Rock and Roll Bands, (In)complete Contracts and Creativity

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Abstract

Members of a rock and roll band are endowed with different creativity. They match and eventually obtain credit for song writing as well as a share of the returns from sales. More creative members increase the probability of success but may also claim a larger share of the pie. In our theoretical model, the nature of matching (postive or negative assortative) as well as the covariation between the probability of having a "hit" and the dispersion of credits given to individual members are a function of the completeness of contracting. When members adopt a "gentleman's agreement" to share credits equally, the covariation between the probability of a hit and the dispersion of credits is negative, which is the consequence of positive assortative matching in creativity. The data show that the relation between dispersion and success is significantly negative, and that rock bands are thus likely to sign incomplete contracts.

1 Introduction

In his analysis of the "battle" between the Beatles and the Beach Boys, Clydesdale (2006) suggests that the Beatles "should not be seen as creative geniuses but as a creative process, [behind which] were two dominant forces. First was the importance of rivalry with the Beach Boys and [secondly] the nature of the working team that possessed high levels of exchange and complementary blends of expertise and thinking styles." Clydesdale also suggests "that the structure of incentives is important in determining the nature of the creative output."

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Indeed, when production is joint, the charactersitics of partners and the nature of contracts are crucial in explaining the success or the failure of the partnership. Better partners increase the probability of success but may also claim a larger share of the pie. If contracts are complete, for instance if partners can choose an output contingent sharing rule *ex ante*, then the way they will match in partnerships is efficient: it is not possible to rematch agents in a way to increase total surplus in the industry. However, if contracts are incomplete, for instance if it is difficult to commit to sharing rules that are sensitive to the types of the partners, the way agents match is not necessarily surplus maximizing and can be quite different from the matching under complete contracting.[2]

This suggests that the pattern of matching can be an indicator of the degree of contract completeness. However, it is often difficult to measure directly the types of agents and therefore the nature of the matching pattern. This is the case here since we are concerned with how musicians endowed with different levels of creativity (for song writing) form groups. Creativity is not observable directly but can be indirectly measured by the number of credits that members of the band receive for writing songs. We develop a model where agents with different levels of creativity match and produce a joint output. When creativity within the group fails, the partnership can purchase a song created by other creators (outsourcing). Songs created within the group are more likely to succeed (think of them as specific to the group members' characteristics) than those created by outsiders. We consider two specifications of the model, one in which the members of the group can sign complete contracts, where, in case of success, the share of each partner can be specified freely, and another specification in which members are limited to incomplete contracts and use a "gentlemen's agreement" to share equally the returns from the activity.

The composition of the group affects the probability of creating within the group and the probability of outsourcing songs. When contracts are complete, musicians match in a negative assortative way: the most creative match with the least creative. Under incomplete contracting, musicians match in a positive assortative way:

[2]See Legros and Newman (2007) for a general analysis of matching models with nontransferabilities.

more creative musicians match with more creative musicians. This difference in the matching pattern has also consequences for the relationship between an index which measures the "dispersion of creativity" within the group (and is directly related to the matching pattern) and the probability that the group will have a "hit."

In the complete contract specification, there is a positive relationship between dispersion and success while when contracts are incomplete, this relation is negative. The data show that the relation between dispersion and success is significantly negative, and that rock bands are thus likely to sign incomplete contracts.

2 Specifying matchings

We consider *groups* where members are jointly involved in the creation and production of songs. Musicians have a creative type that is distributed with distribution $F(a)$ on $[0, 1]$; to simplify, we restrict attention to symmetric distributions.

Each group tries to create one song and produce it. A song that is "normal" brings a profit π_L while a "hit" brings a profit $\pi_H > \pi_L$.

For a given group $\langle a, b\rangle$, the process of creation is such that

- with probability $(1 - a)(1 - b)$ no member succeeds in creating a song. The group can then buy a song at market price q. This song will become a hit with a low probability p_L.

- with probability $a(1 - b)$ member a creates the song and gets the credit while with probability $(1 - a)b$ member b creates it and gets the credit. Because the song is created within the group, it becomes a hit with probability p_H, where $p_H > p_L$.

- with probability ab both members succeed in creating the song, which then becomes a hit with probability p_H. Because the creation is joint in this case, each musician receives a credit.

2.1 Matchings and success

Let

$$W = p_L\pi_H + (1 - p_L)\pi_L$$
$$V = p_H\pi_H + (1 - p_H)\pi_L$$

be the expected profits when the group buys a song from an outsider and when it produces a song created by one of its members. Clearly $V > W$ since $p_H > p_L$ and $\pi_H > \pi_L$.

