

## The Economics of Witchcraft and the Big Eye Effect

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*'Fair is foul, and foul is fair'*  
(*Macbeth*, William Shakespeare)

### I. INTRODUCTION

Witchcraft has been studied by historians and sociologists for a long time, nevertheless economists seem to ignore the matter. Michelet (1862) argues that witchcraft is associated with the propagation of old religions that were prohibited by christianism. Old gods were transformed into demons by the church. Palou (1957), on the other hand, extends this theory asserting that witchcraft is related to misery and is most likely to appear in places with social turmoil. This paper takes a different perspective to explain the existence of witches. The hypothesis is that witchcraft is one of the manifestations of envy. Witches are the persons who envy the success of others and behave in such a manner to hinder others' actions<sup>1</sup>. Witches can also be professionals, who primarily do work for others. An envious person could contract a witch to realise her/his personal desires<sup>2</sup>.

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1. This view contrasts with that of Thomas (1973). For him, witches are gifted people that are forbidden to use their talents. Schoeck (1969) points out that at the witch trials in Europe the accused were the persons who were envious, however, gradually, the envious became the accuser.
2. As jealousy and envy are naturally associated with love and sex, it is not surprising to note that one of the most common uses of witchcraft has been in sexual matters (Amadou 1954). Enchantments, magic beverages and other displays have been used to maximize chances of sexual success for centuries.

This paper explores the role of witchcraft in a team work environment. Teams operate with inside cooperation and competition. Each member in the team tries to do their best in order to maximise individual earnings. They screen their actions by comparing their output with their team mates' output. This is a kind of competitive behaviour. The cooperative behaviour coordinates the members of the team in order to maximise the team output, it thus limits the competitive behaviour.

Until now, the occurrence of free riding has been considered the most important problem related to teams (see Lazear 1998). The message of this paper is to show that witchcraft is another serious problem in the workings of a team. In order to minimise the free rider effect in teams, we restrict our analysis to small groups, where monitoring costs are almost nil<sup>3</sup>.

Academic departments provide a good example of team work in small groups and negligible monitoring costs. In particular, let's focus our attention on economic departments. In economic departments every member tries to maximise its number of publications and by comparing themselves with other members, they try to get higher salaries, position and respect. The department, by maximising the total number of publications, receives a higher grading by research agencies, which entitles the department to get more money, and improves its reputation in the academic market. Witches act in such an environment by lowering the productivity of their team mates. The witches envy their team mates' high productivity and behave in such a way as to make them less productive.

One way to make their team mates less productive is by increasing the quantity of bureaucratic work, for example. It is well known that unproductive scholars have an incentive to increase bureaucracy in academic life in order to decrease the average productivity of the department (McKenzie 1979). By doing so, the evaluation of their own work is improved, despite worsening the situation of the department as a whole. However, let's stress the difference between a witch and a free rider. Witches can be free riders, but this is not what characterises them. Shirking is not their primary purpose. Their interest is mainly to put their victims in bad situations in order to improve their relative position. In an academic department it means that a witch can be productive, but she/he envies others' achievements and behaves in a manner that hinders their efforts.

3. Small groups do not necessarily imply small monitoring costs. A basketball team is an example of a small group with high monitoring costs.

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Witchcraft has several other ways to do its job in more sophisticated and less apparent manners. Gossip, for example, is one of the most common and powerful tools of witches. Gossip is efficient, cheap, and the witches can easily be hidden as their authors. By spreading rumours they create misinformation, fear, personal enmity, poisoning the work atmosphere and increasing discoordination among fellows. In an economic department, knowledge transfer in teams is essential to discuss new ideas and conduct research<sup>4</sup>. By poisoning personal relationships through gossip, the witches diminish the group synergy<sup>5</sup>. A bad working environment lowers productivity.

In what follows, a model of research accumulation in which envy enters the utility function of the witches and the team's production function is presented. The research of the witch's victim is affected by witchcraft and it is shown that there is a fold catastrophe associated with envy and research accumulation. The sudden fall in the research accumulation is named the *big eye effect*<sup>6</sup>. It means that for specific levels of envy, any slight increase in the witch's envy leads to a complete disruption in the victim's research. The whole dynamics of the model yield a cycle between witch's envy and the research of their victim. The analysis of the model raises some measures to fight witchcraft.

