Contributions to Game Theory and Management, IX, 328–367

Incentive Plans Improvement in Movie Value Chain: USA Motion Picture Industry *

Ekaterina Zaytseva[1] **and Margarita Gladkova**[2]

[1] *St. Petersburg State University,*
7/9 Universitetskaya nab., St. Petersburg, 199034, Russia.
E-mail: zaytseva-k@yandex.ru
[2] *St. Petersburg State University,*
7/9 Universitetskaya nab., St. Petersburg, 199034, Russia.
E-mail: gladkova@gsom.pu.ru

Abstract The purpose of the research is to investigate the motives of cooperation in the movie production and to improve the methodology of incentive income imputation formation on the basis of appropriate game-theoretical model construction. As a result a systematized methodology of the income imputations definition generated by the product of cooperation (movie), which can be used as a decision-making support tool in negotiations about shares of the income allocation among the participants of the cooperation of the movie creation, has been elaborated. It should be accentuated that it is not assumed that the implementation of the methodology will give the revenue imputations, which could be taken as per se, however, it can become a substantial help during negotiations of the parties involved about their participation in revenue. The applicability of the methodology has been tested on the cases from Hollywood practice.

Keywords: motion picture, members of motion picture industry, box-office, revenue-sharing contracts, cooperative game, imputation, nondominant revenue imputation, optimal imputation.

1. Introduction

Movie business is an extremely complex business, which involves a lot of people, a lot of interactions among various legal entities, high level of uncertainty about the outcomes of each single project, and thus leaves a lot of loopholes for unfair behavior and possibilities for manipulations. By analyzing the process of movie production, distribution and exhibition, we can trace a very important problem existent in the industry – the issue of optimal incentives for the participants of movie value chain. This issue can actually be broken down into two problems, which constitute two parts of the incentives alignment problem in the movie industry.

The first problem concerns the contract design among the participants of the movie value chain. The demand for the movie is very difficult to assess beforehand, and it can never be forecasted with 100% precision. At the same time the prevailing part of the investments is made at the initial stage, when the final result is completely unknown. The thing is that in the course of project realization some factors appear, which influence the revenue allocation, but which impede its division proportionally the financing of the budget. New groups of participants appear, such as leading actors and directors, which have the ability to substantially increase the

* This work was supported by the Russian Foundation for Fundamental Researches under grants No.16-01-00805.

box-office by their participation in the project. This gives them the advantage during negotiations concerning the level and the form of their compensation. Having a significant bargaining power, they can claim not only for the flat fee, but also for the percentage of revenue or profit (depending on the contract terms) of the project realization. At the same time actors and directors do not finance the budget, and rather on the contrary consume a part of it. According to Epstein (Epstein, 2011) sometimes, although the agreement on the shares is set, the parties may not be fully satisfied with it due to different reasons. For instance, in the case of the production of the movie "Terminator 3: Rise of the Machines" Arnold Schwarzenegger was given the unprecedentedly large share of revenue as a part of compensation without a reasonable basis from the perspective of producers, but they had to undertake this step due to the requirements of the investors. If the producers could underpin their decision with some tool, maybe the situation could have been different, and they would not have had to pay such a large compensation to Schwarzenegger. If a question of inclusion of certain agent of movie making into the allocation of the common revenue is left without attention, different internal problems may arise, such as conflicts between producers from one side and actors and directors – from another, which might activate the problem of lost opportunities and, consequently, smaller amounts of box-office. So here the central question is how to form the cooperative contract, i.e. which percentage of the revenues to assign to each participant.

The second problem concerns the contracts realization in the movie value chain. When the contracts are formed, and the shares of the chain participants are agreed on, they need to be implemented. The agreements among companies, which constitute the main links of the value chain, are in a form of participation contracts, meaning that everybody's income is dependent on the final revenues, generated by the movie. However, currently the value chain has such a form, which allows different parties to behave opportunistically. This issue is thoroughly elaborated by Vogel (Vogel, 2015), who explains how parties tend to cut themselves a larger lump of the pie by artificially increasing their costs on the books, thus leaving a smaller amount for next participants to share. Wasko (Wasko,2003) and Eliashberg (Eliashberg, 2005) support this idea explaining that the weights of the chain participants are different, and some of them may deprive others from the part of the revenue they can obtain by manipulations with numbers or by exertion extra pressure on weaker players. In other words, the profit is allocated unfairly. For instance, producers can very often find themselves in an instable position, since the distributors, being the part of huge media conglomerates, have all the conditions to play with numbers on the books by artificially bloating costs, and at the same time the producers have to set agreements with the talent, who can also manipulate their remuneration by imposing special terms on their participation in the project. Therefore, the gap for the research appears: how to incentivize the participants to act fairly, and consequently to minimize the losses of the weakest players of the chain. Basically, the opportunistic behavior can be eliminated with the mechanisms of the contract implementation in the value chain. Special terms should be introduced, which would mitigate the risk of cheating, and motivate every participant in the chain not no overestimate the costs. Coordination contracts principles can help with the solution of this problem.

1.1. Movie making process

Movie production is a process which consists of a lengthy consequence of the unique creative decisions leading to creation of a product from the initial story till the release and the exhibition in the movie theaters, on television or in the Internet. Movie making process consists of several major stages: Development, Pre-production, Production, Post-production and Distribution.

Development. At this stage a producer selects a story, which may be based on a book, play, game, true story, be an original idea, which can vary from a general idea to a finished script (Vogel, 2010, Squire, 2004). In some cases a producer (or a studio) asks a scriptwriter to write a new (or to adapt an existing) script. However, usually the scriptwriter with the help of a literary agent gives the first draft to several independent or affiliated with the studio producers. If a producer is interested, both parties sign the option-type contract, which gives a producer a right to buy the finished script and a scriptwriter gets an up-front fee (a share of which is taken by the literary agent). From this point on substantial funding resources are required in order to start the project. The financing is not that problematic, if the producer is affiliated with the studio. When signing the contract with the studio, the producer usually gives up the studio a significant portion of rights, which are connected with the sequels, new episodes of the series, distribution. Funding is much more challenging, if a producer doesn't have an agreement with the studio, he needs to find the initial funds from other sources, which is a very difficult task, especially if there are no guarantees concerning the distribution (Eliashberg, 2005). The final version is submitted to investors, studios and other interested parties. For the assessment of the potential success of the movie even at the early stage a distributor can be attracted, who analyze the genre, the target audience, the success of the similar movies in the past, the actors and potential directors. All these factors imply some attractiveness for the spectators. Not every movie can be profitable only from theatrical exhibition, thus the production companies also take into consideration box-office in the world and the DVD sales. Producers and scriptwriters prepare the movie pitch, or treatment, and present it to potential investors. The parties involved negotiate the terms of the deal and sign the contract. As soon as the parties have met and the deal has been set, the movie may proceed to the pre-production stage.

Pre-production. Pre-production is the longest and definitely very important period. Producers hire the director, the actors and the crew, search for shooting locations, think of the design of the production set and the costumes, calculate the budget, based on such factors as script, expenditures for post-production (for instance, for special effects), starting salaries and funding potential. The production budget is compounded and the production expenditures are calculated. In case of massive projects, apart from anything else, the insurance is acquired for the protection of unforeseen circumstances. Then the producer hires the crew, which will be working on a movie production during several months. In many Hollywood blockbusters there are hundreds of people involved, while low-budget independent movies are sometimes created with only eight-nine people (Eliashberg, 2005).

Production. At this stage the crew is enlarged. The production period may last several months, but due to the high cost of this stage, producers try to minimize it by thorough planning and rational organization of the shooting process.

Post-production. At this stage the movie is assembled by the movie editor. The shot material and the sound are edited, and then all the sound elements are married

to the picture and the work on the movie is finished (Weis & Belton, 1985). Usually post-production period lasts longer than the production stage, up to several months in duration. Editing process is often called the second director's production, because with its help it is possible to change the concept of the picture.

Distribution. At this stage the motion picture is released to the big screens. The massive marketing campaign starts. Upon the release distributors usually launch press-releases, interviews with press, preview screenings and film festival screenings. Movies are shown in predetermined cinemas and several months later they are released on DVD. The box-office is then allocated among the exhibitors, the distributors and the production company.

1.2. Producer-studio relationships

There exist different schemes of the relationships between the producers and the studios, which determine the income distribution among them. There are five basic financing-production and distribution options, described by Cones (Cones, 1997). Those are:

1. *In-house production/distribution.* Under this contract the studio (the distributor) finances all phases of the project. In this case a producer, who is responsible for a movie acts as an employee of the studio.
2. *PFD (production-financing-distribution) agreements.* In this case an independent producer comes to the studio/ distributor with a project, where all core elements are already defined, and the studio provides financing of production and distribution.
3. *Negative pickup agreements.* Under this agreement the distributor acquires the original negative with the distribution rights. In other words, it is responsible for distribution and pays the production costs.
4. *Acquisition deals.* The distributor is in charge of the distribution only, and the funds for production is given by other parties.
5. *Rent-a-distributor deals.* In this case practically all financing for the production and distribution has been provided by other parties, and the finished movie is ready for the distribution.

The difference in producer-studio relationship results in different value chains, and thus different problems, arousing on each of the links. This paper concentrates on movie production by an independent producer. First of all, the process is more complicated in this case, and the income distribution is not as obvious as in the case of studio-affiliated production, where a studio, being an extremely powerful player, imposes its own rules of the game, and no other party has enough power to command its own terms. Moreover, in case of studio-affiliated production, both the production and the distribution are under control of the studio, meaning that no contracts exist between the producer and the distributor, thus there is no problem of coordination of contracts. Basically, no contract disputes can occur in this situation. This situation is very advantageous for the studio, however, it is extremely disadvantageous for all other participants, who signed the agreement for sharing contract, because studios very often blow up the expenditures, and profitable movies in reality show no profit at all on the books. What is more, in the case when producer is affiliated with studio, he loses the rights for the movie, including the rights for the last word in the creative part of the production.