At the time of creation of the band, the expected total profit is

$$\Pi(a, b) = (1 - a)(1 - b)(W - q) + [a(1 - b) + b(1 - a) + ab]V.$$

In the complete contracting case, profits are fully transferable between members; in the incomplete contracting case, profits are imperfectly transferable and we consider the extreme situation where profits are shared equally.[3] The other case corresponds to what the industry refers to as a "gentlemen's agreement".

The set of feasible payoff allocations within a group reflects contract (in)completeness. With full transferability, any allocation of $(u, \Pi(a, b) - u)$ between the two partners is on the Pareto frontier; with limited transferability, the Pareto frontier reduces to the pair $(\Pi(a, b)/2, \Pi(a, b)/2)$. An equilibrium specifies a matching function and a payoff allocation in such a way that two matched agents have a feasible allocation for this match and there exist no feasible payoffs for any two agents that are strictly greater than their equilibrium payoffs.

As is well know, in the complete contracting case, the ex-ante formation of groups will maximize total profit in the band, and the way musicians match reflects their comparative advantages. Here, since $\frac{\partial^2\pi(a,b)}{\partial a\partial b} = W - q - V < 0$, the marginal pro-

[3] Imperfect transferability arises if it is too difficult to contract on shares of profits as a function of the characteristics of the agents. One explanation for this is the difficulty to prevent renegotiation and hold-up (Grossman and Hart, 1986): once a song is created, the other musicians could threaten to leave the group or not to produce the song if they do not get a higher share of the surplus. If the song created within the group has no value outside the group, this leads to equal sharing.

ductivity of a given type is *decreasing* in the type of the partner. There is therefore negative assortative matching in equilibrium and if $m(a)$ is the match of a, we must have by measure consistency that $F(a) + F(m(a)) = 1$; since we assume that F is symmetric, it must be the case that $m(a) = 1 - a$. In this case, the expected probability of success is

$$S(a) = p_H - a(1-a)(p_H - p_L), \tag{1}$$

which is increasing in a for $a \geq 1/2$ and decreases if $a < 1/2$. Because there is negative assortative matching, the variance of types in the group varies with a, and in particular the number of credits that each member receives also varies with a. Note that the total number of credits in the group is $a + m(a) = 1$. It is independent of a and therefore the shares of credits received by the partners in equilibrium are $(a, 1-a)$.[4]

By contrast, in the incomplete contracting case, each musician a wants to match with the musician b that maximizes $\frac{1}{2}\Pi(a,b)$: the process of matching is no longer governed by comparative advantage but by absolute advantage. Since $\Pi(a,b)$ is strictly increasing in b, all musicians want to match with the highest possible type, and this leads to positive assortative matching: now, $m(a) = a$.[5] The probability of success is then

$$S(a) = p_H - (1-a)^2(p_H - p_L) \tag{2}$$

which is *increasing* in a.

2.2 Matchings, sharing and outsourcing

The "dispersion of creativity" measure that we use is a "normalized" Herfindahl index: the sum of the squares of the shares of credits divided by the total expected

[4] a is the only one to receive credit with probability a^2 and shares the credit with the other member with probability $a(1-a)$.

[5] This is true for any distribution F.

number of credits in the group. In the complete contracting case, this index is

$$D(a) = a^2 + (1-a)^2 \tag{3}$$

which is increasing in $a > 1/2$ and decreasing in $a < 1/2$. There is therefore a positive covariation between S and D in the complete contracting case.

If contracts are incomplete, the number of credits that go to each member is a while the total number of credits is $2a$. Hence each partner has an equal share of credits, leading to

$$D(a) = \frac{1}{4a} \tag{4}$$

which is *decreasing* in a. There is therefore a *negative* covariation between S and D in the incomplete contracting case.

There also exists a covariation between outsourcing (buying a song instead of creating it) and dispersion. It is easy to see that, in the case of complete contracting, outsourcing is equal to

$$O(a) = a(1-a) \tag{5}$$

which is increasing for $a < 1/2$, and then decreasing. By contrast, if contracts are incomplete

$$O(a) = (1-a)^2 \tag{6}$$

which is decreasing in a.

This leads to the following proposition, which will guide our empirical strategy in the next section.

Proposition *In the complete contracting case, there is a positive covariation between the expected probability of a hit and the dispersion of credits within the group. This covariation is negative in the incomplete contracting case. The covariation between outsourcing and dispersion is negative in the first case and positive in the second one.*

The model developed here deals with two-member bands. In reality, the number of members who are credited is sometimes larger than two, but the basic insight concerning matchings and the (in)completeness would not be different.