## II. THE MODEL

There are two representative agents in the model, witches and normal people (called scholars). They work in an academic department. Witches are defined by having envy ( $E$ ) in their utility functions<sup>7</sup>. Witches are the ones who have pleasure in other's misfortune<sup>8</sup>. For each agent their income is assumed to depend on their research stock, on the average research stock of the team, and on their

4. This is confirmed by the increasing trend in multi-authored papers in economics (see Hudson 1996).
5. On the positive effects of group synergy and good work environment for research, see the interview with Clive Granger (1997).
6. Big eye is a Brazilian expression to describe the perverse effects of envy. The English expression is the *evil eye*.
7. Varian (1974, 1984) defines envy as a situation in which agent  $i$  prefers agent  $j$ 's allocation.
8. Sartre (1947) was right: hell is other people. In our case, hell is witches. For Schoeck (1969) envy is a universal sentiment present in every human being. However, as Schoeck stresses, the envier wants no envy in return. This is modeled here assuming that the witch is not envied by the scholar.

teaching duties<sup>9</sup>. Therefore, the wage of a member of the department varies with his research (his position inside the department), his teaching effort, and with the position of the department in the market, which is given by the department's average productivity<sup>10</sup>.

The representative witch's problem is the following:

$$\text{Max}_{E,c} \int_0^{\infty} U(c,E) e^{-\rho t} dt \quad (1)$$

$$\dot{W} = f(W, S, A(W, R, E)) - c \quad (2)$$

where  $W$  stands for the witch's research,  $c$  is her/his consumption,  $S$  is the teaching effort of the witch,  $A$  is the average productivity of the department,  $R$  is the representative scholar research, and  $\rho$  is the witch's rate of time preference<sup>11</sup>.

The representative scholar problem is the following:

$$\text{Max}_{c'} \int_0^{\infty} U(c'R) e^{-\delta t} dt \quad (3)$$

$$\dot{R} = F(R, T, A(W, R, E)) - c'R \quad (4)$$

where  $c'$  is the scholar's consumption,  $T$  is her/his teaching effort, and  $\delta$  is her/his rate of time preference<sup>12</sup>. Generally we can expect  $\rho > \delta$ , because envy makes people more anxious. Notice that scholars have research in their utility function and witches do not<sup>13</sup>. So, in this setup, team members do not have identical interests, beliefs, and information. Also, there is no manager to coordinate their actions as well (since there is no team decision function to be maximized).

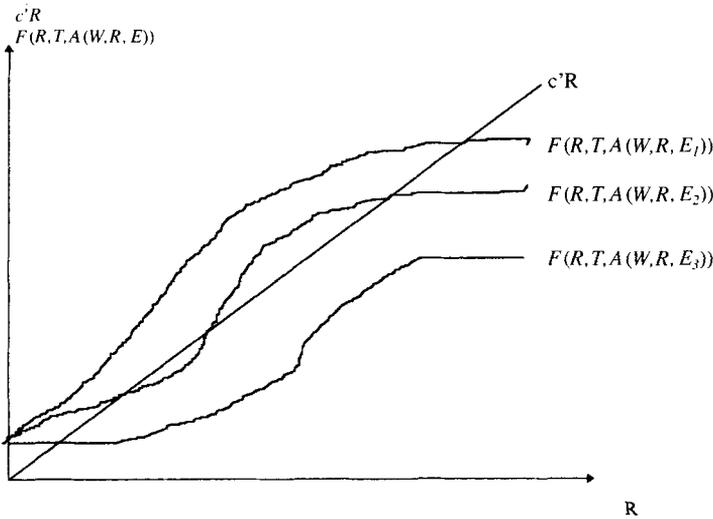
9. So there are basically few tasks for each agent: teaching and research. As these outputs are easily observed with some degree of accuracy, the design of their earnings avoids the problem of low-powered incentives as studied in Dixit (1997).
10. This idea captures the group-based incentive schemes. In the UK they are known as bonus systems and in the USA they are called gainsharing (see Bosworth et. al. 1996). It also captures some features of Holmstrom's (1982) forcing contract to limit the free rider problem. Notice that our payment scheme is less likely to exhibit tournament-type incentive contracts since they discourage cooperation (Lazear 1991).
11. The variable  $E$  represents any of the actions of envy, as gossip, for example.
12. This framework bears some similarity with Palokangas (1997) model of human capital accumulation.
13. It is assumed that there is no mobility of both agents.

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This is sufficient to distinguish our model from the traditional model of a team (see Radner 1991).

The big eye effect can be seen by taking equation (4) into consideration. In the steady state,  $\dot{R} = 0$ , we have a relationship between two functions  $c'R$  and  $F(R, T, A(W, R, E))$ , which appear in *Figure 1* below.