There are a lot of participants of this chain. Those are: the producer, the distributor, the exhibitors, the talent (actors, director, etc.), the scriptwriter, agents (of the scriptwriter, actors, etc.), the investors, the banks, the insurance company.

Rodnyansky (Rodnyansky, 2013) identifies following steps of the movie value chain from the idea creation till the delivery of the movie to the spectators:

1. The scriptwriter creates a script.
2. The scriptwriter finds an agent. If the agent considers the script promising, he starts offering it to the production companies.
3. The producer buys the script and develops it and simultaneously taking care of the search for actors and director.
4. When the script is ready, and the leading actors expressed their confirmation of the participation in the project, the work on the budget and calendar schedule starts.
5. The producer starts negotiations with American distributors.
6. The producer signs the contract with the distributor. If the potential of the movie is high, the contract may imply the payment of the minimum guarantee (MG). For the movie with a budget from $15 mln. to $60 mln. MG may constitute around $5 mln., but such term is quite rare in the contracts. Usually, another guarantee is stipulated: the minimum number of copies, on which the movie will be released, and the minimum budget for the release (P&A).
7. With the mastered support of the American distributor, the producer starts negotiations with sales companies, which take care of the presales of the rights to the international distributors.
8. The location is defined.
9. The next very important step is the getting a completion bond, guaranteeing that even in the case of acts of God, the movie will be finished in accordance with the approved script, budget and calendar schedule. Without the completion bond the producer cannot approach investors or banks. The issuing company reads the script, questions experts on the financial success potential, checks the budget, meets the director and sometimes the leading actors. The amount of the insurance is the budget of the movie + 10% for the unbudgeted expenses. The cost of the completion bond is usually not over 6-7%. The representative of the insurance company is always present on the set of the movie.
10. In order to get the money on security of presales, agreements with the authorities of the state about the reliefs and, if necessary, in order to get the missing amount in the budget, the producer can approach the bank, private or institutional investors.
11. The production and post-production phases are carried out.
12. The work with the US distributor about the positioning of the movie, marketing campaign, etc. is carried out.
13. Realization of other rights. (if any are left after the agreement with the local distributor): VOD, DVD, television.
14. Release of the movie.
15. From the proceeds made by the movie, movie theaters take 50% and the rest of the receipts are given to the distributor. The distributor subtracts expenses for the release (P&A), the amount of the minimum guarantee, if it was paid, and its share of the gross. Money left after the payments on a full scale is passed to the producer.

16. Usually, the first to get the money are banks, which gave loans secured on rights, the next are private investors. Often share of the profit is also given to the director and the main stars of the movie. The last one to get the money is the producer.

2. Cooperation in movie value chain

2.1. Bargaining and negotiations

In the motion picture industry the question of box-office revenues allocation among its creators is always a topical one. The investors have to get the profit, since it is their return on investments. The producers get all the residual income, which is left after the exhibitors and the distributors take their shares. The producers pay back the borrowed money to the investors. However, there are a lot of reasons, why sharing contracts may be arranged with those participants of the movie making process, the contribution of who is intangible. In other words, the producers, who by the principles of motion picture industry get the rest of the money after all deductions, start sharing income from the movie with those participants, the contribution of who is very difficult to assess financially. In this paper we are considering predominantly the case of an independent movie production and consider the following players: producers, actors and directors. The model, where the producer is affiliated with the studio works with completely same logic, the difference is only in the names of the cooperation participants: instead of the producer, the distributor will share revenue with actors and director. Going back to our schematic representation of the movie value chain, now we consider the relationship among the players of the first link of the chain.

The question arises: what exact percentage from the income it is needed to set in order for all the parties to be satisfied and not to have objective reasons to decline the solution. It is quite obvious that the larger power is in the hands of producers, since they are the owners of the rights of the movie, and thus they want to arrange a deal in the most favorable way for themselves. At the same time the stars do not want to agree for the terms, which will not satisfy them sufficiently. The conflict situation appears. Instruments of game theoretical modeling come to the aid, and with their help it becomes possible to define the income imputations in different forms. These imputations can be used as a basis of negotiations. Certainly, a huge role play the skills of the producer, studio representative, agents or lawyers of actors and directors to negotiate more favorable for their own side terms and conditions, but the method, which will be described later in the chapter, is suggested to be used only as a base for negotiations of this type. It serves as a tool for decision-making support.

2.2. Cooperative contract as cooperative game

Imputation in cooperative game. Let's consider game in characteristic function form - game $\Gamma =< N, v >$. Here $N = \{1, 2, \ldots, n\}$ - set of players (in our case those are producers, a director and actors, which can claim for a share of movie proceeds). The real-valued function v with the set of players N defined on coalitions $S \subset N$ is called a characteristic function of the n-person game. Here the inequality $v(T) + v(S) \leq v(T \bigcup S)$, $v(\emptyset) = 0$ holds for any nonintersecting coalitions T, S ($T \subset N$, $S \subset N$) (Petrosyan, Zenkevich, 2016, p. 168). This is called a *superadditivity property*, which means that the payoff of the united coalitions is no less than that of

the two nonintersecting coalitions, when they act independently. If this inequality is not fulfilled (which means that the united coalition does not bring additional payoffs), then the unifying into coalition is senseless, and it will be more rational for the players to act independently. Let's consider that the issue of imputation choice is modeled by a cooperative game.

Value $v(S)$ is a gain of the coalition S, i.e. that payoff, which the participants can get when working together. In game theory it is supposed that function $v\,(S)\,,\ S \subset N$ has a superadditivity property (Petrosyan, Zenkevich, 2016, p. 168), meaning, how has already beed described earlier, the payoff of the participants, if they work together, should be bigger than the sum of their payoffs in case they work independently. In case of the movie industry this property is always fulfilled, since only in cooperation participants can create the final product (a different matter is that the composition of the participants may vary), and all together they achieve a synergetic effect. From the superadditivity property it follows the inequality $\sum_{i=1}^{k} v(S_i) \leq v(N)$. This implies that the maximum payoff may be achieved only upon participation of all players in the maximal coalition, and there is no such decomposition of the set N that the guaranteed payoff to these coalitions would exceed the payoff of all players acting together $v(N)$. Thus, all participants have a motive to cooperate in confines of the maximal coalition. Let's discuss, what happens in terms of motion picture industry. No participant (producer, director and actor) can create a movie by himself only or in a tandem with another participant. The project will be realized only upon the participation of all three parties. Consequently, we can say that there is an obvious synergetic effect.

Now let's bring in the notion of the payoff *imputation*. The vector $\alpha = (\alpha_1, \ldots,\ \alpha_n)$, which satisfies the conditions

$$\alpha_i \geq v\,(i)\,,\ i \in N, \tag{1}$$

$$\sum_{i=1}^{n} \alpha_i = v(N) \tag{2}$$

where $v\,(i)$ is the value of the characteristic function for a single-element coalition $S = \{i\}$, and α_i is the payoff of the same coalition, is called an imputation (Petrosyan, Zenkevich, 2016, p. 171).

Condition (1) of the imputation is called an *individual rationality condition*, and it implies that in order for a member to decide to participate in a coalition he should receive at least the same amount he could receive if acting alone without support of other players. Condition (2) is called a *collective (or group) rationality condition*. It implies that there are no other imputations of the payoff of $v(N)$, which would bring each player a larger payoff than the considered imputation. Consequently, only if the condition of collective rationality is fulfilled, vector $\alpha = (\alpha_1, \ldots, \alpha_n)$ can be taken as admissible. Therefore, in order for the vector $\alpha = (\alpha_1, \ldots, \alpha_n)$ to be an imputation in a cooperative game $\Gamma =< N, v >$, it is necessary and sufficient that it could be represented as $\alpha_i = v\,(i) + \gamma_i,\ i \in N$, where $\gamma_i \geq 0$ payoffs from cooperation of the player $i \in N$. Meaning that each player should gain more in cooperation, than he would gain by acting alone. If the condition $\sum_{i \in N} v(i) < v(N)$ is fulfilled, the game is called essential. This means that cooperation brings a positive payoff.

Cooperative contract in movie production. In motion picture industry, when the movie is under production the main participants of the process face the

problem of income allocation, which they earn from the movie release. As a payoff $v(N)$ we will consider the revenue of the movie excluding the share of the exhibitors (usually 50% of the total box-office), because as it has been discussed in the first chapter of the paper, the exhibitors get their share before the proceeds are distributed among those who actually produced the movie. However, it is important to note that the decision about the receipts allocation is made at the initial stage, when neither the final result nor the success of the movie is known. Thus, the forecasted box-office is considered as payoff. Consequently, the issue of the characteristic function construction arises. It is needed to calculate the value of the characteristi function for the contribution of each participant. At this point we need to look more precisely at the principles of the expected box-office calculations. Analysts look at the movies of the same genre, with the cast of the similar class, and then basing on that data they make their forecasts about the box-office for the new movie. Moreover, they look at the box-offices of the movies with the participation of the certain leading actor and compare them to the movies of the same genre with less renowed actors. Moreover, movies of the director, which pertain to the same genre, as the one under production, are analyzed. All those estimations are taken into consideration, and on their base the forecast of a specific movie is made. In Hollywood there exist various advanced box-office forecasting models, which allow to obtain quite accurate estimates.