3 Data

The database consists of albums created by all 151 bands that are listed in Dodd's (2001) *Book of Rock* and started their career between 1970 and 1979. Dodd's definition of rock includes not only the most important artists in the genre but also musicians who had a significant influence on the pop/rock scene. Larkin's (2006) *Encyclopedia of Popular Music* is used to establish discographies. To treat each band equally, we adopted a 25 years span limit for all of them. For example if a band released its first album in 1975 we track its discography up to 2000. In most cases, the lifetime of a group is shorter than 25 years and in any case 25 years is a period long enough to be representative of a musician's creative output. Compilation or live albums which collect songs from different studio albums are excluded. The final database consists of 1,494 albums released between 1970 and 2004 by 151 bands. Since we are interested in bands where several members are active, we excluded albums in which all credits go to a unique musician. This reduced the database to 107 bands and 982 albums.

Certifications awarded by the Recording Industry Association of America (R. I. A. A.) are used as proxies for success. R. I. A. A. awards albums that reach a minimal number of sales. Gold and platinum awards (introduced before 1976) certify sales of 500,000 and 1,000,000 units, respectively. Multi-platinum (2 million units sold) and diamond (10 million) awards were introduced in 1984 and 1999 respectively. To avoid "backward spillover effects" due to awards given to new releases of old albums, the only certifications taken into account are those obtained at most one year after the date of the first release. This leads to 110 platinum (multi-platinum and diamond) and 123 gold awards, while 749 out of the total of 982 albums received no award.

Two reasons led us to use albums instead of bands. First, bands are often unstable. Though the name of the band may remain the same, members change, and it would have been difficult to deal with such changes, which amount to 37%. Second, the number of albums is much larger than the number of bands. This turns out to assume that each album is produced by a different band.

Following our theoretical model, two variables define the internal organization of a band, or here, of an album: dispersion and outsourcing. Dispersion is defined as the Herfindahl index divided by the total number of credits. Outsourcing measures the share of songs that a band buys on the market for songs. On average, 6% of the production is outsourced.[6] Success is represented by a dummy variable that takes the value 1 if the album received at least a gold award, and 0 otherwise.[7]

Table 1 gives an overview of the data. It is useful to note that the percentage of awards is roughly the same for soloists (21%) and for groups (24%), but soloists have to outsource three times more than groups.

4 Results and Conclusions

Proposition 1 provides an easy way to test which model (complete or incomplete contracting) is relevant, since the sign of the correlation between success and dispersion, and between outsourcing and dispersion tells us which type of contract is signed. Results are summarized in Table 2. Since success is a dichotomous variable, we simply test whether the difference in mean dispersion is different in the case of no success and success. The test shows that the difference is significantly negative and has a very low probability (0.0002) of being positive. Similar results are obtained with logit regressions, whether we introduce or not exogenous control variables.[8]The coefficient of success on dispersion is significantly negative in all cases. The correlation coefficient between outsourcing and dispersion is equal to 0.09 which is significantly different from 0 at the 0.5% probability level. Both results lead the

[6]Note that dispersion and outsourcing are calculated as above, but may differ across albums.

[7]Separating gold from platinum and multi-platinum, does not change the results.

[8]The control variables are the following: (a) a dummy variable equal to 1 if the band is American, 0 otherwise; (b) a dummy variable equal to 1 if the label is from one of the majors, 0 otherwise; (c) a piracy variable equal to 0 before 1999, and to 1 afterwards, to take into account that sales may have decreased as a result of piracy, and therefore success more difficult to reach.

conclusion that contracts are incomplete and there is positive assortative matching of partners in a band.

5 References

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Table 1. Description of the database

	Soloists	Groups
No. of bands	44	107
No. of albums	512	982
No. of (multi-)platinum and diamond awards	66	110
No. of gold awards	41	123
No. of albums with no award	405	749
Average dispersion	1	0.04
% of changes in the composition of bands*	0	37
% of outsourcing	20	6

"Soloists" are bands where all the credits go to a unique member (Michael Jackson, for example). "Groups" are those who distribute credits to several members (Led Zeppelin).We assume that if the leader of a solo band changes, the name of the band changes.

Table 2. Estimation Results (success and dispersion)
Groups Only

Comparison of means of dispersions	
Success = 0	0.050
Success = 1	0.026
Difference of means	-0.024 (-3.56)
H_0 : Difference < 0	Pr = 0.9998
Coefficients of logit regressions, dependent variable is success	
Dispersion only	-8.46 (-3.81)
Intercept	-0.88 (-8.99)
Dispersion	-10.77 (-3.88)
USA group	0.91 (5.52)
Major label	2.10 (8.25)
Piracy	-0.63 (-1.11)
Intercept	-2.80 (-10.90)
No. of observations	982

Note: t-value for the comparison of means' test; z-values for the coefficients of the logit regression