*Figure 1*  
The Effect of Envy on Scholar's Research for  $E_1 < E_2 < E_3$



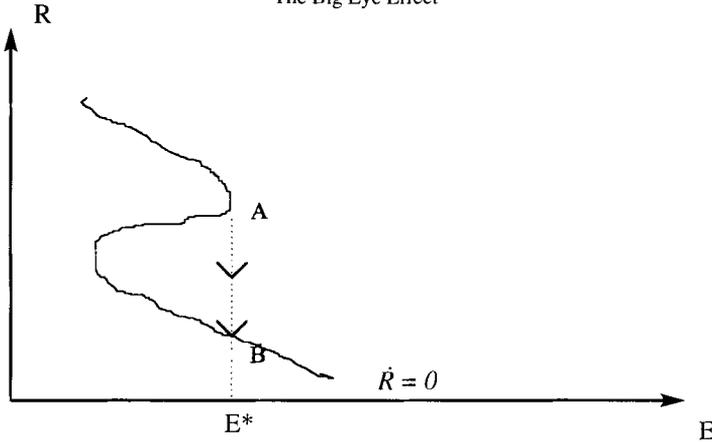
By analyzing *Figure 1*, notice that when the level of envy increases, the locus  $F(R, T, A(W, R, E))$  shifts to the right<sup>14</sup>. So the equilibrium values of research  $R$  jump. For low levels of  $R$ , there is an increase in  $R$ . On the other hand, for high levels of  $R$ , when envy increases,  $R$  falls down. This is a fold catastrophe<sup>15</sup> similar to that one studied by Varian (1979).

*Figure 2* shows the fold catastrophe. The big eye effect is precisely the sudden fall in the research output of the scholar (from A to B). It is associated with a determined level of envy  $E^*$ . The big eye effect is the worst effect of witchcraft and envy.

14. The shape of function  $F$  is explained by the fact that for small quantities of  $R$ , teams provide a positive spillover effect on scholar's productivity. After some point, however, decreasing returns start to prevail.

15. For a detailed presentation of catastrophe theory, see Thom (1975).

Figure 2  
The Big Eye Effect



The whole dynamics of our model is given by the relationship between the dynamics of envy and the dynamics of scholar's research (equation 4). The dynamics of envy comes from the solution of the witch's problem and is given by the following differential equation:

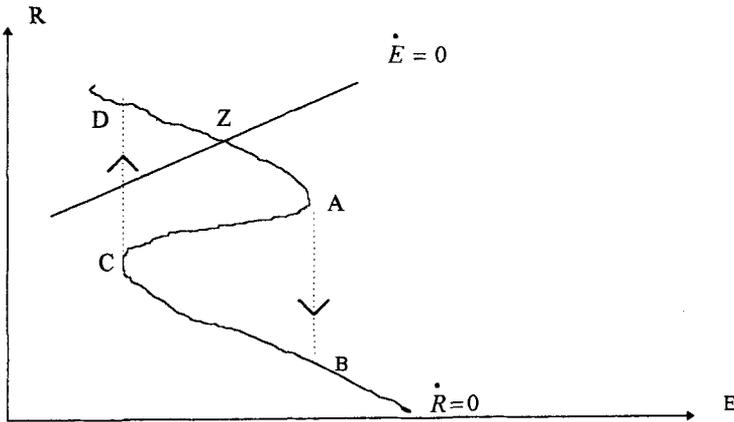
$$\dot{E} = \frac{U_E}{U_{EE}} (\rho - f_W - f_A A_W) \quad (5)$$

Envy evolves according to the difference between witch's rate of time preference and her/his productivity and the effect of her/his productivity on the average productivity of the department.

By inserting the steady state locus of  $E$ ,  $\dot{E} = 0$ , into Figure 2, we have the complete picture of the role of witchcraft on team work. Depending on the specifications of the witch's and scholar's production function (functions  $f$  and  $F$ ) and average output (function  $A$ ), the stability properties of the equilibrium can be assessed. However, qualitatively the result is quite interesting, Figure 3 shows that for small perturbations in  $E$ , there can be a cycle between the scholar's research and witch's envy.

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*Figure 3*  
The Cycle



The cycle is easy to be explained. If the scholar has an initial high productivity, the witch envies the scholar and tries to decrease her/his productivity. She/he increases her/his envy up to point A. As soon as the big eye effect occurs (from A to B), the witch's envy diminishes, since she/he does not fear any more the competition from the scholar. She/he has two incentives to decrease her/his envy. First, the economic motive, since the fall in the scholar productivity pushes down the average productivity of the department, it implies that the witch's earnings decrease. The other motive is that she/he will not gain anything by increasing her envy, since the scholar's productivity is at its lowest level. When her/his envy decreases to a certain level (point C), there can be a jump in the scholar's productivity (from C to D), which will increase the witch's envy and the whole process will be repeated.