In order to demonstrate the mechanisms of the imputation calculations mechanisms we would like to show them on numerical examples. First, let's consider a fabricated example, and later in the paper examine real cases from Hollywood practice. So let's assume that a certain movie "Z" is produced. As we remember, the producer is a person with ultimate responsibility for a movie, meaning that he owns all the rights (if we consider an independent movie production). He is responsible for finding the funding for movie creation, which can come from different sources, including his own assest. Those mechanisms were discussed in the first chapter of the paper. So basically, he either spends his own money, or he has an obligation to the investors to pay back the borrowed money. Thus, we will consider that his contribution will be estimated proportionally to the financing assets he brings to the project, since for the purposes of this model we assume that the producer is in possession of the sum of money, which is enough to make a movie. What is more, the producer later deals with the investors with the money, which he receives as a part of revenue distribution deals, that is why it is also important to make sure that the producer makes enough money to pay back. Moreover, money as a hard asset stresses the high bargaining power of the producer. Now let's move back to the example. The movie's "Z" budget equals to $20 mln., however, due to high risks of the project, two producers: producer A and producer B, decide to cooperate in order to share risks, and each of them commits $10 mln. For the leading role a star actor X with worldwide recognition is invited. It is forecasted that his participation may significantly increase the movie's box-office. It is expected that on condition of this actor's participation, the box-office will equal $200 mln. At the same time without this actor the movie will also be able to become profitable, although not to such an extent: the box-office is forecated to be $160 mln. So it is possible to say that by his participation actor X is increasing the box-office by $40 mln. Since the participation of this actor significantly augments the profit-earning capacity of the movie, it will be more advantageous to all of the project participants, if he stays in

the project. In other words, this actor obtains a large power to influence his remuneration. He may set a deal for movie earnings participation. Since in our case we consider an A-list star, let's consider that he is able to sign a contract for revenue (and not profit) participation. Here the issue arouses: what share exactly to offer an actor in order for him to have enough motivation to work on the movie, but at the same time not give him a share, which would be too large, in order to guarantee the return on investments to producers. It is also needed to take in account the uncertainty of the box-office, because the forecasts do not have 100% accuracy and in reality they may be far from estimations.

The revenue, which will be divided among the considered participants after the deduction of the exhibitors share (50%) will equal to \$100 mln. or $v(\{1,2,3\}) = 100$. Now let's find out, how much the players will be able to earn, if they do not operate in maximal coalition. Not a single player will be able to create a movie alone, and consequently to gain additional gains. So $v(\{1\}) = v(\{2\}) = 10$ (each producer has his \$10 mln.); $v(\{3\}) = 0$ (the actor does not earn anything). If producers A and B try to make a movie without this actor, they will manage to do it, because they can hire another less famous actor, which will not claim for revenue share. However, the expected box-office of such movie will be smaller and will equal to \$80 mln. or $v(\{1,2\}) = 80$. If any of the producers tries to create a movie on his own, none of them will succeed due to insufficiency of the budget. Thus, the producers will only have their \$10 mln. in hand: $v(\{1,3\}) = 10$; $v(\{2,3\}) = 10$.

The imputation of this cooperative game is an allocation of revenue, gained under cooperation. It is worth stating that the superadditivity property is fulfilled, which assumes that each player in coalition should add some value to this coalition. Now let's move to the definition of income imputation.

2.3. Optimal imputations in cooperative game

Nash bargaining solution. Obviously, for each player the notion of optimality means the maximization of his share of cooperation payoff. However, not a single player can guarantee the maximization of the payoff, since the matter is the division of the common payoffs.

First of all, let's consider bargaining problem (Petrosyan, Zenkevich, 2016, p. 160). It will allow us to define the upper border of pretentions of the weakest participant of cooperation, in our case an actor (or a director), since their contribution to cooperation is intangible and therefore difficult to assess. The thing is that negotiations about the way, how to allocate the proceeds, may last infinitely long, and then end up with no result, if systematical approach is not applied. Thus, the reasonable solution to a dispute would be to invite some independent arbiter, who has an equal attitude towards all the parties, and who would act fairly. If the arbiter is in fact unbiased and fair, then he will probably make a decision, which would suit all players. Nash bargaining solution serves as such arbiter.

To find Nash bargaining solution (NBS) we need to apply Nash function:

$$H(\alpha_1, \ldots, \alpha_n) = \prod_{i=1}^{n} (\alpha_i - v_i). \tag{3}$$

NBS is the solution to the following optimization problem (Petrosyan, Zenkevich, 2016, p. 164):

$$\max H \ \ (\alpha_1, \ldots, \alpha_n) = \max_{\{\alpha_i\}} \prod_{i=1}^{n} (\alpha_i - v_i) \tag{4}$$

under conditions:

$$\alpha_i \geq v\,(i)\,,\ \ i \in N,$$

$$\sum_{i=1}^{n} \alpha_i = v(N).$$

In other words, the payoff of every coalition from cooperation should be no less than they could earn when working alone. The sum of those payoffs should be equal to the total payoff of the coalition.

It is clear that the result achieved in such a way is Pareto optimal. This means that there is no other division of the game $v(N)$, under which each each player gets more than his share in a specific imputation.

Nash bargaining solution arouses interest, because it has a number of important properties (Mazalov, 2010): efficiency (or Pareto optimality); linearity (under linear transformations optimality remains) and symmetry. The latter property implies the equal status of the players, i.e. if players have the same market (bargaining) power, then the Nash bargaining solution is symmetrical.

In case of the motion picture industry NBS can be applied for calculation of the participation shares in proceeds allocation as a kind of a reference for further negotiations, because it can always be calculated, under any values of the characteristic function. This imputation can be considered as an upper border of the share, to which an actor or a director may claim. The thing is that as has already been said before, the NBS is considered fair, just because it allocates the total payoff from cooperation among players (the income with the exclusion of costs) in equal shares. It does not take into consideration probable inequality of the players. Thus the calculated shares may not satisfy the producers, which would not want to share with the participants that much, since he or she does not contribute to the common affair tangibly, and consequently, it is very hard to estimate the degree of his input contribution to the overall performance of the project. Consequently, it is needed to find such imputations, under which not a single coalition would have objective reasons to decline them.

However, let's first go back to our reference example and calculate a Nash bargaining solution. NBS will be a solution to the following problem:

$$\max(\alpha_1 - 10) \ * (\alpha_2 - 10) * \alpha_3$$

under constraints:

$$\alpha_1 + \alpha_2 + \alpha_3 = 100 \tag{5}$$

$$\alpha_1 \geq 10,$$

$$\alpha_2 \geq 10,$$

$$\alpha_3 \geq 0.$$

In order to calculate Nash bargaining solution we need to maximize the product of the gains of each player. In addition, both of the considered producers expect to get no less than what they have contributed, i.e. not less than \$10 mln., actor X also expects to het some reward for his participation in the project. All together they will not be able to get more than the box-office revenue of \$100, which we have forecasted.

By solving (5) problem, we get the following imputation:

$$\alpha_1 = 36,67, \alpha_2 = 36,67, \alpha_3 = 26,67. \tag{6}$$

We can see that the shares are divided in a way, if all the participants were equal. We cannot forget that the producers have invested \$10 mln. each, thus, if we deduct their expenditures from the total payoff, we get the absolutely equal distribution of profit among the producers and the actor, a situation, which certainly cannot happen in real life, because producers, having a higher bargaining power, than actor, will simply not allow him to receive such a large share. However, Nash bargaining solution let us make a conclusion about the maximum of all possible shares, which could theoretically get the weakest player.

Nondominant bargaining solution. Now we need to find such imputations, which would be nondominant, meaning that no coalition would have objective reasons to disagree with these imputations. In other words, the gain of each coalition (both single-element and two-element) of players would be no less than that if they worked independently. Since each participant in any situation gets benefits from the joint activity with other players, they do not have objective reasons to disagree with such imputation. Basically, such distribution is stable in a way that it is disadvantageous for any coalition to separate from other players and distribute a payoff of this smaller separated coalition among its members. There can be many such imputations, and the participants may have different subjective reasons to disagree with a certain earnings imputation. Thus, it is needed to find an solution, which would satisfy all the players. Such impulation may become nondominant bargaining solution. For its definition we need to consider only the set of nondominant imputations.

Mathematically the problem of finding nondominant bargaining solution would look as following:

$$\max_{\alpha_i} \prod_{i=1}^{n} (\alpha_i - v_i)$$

under constraints:

$$\sum_{i=1}^{n} \alpha_i = v(N), \tag{7}$$

$$\alpha(S) \geq v(S), S \subset N,$$

where $\alpha(S) = \sum_{i \in S} \alpha_i$.

This method will again give us the fair division, as in the case of Nash bargaining solution, however, it will take into consideration the inequality of the initial

contributions of the players. Nondomination of the imputation means that no coalition has objective reasons to decline such imputation. This gives another reference during negotiations about the final earnings division. Despite the clear advantage of such method over the previous one, its disadvantage resides in the fact that it does not consider the inequality of the bargaining power of players, and the difference is in their abilities to impose their own rules of the game.

