s - \frac{e^2}{2k^L} - \frac{s^2}{2q^L} \to \max_{e,s} \tag{9}$$

FOC:

$$\begin{cases} (e_h^L)^* = \alpha_h^L k^L \\ (s_h^L)^* = \beta_h^L q^L \end{cases} \tag{10}$$

observes a Low-Quality Firm (Type l):

$$u_l^L = \alpha_l^L e - \frac{e^2}{2k^L} - \frac{s^2}{2q^L} \to \max_{e,s} \tag{11}$$

FOC:

$$\begin{cases} (e_l^L)^* = \alpha_l^L k^L \\ (s_l^L)^* = 0 \end{cases} \tag{12}$$

2.3 Asymmetric information

We seek a separating equilibrium where high-quality firms (h) signal and low-quality firms (l) do not, enabling workers to correctly identify firm types

2.3.1 Type L Incentive Compatibility: Signal $\widehat{m}_h$

Payoff:

$$u_h^L\left((e_h^L)^*, (s_h^L)^*\right) = \frac{(\alpha_h^L)^2 k^L + (\beta_h^L)^2 q^L}{2} \tag{13}$$

No-deviation condition (exclusion ellipse):

$$\frac{(e_h^H - \alpha_h^H k^L)^2}{k^L} + \frac{(s_h^H - \beta_h^H q^L)^2}{q^L} \geq \left((\alpha_h^H)^2 - (\alpha_h^L)^2\right) k^L + \left((\beta_h^H)^2 - (\beta_h^L)^2\right) q^L \tag{14}$$

2.3.2 Cho-Kreps Intuitive Criterion

Minimize distance from type-H ellipse center to type-L ellipse boundary

$$\begin{cases} (e_h^H - \alpha_h^H k^H)^2 + (s_h^H - \beta_h^H q^H)^2 \to \min \\ \frac{(e_h^H - \alpha_h^H k^L)^2}{(k^L)^2} + \frac{(s_h^H - \beta_h^H q^L)^2}{(q^L)^2} = \star \end{cases} \tag{15}$$

Lagrangian:

$$\begin{aligned} \mathcal{L} = {} & (e_h^H - \alpha_h^H k^H)^2 + (s_h^H - \beta_h^H q^H)^2 \\ & + \lambda \left(\star - \frac{(e_h^H - \alpha_h^H k^L)^2}{(k^L)^2} - \frac{(s_h^H - \beta_h^H q^L)^2}{(q^L)^2} \right) \end{aligned} \tag{16}$$

FOC:

$$\begin{cases} e_h^H - \alpha_h^H k^H = \lambda \frac{(e_h^H - \alpha_h^H k^L)}{(k^L)^2} \\ s_h^H - \beta_h^H q^H = \lambda \frac{(s_h^H - \beta_h^H q^L)}{(q^L)^2} \\ \frac{(e_h^H - \alpha_h^H k^L)^2}{(k^L)^2} + \frac{(s_h^H - \beta_h^H q^L)^2}{(q^L)^2} = \star \end{cases} \tag{17}$$

2.3.3 Firm's Conditions

High-type firm expected profit under signaling:

$$E\pi_h = p\Delta_H + (1-p)\Delta_L - m \geq 0 \tag{18}$$

With linear benefits $g_{\tau_i}(s) = b_{\tau_i} s$, $b_h > b_l$:

$$p(s_h^H - s_h^L - s_l^H) + s_h^L \geq \frac{1}{b_h} \tag{19}$$

...