In practical terms what occurs is that all the traditional displays of witches to decrease the productivity of the scholar, as gossip, creation of bureaucratic work, and others, operate until certain critical levels in which the scholar's research falls down. When it happens, the witch's situation improves, however, the department's situation worsens. As soon as it is realised, the department acts in order to restore the former average level of productivity. The work environment must be improved, the waste of time in useless activities is dropped, and after some improvements the scholar's productivity jumps again to the former level.

Simple measures can be taken to fight witchcraft. As the remuneration of the agents is reflecting the team performance, I will not discuss direct monetary

ways to avoid witchcraft. Instead, I prefer to suggest some nonpecuniary measures, such as norms. Norms are the best way to limit and control the variable  $E$  (witch's envy) in our model. Imposing strong and self-enforcing moral constraints (such as loyalty) helps to decrease the impact of gossip. As Sen (1973) has pointed out:

'people may be induced by social codes of behaviour to act as if they have different preferences from what they really have' (p. 258).

This implies that norms can drive the behaviour of witches, or, at least, minimise the impact of their actions<sup>16</sup>. The imposition of minimum productivity targets to each individual in the team assures that the witches have to take care their own work and not waste time acting to diminish scholar's productivity. The creation of clear rules to distribute and create bureaucratic work also limits witch's intentions. In general, every rule that defines the role of each member of the team works against the effects of witchcraft. *Finally, as soon as a witch is identified, do not burn her, just fire her!*<sup>17</sup>

### III. CONCLUSIONS

Witchcraft is one of the manifestations of envy. This paper has examined the role of witchcraft in a team work context. Witch is defined as the agent who has envy in the utility function. The model studies the dynamics of two different representative agents, witches and scholars. Their remuneration reflects the effort of the team, and as envy hinders the productivity of scholars, envy affects their remuneration. It is shown that for critical values of envy there can be a fall in the scholars productivity, which is termed the big eye effect. The big eye effect is represented by a fold catastrophe. The whole system is complete when the dynamics of envy are taken into consideration. A cycle between witch's envy and scholar's research is the outcome of the model. Prescriptions to fight witchcraft in team work are proposed. In general, the creation of simple rules defining the role of every member of the team helps to oppose witchcraft.

16. The point here is that rules are an external intervention that are designed to reduce intrinsic incentives of witches to act as witches. For a discussion on intrinsic motivation and extrinsic incentives see the presentation of Crowding Theory in Frey (1997). See also Kreps (1997). Lindbeck (1997) examines the interaction between economic incentives and social norms. For an overview of social norms and economic theory, see Elster (1989).

17. As a consequence, if the witch is identified and fired, the cycle and the big eye effect disappear.

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### SUMMARY

Witchcraft is one of the manifestations of envy. It has disruptive effects on team work. A fold catastrophe is shown to exist between the degree of envy and the productivity of the witch's victim. The big eye effect is the discontinuous dip in productivity, driven by an increase in envy. There is a cycle between envy and the productivity of the witch's victim. Witchcraft damages team work until the point at which the productivity of the witch's victim falls. When this happens, the witch's envy decreases and a recuperation to the former levels of productivity occurs. The model can be applied to improve team work management.

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ZUSAMMENFASSUNG

Hexerei ist ein Symptom von Neid und hat zerstörerische Auswirkungen auf Teamarbeit. Dieser Artikel zeigt, dass ein Zusammenhang zwischen dem Ausmass an Neid und der Produktivität der Opfer einer Hexe besteht. 'Big eye effect' bedeutet eine sprunghafte Abnahme der Produktivität, die durch eine Zunahme von Neid verursacht wird. Neid und Produktivität des Opfers bewegen sich gegenläufig. Die Hexe übt so lange einen schädlichen Einfluss auf die Teamarbeit aus, bis die Produktivität des Opfers fällt. Danach nimmt der Neid der Hexe ab und die Produktivität des Opfers steigt wieder auf die frühere Höhe. Dieses Modell kann zur Verbesserung des Managements von Teamarbeit angewendet werden.

RÉSUMÉ

La sorcellerie est un symptôme de l'envie. Elle a des effets destructeurs sur le travail en groupe. Cet article démontre qu'il existe une relation entre le degré d'envie et la productivité de la victime de la sorcière. L'effet du grand œil ('big eye effect') correspond à une chute abrupte de la productivité, due à l'augmentation de l'envie. L'envie et la productivité de la victime de la sorcière évoluent dans un sens contraire. La sorcellerie perturbe le travail en groupe jusqu'à ce que la productivité de la victime de la sorcière diminue. Quand ceci arrive, l'envie de la sorcière décroît et la productivité de la victime retourne à son niveau initial. Ce modèle peut être appliqué afin d'améliorer la gestion du travail en groupe.