Let's move to our example and calculate the nondominant bargaining solution in respect to the producers A and B and the actor X. We need to solve the following problem:

$$\max(\alpha_1 - 10) \ * (\alpha_2 - 10) * \alpha_3$$

under constraints:

$$\alpha_1 + \alpha_2 + \alpha_3 = 100, \tag{8}$$

$$\alpha_1 \geq 10,$$

$$\alpha_2 \geq 10,$$

$$\alpha_3 \geq 0,$$

$$\alpha_1 + \alpha_2 \geq 80,$$

$$\alpha_1 + \alpha_3 \geq 10\ ,$$

$$\alpha_2 + \alpha_3 \geq 10.$$

We again maximize the product of the players' payoffs, and at the same time not only each participant expects to get not less than he has contributed, but each pair of players also expects to get from cooperation not less than they could earn if working in pair. Since producers A and B can manage to create a movie without the participation of this certain actor, and it will have a drawing capacity of $80 mln., they assume that if they hire the actor X for the leading role, their income will also increase, as otherwise the decision to share proceeds with him would be senseless. At the same time if producers work alone, they will not be able to finance the budget, thus, the movie will not be produced, and they will remain only with their $10 mln. at hand.

After solving the (8) problem we get the following result:

$$\alpha_1 = 40, \alpha_2 = 40, \alpha_3 = 20. \tag{9}$$

Therefore the nondominant bargaining solution of the payoffs shares under cooperation gets the following form: (40%, 40%, 20%). We can see that the revenue again has been divided quite evenly, however, now the inequality of the initial contribution is taken into account, and the producers receive $10 mln. more than in the case of NBS. Nevetherless, such solution would hardly suit the producers, as 20% of the movie box-office is a way too large percentage for investors to give to

an actor. Therefore, although this solution is not optimal for solving the considered problem, it allows an actor to roughly estimate, what he can generally claim his pretentions for when cooperating on the movie creation. From this provision the next idea appears, which could serve as a support for defining the payoff imputations.

Maximum and minimum nondominant imputations. With the help of the nondominant imputations calculation (those imputations, under which no coalition of players would have objective reasons to decline them) we can calculate maximum and minimum value of the actor's or director's share from cooperation. Thus, we will get a corridor of the values on the set of nondominant imputations, in which there will be located the share of the weakest of the players. In other words, we will get the pretentions' range of a player with intangible input. In the general case such corridor of feasible changes of the income share can be calculated for any player.

In general case the set of equations for *minimum nondominant imputation (MIN solution)* for player i will look as follows:

$$\min_{\alpha_i}(\alpha_i - v_i)$$

under constraints:

$$\sum_{i \in S}^{n} \alpha_i = v(N), \tag{10}$$

$$\alpha(S) \geq v(S), S \subset N.$$

We minimize the payoff of player i, for which we want to find a corridor of the possible income percentage values. Income of the other players is divided among them proportionally to their contribution to the result of cooperation.

The problem of the search of *maximum nondominant imputation (MAN solution)* for player i will be as follows:

$$\max_{\alpha_i}(\alpha_i - v_i)$$

under constraints:

$$\sum_{i \in S}^{n} \alpha_i = v(N), \tag{11}$$

$$\alpha(S_i) \geq v(S_i), S \subset N.$$

The problem is absolutely similar with the first one with the only difference that now the payoff of the considered player is not minimized, but maximized.

Now let's go back to our example of the movie "Z" production and calculate minimum and maximum nondominant solutions for it.

For calculation of the MIN solution for player 3 (actor X) let's solve the following problem:

$$\min \alpha_3$$

under constraints:

$$\alpha_1 + \alpha_2 + \alpha_3 = 100, \tag{12}$$

$$\alpha_1 \geq 10,$$

$$\alpha_2 \geq 10,$$

$$\alpha_3 \geq 0,$$

$$\alpha_1 + \alpha_2 \geq 80,$$

$$\alpha_1 + \alpha_3 \geq 10\ ,$$

$$\alpha_2 + \alpha_3 \geq 10.$$

As a result we get the MIN solution:

$$\alpha_1 = 50, \alpha_2 = 50, \alpha_3 = 0. \tag{13}$$

Obviously the minimum value of the actor's X share is 0%, i.e. he does not participate in the revenue distribution and gets only fixed payment from the movie budget. The shares of the producers are equal, as they have financed the budget in equal proportions.

Now let's find the maximum nondominant solution, which would show the shares of the box-office allocation, if the actor was offered the maximum possible percentage.

$$\max \alpha_3$$

under constraints:

$$\alpha_1 + \alpha_2 + \alpha_3 = 100 \tag{14}$$

$$\alpha_1 \geq 10,$$

$$\alpha_2 \geq 10,$$

$$\alpha_3 \geq 0,$$

$$\alpha_1 + \alpha_2 \geq 80,$$

$$\alpha_1 + \alpha_3 \geq 10,$$

$$\alpha_2 + \alpha_3 \geq 10.$$

As a result we get the MAN solution:

$$\alpha_1 = 40, \alpha_2 = 40, \alpha_3 = 20. \tag{15}$$

The computed solution shows that the maximum share, which an actor can claim for, equals 20%. So we have set the borders, within which actor X can negotiate about his percentage. However, they give us only a range of actor's pretentions.

It is quite obvious that 20% is too high, and the producers will not accept such imputation. Generally speaking, one needs to take into account that the participants of our cooperation are unequal in their power of influence on negotiations' result. Generally speaking, producers have a higher bargaining power, than actors, because they are owners the rights for the picture and they possess the unambiguous and easily measurable resource – finances. Creative participants of cooperation, having an intangible input in cooperation, have a lesser extent of influence on the final decision concerning their remuneration, since their contribution is hard to assess numerically. All the methods of revenue distribution, which were considered before, did not take into account the inequality of players' power of influence on their payoff share. Consequently, there is a need of introducing the weights for each of the players, which would allow removing the problem of inequality of the players.

Weighted nondominant bargaining solution. If every player would be assigned with some weight, then is seems that the problem of bargaining power inequality of different players would be offset, and the game would be normalized. So in general case *weighted nondominant bargaining solution* (WNB solution) is the solution to the following problem:

$$\max \mathrm{H}^{\mathrm{w}}\left(\alpha_1, .., \alpha_{\mathrm{n}}\right) = \max_{\{\alpha_{\mathrm{i}}\}} \prod_{\mathrm{i}=1}^{\mathrm{n}} \left(\alpha_{\mathrm{i}} - \nu_{\mathrm{i}}\right)^{w_i}.$$

under constraints:

$$\sum_{i \in S} \alpha_i = v\left(S\right), \ S \subset N, \tag{16}$$

where $w_i \geq 0; ; w_1 + .. + w_n = 1$. The vector $w = (w_1, .., w_n)$ is a set of weights w_i of players, where parameter w_i characterizes the power of player i, $i \in N$ in the game.

Shapley index. For the producer the weight is defined by the amount of commited financing sources. With those participants, the contribution of who is intangible, everything is not so obvious. For the definition of the weights of those players two methods can be introduced. First of them is the use of Shapley index. Shapley index is calculated on the basis of Shapley value, which actually can be considered as as a tool for solution of the problem, considered in the paper. The advantage of optimal imputation's definition with the use of Shapley value resides in the fact that such imputation exists in each game and it is unique. Shapley value is calculated as follows:

$$\phi_i\left[v\right] = \sum_{S \backslash i \in S \subset N} \frac{(s-1)!\,(n-s)!}{n!} \left[v\left(S\right) - v\left(S \backslash i\right)\right], \ i \in N, \tag{17}$$

where $s = |S|$.

Shapley value has several properties (Petrosyan, Zenkevich, 2016, p. 182): independence from irrelevant alternatives; independence from repositioning of the numbers of the players and linearity.

On the basis of *Shapley value* it is possible to calculate *Shapley index*, which is often used as a measure of the player's power in a certain game:

$$sh\left[v\right] = \left[sh_1\left(v\right), ..., sh_n(v)\right],$$

where

$$sh_i = \frac{\phi_i[v]}{v(N)}, i = \overline{1,n}. \tag{18}$$

Going back to our example, let's calculate the Shapley value according to the above stated formula. We get the imputation: (46,67%, 46,67%, 6,67%). By deviding the obtained shares by the expected value of the movie revenue, we get Shapley index, which we will use as a power of influence of this or that player. Generally, Shapley index is widely used in politics in evaluation of parties influence in parliament. In our case the index will calculate the influence of certain participants of moviemaking with the help of relationships among coalitions, in which a participant is essential towards all winning coalitions. Weights of the participants can be also shown in vector form (0,47; 0,47; 0,07). Using these weights let's calculate the revenue imputation with the formula of weighted nondominant bargaining solution. By solving the problem with Excel functions, we get the solution (47,33%; 47,33%; 5,33%). The revenue is divided in the other way than was obtained with the usage of Nash bargaining solution and nondominant bargaining solution. Now it is taken into account that the producers have more opportunities for exerting pressure on an actor. This is an approximation of what happens in real life. The thing is, no matter how talented and famous an actor is, producers will not allow him to claim for unlimited amount of money. Even in the cases when the role is written specially for a certain actor, and the director does not want to consider anyone else for this role, it is needed to accept that in motion picture industry, just as in any other business, those who possess rights and money, are the ones to dictate the termes.

Expert weighted solution. However, weights of the players can be calculated not only by the method of Shapley index. In fact, with all its advantages, it has one serious disadvantage when applied to movie industry: it is impersonal and does not consider the details of each specific project. In motion picture business there are never two absolutely identical projects, although the main principles of the movie production are always the same. Moreover, when the weights of an actor or a director are estimated, a very important role is played by individual properties of each single person. That is why in this work for defining weights of actors and directors it is suggested to use the questionnaire, questions of which are aimed at estimation of factors, which influence the bargaining power of actors, i.e. their weight. It is supposed that the questionnaire is intended for the movie experts, those people, who are to a large extent aware of the mechanisms of the movie industry, who know this business from the inside and sometimes possess the insider information. The questions are not abstract, but always concern certain movies, certain actors and directors. The answers intend subjective opinions of experts towards the influence on the box-office of such factors as Oscars awards or nominations, the number of those, the experience of an actor at the moment of the movie production, number of financially successful movies with his participation. Moreover, the experts are invited to give a subjective estimation of influence on the bargaining power and consequently on the probability of signing a sharing contract of such factors, as the fact that the movie is a sequel, the established reputation of an actor/ director in terms of the behavior and tendency towards shrinking, the length of the contract with this or that studio/ producer (in case of the franchise, when initially a serie of movies is planned to be created), the diversity of the actor's/ director's areas of activity, for instance, his musical activity, participation in TV series, advertising of

famous brands, in other words, everything, which allows to increase the visibility of a person. The most important factor, which is suggested for the experts to estimate in the questionnaire, is the level of participant's ability to increase the final movie's box-office. It is possible to examine the questionnaire more thoroughly in the appendix.

The criteria, in their turn, are devided into groups in order of importance. Therefore, to the most important the following ones were assigned: the ownership of the Oscar award, Oscar's nominations, the length of the career and consequently the experience, the variety of activities, and the fact that the movie is a sequel. To the next in descending order of importance group of factors were assigned: the number of Oscar awards, the number of Oscar's nominations, the fact (or the absence) of previous joint projects of an actor and a director. To the less least important criteria were assigned: the reputation of an actor in terms of his behavioral patterns. Consequently, to each group an importance value was assigned on the scale from 1 to 3. The answers of the experts on each question are converted to the 5-point scale. Then the average values are calculated on each question. At the same time the weight of the each criteria is calculated by division of the importance value of each criteria by the sum of all importance values. In other words, if, for example, the importance value of the question is 3, and the sum of importance values for all questions for the estimation of this actor is 14, then the weight of the criterion will equal 0,21. Then finally the weight of the actor is found by the sum of the products of average values of each question and the corresponding weight of the criterion.

However, due to the fact that the weight is calculated irrespective to other participants of cooperation, it arrives too big for obtaining relevant results. Thus, to calculate the weighted nondominant bargaining solution, we normalize the weight of an actor or a director by multiplying the calculated weight by the largest in history percentage, which has ever been obtained by a participant with a similar degree of involvement to a project. Under the similar degree of involvement to a project it is implied the quantity of the obligations taken by a participant: whether he fulfills only an acting job, or also a producing one; whether the director is only fulfilling his direct job or he also possesses the rights for the script and in addition produces the project. By multiplying the weight, which was obtained in the course of the expert evaluations, by the largest in the history participation share, we can get the final weight, which would be used for actually imputation calculations.

The general form of the set of equations for defining the expert weighted solution have the following form:

$$\max H^{w}(\alpha_1, .., \alpha_n) = \max_{\{\alpha_i\}} \prod_{i=1}^{n} (\alpha_i - v_i)^{w_i}.$$

$$\alpha(S) \geq v(S), \ S \subset N, \tag{19}$$

where: $\alpha(S) = \sum_{i \in S} \alpha_i$; $w = (w_1, .., w_n)$; $w_i \geq 0; ; w_1 + .. + w_n = 1$.

Let's move to the reference example. Let's suppose that according to the expert questionnaire, the weight of an actor amounted to 0,8. Consequently, by multiplying this coefficient by the maximum revenue share in history, which amounts to 0,2 (the remuneration of Arnold Schwarzenegger for the movie "Terminator 3: Rise of the Machines") we get that the final weight of an actor X equals to 0,16. Let's remind, that weights of the producers are difined proportionally the invested resources. Since

in our case both producers provided equal amount of funding, their weight is also equal, and it amounts to 0,42. It is needed to specify, why the value is exactly 0,42. In order for the game to be normalized, the sum of participants' weights should equal 1. Consequently, when we first found the weight of the weakest player, we deducted it from 1, and the remaining sum of weights we divided between the producers proportionally their financial contribution to the project.

Now we need to solve the following problem of non-linear programming:

$$\max \left(\alpha_1 - 10\right)^{0,42}\} * \left(\alpha_2 - 10\right)^{0,42} * {\alpha_3}^{0,16} \tag{20}$$

under constraints:

$$\alpha_1 + \alpha_2 + \alpha_3 = 100,$$

$$\alpha_1 \geq 10,$$

$$\alpha_2 \geq 10,$$

$$\alpha_3 \geq 0,$$

$$\alpha_1 + \alpha_2 \geq 80,$$

$$\alpha_1 + \alpha_3 \geq 10\ ,$$

$$\alpha_2 + \alpha_3 \geq 10.$$

By solving this problem in Excel, we get the expert weighted solution:

$$\alpha_1 = 43,6, \alpha_2 = 43,6, \alpha_3 = 12,8. \tag{21}$$

In the percentage format the imputation will look as following: (43,6%; 43,6%; 12,8%). We see that this solution is more fair than all of the considered earlier. From the one hand, it takes into account the contribution of an actor, but not overestimates it, what Nash bargaining solution and nondominant bargaining solution did. From the other hand, it does not give the large overbalance in favor of producers, what showed Shapley value imputation and Shapley index weighted solution. The thing is that the two latter methods substantially underestimated the contribution of an actor, since they did not consider the specificity of projects, and were calculated only on the basis of mathematical repositionings and that utility addition, which actor X could bring to each coalition under condition that his initial input equals zero in money terms. Thus, we can draw a conclusion that the method of revenue imputation finding using the weighted nondominant bargaining solution, when weights are found by expert estimations, gives the most unbiased results from all methods. It should be stressed that the results obtained are not postulated as reference ones. The offered tool set is suggested to be used as a mathematically justified system of support to solution of strategically important ptoblem of revenue distribution among the participants of cooperation.

Let's look at the method of the income imputation finding in a more concise way. We proceed from the assumption that in the receipts allocation may take part following parties: a producer, leading actors and a director. All other participants of the movie making are included in the budget part of the movie, and their payments are fixed. The first step is the definition of the expected box-office and the quantitative forecasts concerning the ability of each of the participant, whose input is intangible, to increase the expected box-office by his participation. This is carried out on the basis on their previous works analysis and the box-office results of the similar genre or storyline movies. Then on the basis of the achieved data the characteristic function is built. After that the imputations are calculated by different methods.

Firstly, it is suggested to calculate the Nash bargaining solution, which shows the absolute maximum of the share, which an actor can claim for. Then the maximum and the minimum nondominant imputations are calculated, which denote the range of pretentions of an actor or a director, which might be accepted by a producer due to the fact that they will not have the objective reasons to decline the imputation. Inside this corridor of values the nondominant bargaining solution is situated, which tries to solve the problem of the as even income imputation among the participants as possible. In order to solve the problem of inequality of power of influence of the participants, it is suggested to bring in the notion of the weighted bargaining solutions, which would consider the bargaining power of an actor and would give more realistic results. Upon that weights are suggested to be calculated by two methods: by calculating Shapley index or by expert questionary. Since for calculating Shapley index the Shapley value itself is needed, it makes sense to check this imputation with respect to relevancy for finding the optimal solution. The imputation, found with the help of Shapley value, and weighted nondominant bargaining solution with the weights-Shapley index, both give realistic results, however, the shares of actors nevetherless remain too big in relation to the shares of producers. This situation can never happen in real life. Therefore, it is suggested to bring in another approach to income imputation definition, namely, expert weighted nondominant bargaining solution. In this case the weights of the producers would be defined proportionally the funding of the project, and the weights of actors and directors would be defined on the basis of expert evaluations. At the same time the value, which was found by consolidation of the expert evaluations, is suggested to be taken as a share of the maximim percentage, which has ever been received by a participant of a movie project with the same level of involvement. This is exactly what will be taken as the weights of actors and directors. Weighted nondominant imputation has an advantage over the other imputations in the sense that it takes into consideration the main characteristic of actors and directors for the motion picture business: their ability to bring in the added value to a movie, which results in increased cash flow generation. However, this method gives a realistic proceeds division, since it considers the larger bargaining power of producers in comparison to creative talent. Thus, a whole spectrum of mathematically justified imputations is presented, and the reliance on them may facilitate negotiations. Although the final decision will anyway to a high extent depend on the skills of layers and the representatives of actors and directors, as well as on the ability of producers to negotiate favorable deals, the author of this work suggests to use the method of weighted nondominant bargaining solution as a base of negotiations, since this solution seems the most

relevant in application to the sphere of movie making due to the specific context of the motion picture industry.

2.4. Case studies of producer's and talent revenue-sharing imputation.

In this part of the paper the author would like to show the realization of the methodology and test its applicability of specific examples. Let's consider the creation of three movies: "Inception" (2010), "Alice in Wonderland"(2010) and "Terminator 3: Rise of the Machines" (2003) and try to calculate the income imputations for each of them.

Movie Inception. Let's start with Christopher Nolan's movie "Inception", the main role in which was performed by Leonardo DiCaprio. This movie initially had a very large budget of $160 mln (IMDb) due to the star cast and massive special effects, consequently, quite a massive payoff was also expected. It is necessary to state here that although the main trajectory of this paper is devoted to the independent movie production, the case of "Inception" is actually the situation, when the producer is affiliated with the studio (i.e. distributor). The thing here is that financing of "Inception" was quite a complicated deal, since the budget was quite large. The The rights for the movie were in the possession of Christopher Nolan, because he wrote the original script, thus, he decided to co-produce this movie with another producer Emma Thomas. The deal with Warner Bros. was arranged, and all the financing was provided by the studio. Later Warner Bros. distributed the movie for the US theatrical release. Now let's try to model the game situation, as if we were in the shoes of people making decisions on the revenue distribution. In the situation considered the following participants claim for the revenue share: the studio (who was the investor of the project), the leading actor, A-lister Leonardo DiCaprio and the director (and at the same time the scriptwriter and the co-producer of the project) Christopher Nolan. Let's call them Player 1, Player 2 and Player 3 correspondingly. All them due to their high power of influence claim for the revenue and not profit participation share.

Let's first build characteristic function, and for that task we need box-office forecast. In order to do that, we need to analyze the movies of the same genre, the same scale and intensity of special effects usage and the same degree of star cast involved, and then we will be able to get the idea of the approximate box-office amount. Let's take an average box-office amount and assume that "Inception" will earn around $800 mln. However, we should remember that not the entire box-office is distributed, but the revenue after deduction of the exhibitors' share, which is according to the established practice, constitutes 50%. Therefore, the value of the characteristic function of the maximal coalition is $400 mln., i.e. $v(N) = 400$. No one from the participants will be able to create a movie working independently. Christopher Nolan will not have funding for such a large scale project, the producer does not have the rights for the script, as it is in Nolan's possession, and obviously that DiCaprio will not be able to create a movie on his own. Therefore, the payoffs of Nolan and DiCaprio will be zero ($v(2) = v(3) = 0$). As we have decided earlier in the paper, the producer's power will be estimated proportionally to the investments, he has been able to obtain, since he has obligations to investors. So the producer will only have the money in the amount of $160 mln. ($v(1) = 160$). If the participants started to team up into different paired coalitions, only a coalition of Nolan and the studio would be able to make a movie. They could assign another actor, who would have a fixed fee and not a sharing contract. Let's assume that without DiCaprio's

participation the expected box-office of the movie would be of a smaller amount. For getting a sense of this possible amount let's analyze the filmography of Christopher Nolan, then look at the coefficient of return on investments of these movies and after that let's multiply the budget of "Inception" on average return on investments coefficient. (Actually there are a lot of different means of forecasting the box-office, however, this is not the goal of this paper, thus in this work only simplified versions are represented, moreover, all the forecasts are approximations). So we get that the forecast on "Inception" box-office without DiCaprio's participation in it equals to $500 mln., and consequently, the considered for the reasons of imputation allocation amount will constitute a half of it and will equal to $250 mln., $v(1,3) = 250$, $v(1,2) = 160$, $v(2,3) = 0$.

Therefore, after definition of characteristic function we can start calculating the imputations by different methods. With the help of Excel program, we get the following imputations:

1. Nondominant bargaining solution: (240; 80; 80) or in percent format: (60%; 20%; 20%).
2. Minimum nondominant imputation: (400; 0; 0) or in percent format: (100%; 0%; 0%).
3. Maximum nondominant imputation: (160; 0; 240) or in percent format: (40%; 0%; 60%).
4. Shapley value: (255; 50; 95) or in percent format: (64%; 12%; 24%).
5. Shapley index weighted solution (weights of the participants are defined by Shapley index): (313; 30; 57) or in percent format: (78%; 8%; 14%).
6. Expert weighted solution (weights are defined by expert questionary): (306; 38; 55) or in percent format: (76%; 10%; 14%).

However, the calculation of the last imputation is needed to be examined in more detail, as at this moment it makes sense to show the method of weights calculation of a participant on a specific example. In order to find out the power of influence of Leonardo DiCaprio and Christopher Nolan, expert questionary were conducted. In my case they were 40 people, who are somehow connected with the movie industry: current and former managers of the production companies and students of movie universities in Russia and the USA. The questionnaire can be examined in the appendix. After converting the answers to a 5-point scale and their normalization relatively to the significance of these of those factors the following results were obtained: DiCaprio's "weight" constituted 0,8 and Nolan's – 0,77. However, these weights were calculated relative to 1, and we need to normalize them for our game. Consequently, in order to find out the power of influence of Leonardo DiCaprio on the final box-office we calculate his share from the maximum percentage, which has ever been received by an actor in history. Maximum percentage was received by Arnold Schwarzenegger in 2003 for his role of Terminator in the third part of the Terminator franchise, and it constituted 20% (Epstein, 2011) of the movie's gross. Thus, the weight of DiCaprio, which defines his influence on the final box-office is: 0,8*0,2=0,16. For Christopher Nolan the base for the weight computation will be different. The maximum percentage for a director, who is also a scriptwriter and a co-producer, in history was received by James Cameron for the movie "Avatar" (2009) and constituted 30% (deadline.com). Therefore, the final weight of Nolan is: 0,77*0,3=0,23. After calculating the weights of the perticipants, we can compute

the weighted nondominant bargaining solution, which is described earlier in the paragraph.

Then we can compare the obtained results with the revenue distribution in real life. The total box-office amounted to $823 mln., consequently, after deduction of the exhibitor's part, the amount entitled to distribution among the main players was $411,5 mln., from which Leonardo DiCaprio has taken $59 mln. and Christopher Nolan – $69 mln., which is in percentage form was 14% and 17% correspondingly. The distribution, calculated by the weighted nondominant bargaining solution method is close to the real numbers, which gives us a notion that the methodology can be applied to real life cases. Even more than that, we can even say that actually Nolan and DiCaprio could have claimed for a larger percentage than the one, whey have received in reality. It only proves the fact, that producers (especially, if they cooperate with studios for finding the financing, and thus they are binded to their obligations to those huge and powerful parts of media conglomerates, like we have seen in case of "Inception") due to their lagre level of influence can impose their own termes by making weaker participants of the cooperation agree on less favorable conditions.

Movie Alice in Wonderland. Now I would like to move to the approbation of the methodology on another example, namely on Tim Burton's movie, which was released in 2010, "Alice in Wonderland". One if the leading roles in the movie was performed by Johnny Depp. The budget of this movie was even larger than the one in the previous example: $200 mln (IMDb). All the investments were found in one source - Walt Disney Pictures, meaning that the producer Richard D. Zanuck was binded with an obligation to Walt Disney Pictures and thus, in negotiation model he incorporates the bargaining power of the studio. Let's model this game situation, by solving which we will get the revenue distribution of the motion picture. Just as in our previous example three participants claim for the share of revenues: the producer (and in our model we assume that he incorporates the bargaining power of a studio as an investor), the leading actor Johnny Depp and the director of the movie Tim Burton. For the purpose of our game construction they will be denoted as Player 1, Player 2 and Player 3. All of them claim for a share of revenue, not of net profits. On basis of the previous mutual works of Burton and Depp, as well as on the basis of movies of the similar genre, let's assume that the forecasted amount of revenues after the deduction of exhibitor's share will amount to $600 mln., i.e. $v(N) = 600$. Now let's find the characteristic function value for each coalition. We assume that players will not be able to make the movie under any circumstances except for the situation of the maximal coalition of three players. The producer will only have the money, but will not be able to shoot the movie, Burton and Depp will not manage without financing as well. Moreover, this game has a peculiarity: Burton and Depp will form a coalition, meaning that their actions will be coordinated, and they will act as a single player. This situation happens, because when Tim Burton was invited to direct the cinematization of Lewis Carroll's novel, as one of his terms he claimed the mandatory participation of Depp in this motion picture. Otherwise, Burton refused to direct "Alice in the Wonderland". Burton and Depp have constituted a great tandem for many years now, which attracts a huge crowd to movie theaters, and a rare Burton's movie does not have Depp in it. The producer had to accept this term, since, firstly, it was only Burton, who they wanted to see as a director, and, secondly, as has been stated earlier, this

tandem attracts a lot of people. Therefore, taking into consideration this condition, it is clear that the coalition of Player1 and Player 2 or a coalition of Player 1 and Player 3 is impossible. Thus, the characteristic value for each coalition will look as following:

$$v(1) = 200,$$

$$v(2) = v(3) = 0,$$

$$v(1,2) = 200,$$

$$v(1,3) = 200,$$

$$v(2,3) = 0.$$

Now we can calculate the revenue imputations. With the help of Excel program we obtain the following results:

1. Nondominant bargaining solution: (333; 133; 133) or in percent format: (56%; 22%; 22%).
2. Minimum nondominant imputation: (600; 0; 0) or in percent format: (100%; 0%; 0%).
3. Maximum nondominant imputation: (326; 147; 126) or in percent format: (54%; 25%; 21%).
4. Shapley value: : (333; 133; 133) or in percent format: (56%; 22%; 22%).
5. Shapley index weighted solution (weights of the participants are defined by Shapley index): (422; 89; 89) or in percent format: (70%; 15%; 15%).
6. Expert weighted solution (weights are defined by expert questionary): (444; 72; 84) or in percent format: (72%; 12%; 14%).

In order to calculate the expert weighted solution the weights were calculated by expert questionary. 62 industry insiders answered questions about Tim Burton's and Johnny Depp's powers of influence. According to the evaluations, weight of Johnny Depp (in absolute terms) equaled to 0,9, and weight of Tim Burton – 0,82. In order to normalize these coefficients, we again take the obtained share from the maximum percentage, which was received by the movimaking process participant of the same category. If for Depp the basis remains 20%, the basis for Burton differs from the previous example, since during the production of Alice in Wonderland Burton accomplished functions only of a director. Consequently, his share will now be calculated on the basis of 25%, the largest revenue share obtained by Michael Bay for the movie "Transformers", and it will constitute 0,21. Under these weights we get the imputation (72%; 12%; 14%).

Now let's check, what has happened in reality. The total box-office amounted to $1,02 bln., consequently, $510 mln. were distributed among the participants. Johnny Depp received $40 mln. and Tim Burton - $50 mln. In order to offset the difference in scale, let's look at the percentages. The share of Depp was 8% and Burton got 10%. We can trace that despite the smaller size of the participants' shares of remuneration (than in previous example), the proportion between the shares of actor and director

in both cases is the same: the director's share is 1,2 times larger than the actor's one. Moreover, the calculated remuneration share is of the approximately same order, which happened in reality. Therefore, it is again proved that it is possible to effectively calculate participation shares of the participants of cooperation on the basis of the methodology elaborated in this paper.

Movie Terminator 3: Rise of the Machines. The last example, which will demonstrate the suggested methodology of the income allocation, is the third part of the Terminator series "Terminator 3: Rise of the Machines", which has already been mentioned earlier in the paper. The budget of the "Terminator 3" equaled to $150 mln., which constituted an unbelievably large sum of money for the motion picture budgets of the early 2000s. However, the task of finding such a big sum for financing the movie was not an easy task for the producers. Not a single investor wanted to invest so much money into one project, because the risks were very high. The producer Mario Kassar came up with a solution and decided to raise money from several studios. Three studios agreed to participate in the deal: Warner Bros., which invested $51,6 mln., Tokio-based company Toho-Towa with $20 mln. investment and Sony Pictures Entertainment, the share of which in co-financing was the largest - $77,4 mln. However, all the companies had a mandatory requirement to the producers: Arnold Schwarzenegger should participate in the project. They considered that only the face of Schwarzenegger could draw significant box-office to the movie. Otherwise they refused to provide the funding. This is exactly the reason, why this movie project is of such an interest to us. This term gives Schwarzenegger a huge bargaining power, because he, having a support of the investors, could make almost any claims, concerning his remuneration. Since forecasted box-office promised to be quite big, and also due to the fact that the acquisition of the rights for the franchise and the script development cost the producer a couple douzens million dollars, they did not want to abandon the project and continued the movie production.

So let's proceed to the modeling of the game situation. Since the producer has arranged the deal with three studios for the funding of the movie, and thus he has obligations to all of them, and consequently according to our model, he incorporates the bargaining power of all three, but since their investments were different, for the purposes of more explicit demonstration of the model and more precise results, the author decided to consider 4 players, instead of 2. So instead of saying that the producer acts on behalf of each of the studios, for simplification of labelling we will be naming studios by their names. So 4 players claim for the revenue share: studios Warner Bros., Toho-Towa and Sony Pictures Entertainment, as well as the leading actor Arnold Schwarzenegger. For the purpose of convenience let's denote them as Player 1, Player 2, Player 3 and Players 4. In our case we have an assumption that they will be able to create a movie only in maximal coalition, which consists of all four players, and the characteristic function value in this case will be the expected box-office of the movie with the deduction of the exhibitors' share. On the basis of available data on two previous Terminator movies, let's assume that the expected box-office will constitute $520 mln., consequently, the revenue of the maximal coalition will constitute $260 mln. ($v(N) = 260$). It is needed to specify that as a forecasted revenue the amount, larger than actual box-office, which was achieved in reality, was chosen on purpose. Usually, each new movie which is a sequel, is able to draw a larger box-office than the previous serie. "Terminator 2" was an

exceptionally successful motion picture, which managed to achieve $519 mln. in the box-office. So it is logical to presume that the expected revenue of "Terminator 3" was supposed to be at least equal to that of the previous serie of the franchise.

In all other cases of different coalitions combinations, characteristic function value will equal the sum of the disposed funds of the participants of the coalition. Thus, $v(1) = 52$, $v(2) = 20$, $v(3) = 78$, $v(4) = 0$, $v(1,2) = 72$, $v(1,3) = 130$, $v(1,4) = 52$, $v(2,3) = 98$, $v(2,4) = 20$, $v(3,4) = 78$, $v(1,2,3) = 150$, $v(1,2,4) = 72$, $v(1,3,4) = 130$, $v(2,3,4) = 98$.

When characteristic function is defined, we can proceed to imputations calculation. With the help of Excel, we get the following results:

1. Nondominant bargaining solution: (84; 25; 151; 0) or in percent format: (32%; 10%; 58%; 0%).
2. Minimum nondominant imputation: (84; 25; 151; 0) or in percent format: (32%; 10%; 58%; 0%).
3. Maximum nondominant imputation: (52; 20; 78; 110) or in percent format: (20%; 8%; 30%; 42%).
4. Shapley value: (79; 48; 106; 28) or in percent format: (31%; 18%; 41%; 11%)
5. Shapley index weighted solution (weights of the participants are defined by Shapley index): (86; 40; 123; 12) or in percent format: (33%; 15%; 47%; 4%).
6. Expert weighted solution (weights are defined by expert questionary): (77; 30; 115; 38) or in percent format: (30%; 11%; 44%, 15%).

Let's look at the expert weighted solution. Interest here raises the basis of the weight. In all other cases, which were considered earlier in the paragraph, we have taken the share (calculated on the basis of expert questionary) from the maximum percentage, which an actor ever received for his work. As that percentage appeared the share of Schwarzenegger for his work in "Terminator 3" movie. Therefore, an approach, based on historic data is not applicable in current example. We know the maximum share, which Schwarzenegger can get for his participation in this movie (this share was calculated on the basis of maximum nondominant imputation). It equals $110 mln. or 42% of the revenue. These 42% we will take as a basis for Schwarzenegger's weight calculation in this project, which will define his degree of influence on the final outcome of negotiations. Subsequent to the results of expert questionary (62 experts) Schwarzenegger's weight equals to 0,82, consequently, his normalized weight equals to 0,11. The weights of investors are defined proportionally to the share of their funding of the budget. Thus, the weights of the companies were as following: Warner Bros. – 0,31; Toho-Towa – 0,18; Sony Pictures Entertainment – 0,41. In accordance with such power of influence distribution of the cooperation participants we get expert weighted solution: (30%; 11%; 44%, 15%).

In reality Schwarzenegger for his role in "Terminator 3: Rise of the Machines" received 20% of the movie receipts, which constitutes a much larger amount than practically any other share of income distribution, which are considered in this paper. Generally speaking, the contract, obtained by Schwarzenegger, is still considered one of the best examples of deals ever made by actors in Hollywood. This result was achieved, firstly, due to paramount importance of Schwarzenegger participation in the movie production for investors. Secondly, a significant role is played the high level of professionalism of actor's layers, because only thanks to their negotiation skills Schwarzenegger was able to emerge the winner from the unequal

battle with studios and producers. What is more, an effect may be exerted by the poor performance of the movie in the box-oofice: it earned almost $100 mln. less, than expected. If the assumption, that the expected revenues of the subsequent part of the franchise should be larger than those for the previous one, is right, and the same was presumed by the producers during calculations of different scenarios, it is possible to say that Schwarzenegger did not realized expectations of the producers and investors. In this case his contribution, which was estimated at 20% of the movie's revenues is overestimated. If the methodology, which is suggested by the author, was used, such situation may have been avoided, since mathematically justified recommendations would have clearly showed the overestimation of the actor's contribution.

From studying Table 1, where the consolidated results of methodology approbation on Hollywood cases is presented, it is easily traceable that the Expert weighted solution gives the best results in terms of feasibility and applicability to real life. The fact that it takes into account the considerations of the experts of the industry, and, thus, the bargaining power of the participants is incorporated into the calculations, allows for the most accurate results from all of the methods considered in the paper. Therefore, the expert weighted solution is the solution, recommened to usage by the author.

Table 1: Methodology approbation results

	Inception	**Alice in Wonderland**	**Terminator 3**
Nondominant BS	(60%; 20%; 20%)	(56%; 22%; 22%	(32%; 10%; 58%; 0%)
MIN solution	(100%; 0%; 0%)	(100%; 0%; 0%)	(32%; 10%; 58%; 0%)
MAN solution	(40%; 0%; 60%)	(54%; 25%; 21%)	(20%; 8%; 30%; 42%)
Shapley value	(64%; 12%; 24%)	(56%; 22%; 22%)	(31%; 18%; 41%; 11%)
Shapley index WS	(78%; 8%; 14%)	(70%; 15%; 15%)	(33%; 15%; 47%; 4%)
Expert WS	(76%; 10%; 14%)	(72%; 12%; 14%)	(30%; 11%; 44%, 15%)
Reality	(69%; 14%; 17%)	(82%; 9%; 10%)	(28%; 11%; 41%; 20%)

Source: Compiled by the author

3. Coordination in movie value chain

3.1. The concept of coordination

When the value chain of a movie exists, a question of how to incentivize all the crucial links to act fairly and avoid opportunistic behavior arouses. As has been discussed in the first chapter, there is quite a substantial amount of cheating involved in the value chain. Exhibitors distort the amount of revenue in order to retain a larger lump of it; the distributors creatively increase the amount of their expenses on the books in order to eliminate the net profit, which is to be distributed among the producer and the creative talent. Actually, the weakest party here is the

producer, since it is he, who receives all the residuals from the proceeds, therefore, it is in the producer's primary interests to have the contracts in the value chain coordinated. The contracts in such value chains are participation ones. Generally (without the relation to the motion picture industry), such contracts are organized in the following way. A supplier sells a product to a retailer for a specific price and the latter shares a part of the revenue with the supplier. Upon the offer of the purchase price of the supplier, the retailer sets the quantity of the product to order before the demand is actually realized. Depending on the business situation, it is also in the power of a retailer to set the retail price for the product when the order is placed to the supplier, or it can determine the price on the basis of the market price. In these settings, a typical revenue sharing agreement determines a fraction of the supply chain revenue to be kept by the retailer. The proportion, in which the contractors share their revenue in the case of a typical revenue sharing contract, is independent of the amount of the revenue realized (Pasule-Desai, 2012). Under a revenue-sharing contract, a retailer pays a supplier a wholesale price for each unit purchased, plus a percentage of the revenue the retailer generates (Cachon and Lariviere, 2005).

However, movie industry has its own peculiarities. The exhibitor does not pay a distributor a wholesale price for getting the motion picture for exhibition, and the income of both is only the shared revenues from the movie exhibition. In their turn, the distributor and the producer also usually do not have monetary relationships before the final income is actually distributed. The producer usually transferres the rights for movie distribution, and only then receives the income as a share of the final box-office. However, there still are cases (although rare), when the minimum guarantee is paid by the distributor to the producer for obtaining the rights for movie distribution. So basically, there is a kind of a wholesale price, but at the same time they also share revenues from the movie release. Moreover, in case of movie industry there is no supply chain; it is rather a value chain: each link of the chain adds some value on the way of a product from initiation till the end consumer. Thus, in this chapter we will try to adapt the existing coordination models of supply chain sphere to the value chain of motion picture industry environment, and then we will approbate those on numerical examples.

Supply chain coordination. First of all, let's study the supply chain coordination to derive some conclusions for the purpose of our paper: coordination in the movie value chain. However, in order to be more consistent, it makes sense to first look at the bigger picture of supply chain inter-organizational stages.

This framework – C3: cooperation, coordination, collaboration – is very popular for classifying the nature of the relationships inside the chain. *Cooperative relationship* is defined by motivating one of the partners to invest resources or increase profitability of the other partner in the chain. These partnerships usually are more advantageous towards that partner of the chain, who enjoys a greater bargaining power (Munson et al., 1999). Usually, this incentive takes a form of a long-term contract. In this kind of relations the structure and control originates from one partner, but actually both partners experience advantages from the relationships, since they secure business and behavior. Moreover, as contract and financial investments involved have a long-term nature, a particular level of trust is required (Ketchen et al., 2006). By *coordinative relationships*, supply chain tries to gain alignment and fluidity across the chain by informing each chain member of the preferred behavior

for each transaction (Arshinder, 2007). Coordination contracts benefited both parties downstream and upstream, although the company with the larger bargaining power enjoyed more advantages. By these contracts downstream party secured the price and the quality level, whereas the upstream party decreased the risk connected with the errors of the downstream partner (Park et al., 2006). *Collaborative relationships* require the established cooperative and coordinative relationships. Thus, a collaborative supply chain is defined as "integration and management of chain organizations and activities through cooperative organizational relationships, effective business processes and high levels of information sharing to create high performing value systems that provide member organizations a sustainable competitive advantage" (Handfield and Nichols, 2002). Collaborative relationships concentrate on constructive disagreement and part from the idea of bargaining power in the intention to create the strongest supply chain. Generally, collaborative chains are defined by the voluntary investment of resources by one chain participant to another chain participant or joint venture in order to reinforce the partnership overall. Such type of relations is considered rather as a long-term investment than a short-term tactic (Ketchen et al., 2008). However, collaborative type of relationship is out of the scope of our paper, and is considered as a possible direction of further research in application to the motion picture industry.

Since the topic of this part of the paper is coordination, a more detailed look should be focused on it. If a company wants to effectively transform the competitive advantage into profitability, it should develop efficient coordination within its boundaries and beyond them (Dyer and Singh, 1998). Basically, coordination between independent companies is crucial in order to achieve flexibility, which is needed to constantly improve logistic processes in response to ever changing external environment. The main problem resides in the method to attain the consistency towards the mutual goal of the partners, since the effectiveness of the chain is dependent on how well the members perform together, and not on how well each member works independently. There are different coordination modes distinguished. The classification is constructed on the concepts of mutuality and focus. The concept of mutuality pertains to unifying efforts of the independent companies (MacNeil, 1980). Mutuality is comprised of complementarity and coherency of actions of the chain links. In its turn, focus refers to putting emphasis on operational and organizational relations. The classification distinguishes four coordination modes: logistics synchronization, information sharing, incentives alignment and collective learning (Simatupang, Wright, Sridharan, 2002). In order to achieve the common goal by integration the actions of various players, the knowledge of coordination is needed. It consists of notion about key drivers of coordination modes, which influence the chain's performance. Let's move to the taxonomy of coordination modes. Reciprocal relations become important in order to make networking within the members of the chain easier. The main issue of supply chain management becomes how to coordinate the members in order to perform all together as a whole to achieve the common goal of chain profitability in unstable market environment (Simatupang, Wright, Sridharan, 2002). Malone and Crowston (1994) identify coordination as management of interrelatedness between performed operations, which air to achieve a goal. In terms of supply chain, coordination may be regarded as a proper combination of a number of objects in order to attain a goal.

Let's consider the concepts, on which the taxonomy is built on. Simatupang, Wright and Sridharan (2002) identify mutuality of coordination as "the underlying values of responsibility among partners with a strong emphasis on sustaining relationship in order to build effective goal attainment". Milgrom and Roberts (1990) state that modern supply chain does not accept incremental adjustments made independently, but rather requires significant and coordinated changes in the comprehensive perspective of business. Complementarity of the stages of the chain will lead to augmentation of the total gains, such as, for example, higher level of sales and lower costs, which may be shared by all the participants of the chain. "When the links of the chain synchronize the decision-making about value creation to coordinate the sharing of the benefits associated with logistics improvement, they are likely to shape complementarity" (Simatupang, Wright, Sridharan, 2002).

The other important dimension of coordination is focus. It can be on either operational or organizational linkages. Linkages exist when the operations, performed by one of the participant of the chain may somehow influence the work or the results of work of another chain participant. Thus, linkages are the liaisons among companies, where joint decisions between chain participants have to be coordinated. Milgrom and Roberts (1990) identify four coordination modes:

1. Logistics synchronization;
2. Information sharing;
3. Incentive alignment;
4. Collective learning.

Every mode exists in different context and stresses different cognitive processes. In our case, case of producer's incentives plan improvement, clearly, from the modes mentioned above, we need to consider the incentive alignment one.

Incentives define how those in charge of decision-making will be rewarded or penalized for the taken actions. Current incentives affect both types of behavior of a chain participant: individual and communication with partners. A conflict of interests may arouse, when the incentives lead to actions, which maximize personal benefits, but at the same time decrease total gain (Clemons and Row, 1993). Simatupang and Sridharan (Simatupang and Sridharan,2002) consider that one of the methods to deal with this conflict of interests is to introduce the incentive schemes that are based on the all-embracing performance, and which include both value creation with regard to the customers and profitability. This coordination mode is known as incentive alignment, and it encourages the behavior of the partners, which would be consistent with customer focus and total profit (Lee, 2000). Companies, which partake the complementarity of business process, will try to solve the issue of incongruity of incentives in reciprocally satisfying ways, drawing on relational contracts, especially is the customer demand is uncertain. These contracts determine such parameters as price, quantity, time and quality (Simchi-Levi et al., 1999).

One of the features of the incentive scheme is that it is offered before the mutual benefits are realized. It is intended to motivate the chain participants to relate their decisions with the profitability of the entire supply chain. A number (or even all) of the reciprocal benefits that follow from better coordination of the chain can be allocated in more incentives. Larger gains from incentives will affect the behavior of decision-makers and make them improve chain performance (Simatupang, Wright, Sridharan, 2002).

Coordination problem in movie value chain. This principle of increasing the motivation of the chain members by means of coordination, which was studied in the sphere of supply chain, perfectly fits the task of incentives alignment in the movie industry, where the value chain is considered. As has been studied in the first chapter of the paper, there are a number of problems, which appear between the links of the value chain, due to possibility of opportunistic behavior. However, it has been noticed by the author of the paper that the situations of the opportunistic behavior may be avoided, if all the chain members were motivated to think in the terms of the benefits of the entire chain and not in terms of their own benefits individually. Let's first formalize the stages of movie creation and delivery to the end consumer in terms of the value chain.

Producer is considered as a manufacturer or a supplier, since he produces the product and initially it is he, who has the rights for the product. Then he transferres (and sometimes sells) the rights for movie distribution to the distributor. If the sale occurs, those usually are presales, which are carried out before the movie is actually ready, and the price (minimum guarantee) is used by a distributor to cover a part of the incurred costs, and basically can be considered as a part of the budget funding. Rights are transferred for a specific time period (usually, between 5 and 15 years), and the distributor has to squeeze everything possible from the movie. Then the distributor makes prints (copies of the movie), which will be then distributed to the movie theaters. He also is responsible for marketing campaign. Those activities are quite costly ones. The distributor arranges contracts with exhibitors – retailers – where the movie will be released. At this point there is no prices. Usually, the distributor works with exhibitors for a long period of time, the relations are already well established, and there is no need for extra insurance. Exhibitors order a specific quantity of copies (they can be adjusted later depending on the demand of the movie), and they get those copies for a specific period of time (which can also be adjusted upon necessity). Then after the movie is released, there is a movement backwards the chain. Firstly, there is revenue split between the exhibitors and the distributors (the percentages have been discussed in the first chapter of the paper), then the rest of the proceeds are split between the distributor and the producer. It can be traced that this chain has some similarities with the supply chain, thus we assume that some of the supply chain principles may be transferred to the topic of our research. As has already been discussed earlier, there are possibilities for cheating and opportunistic behavior to appear in the relationships of the links. This problem can be solved by the tools of mathematic modeling, which will be considered further.

Revenue sharing base model. Firstly, let's study the revenue-sharing contracts coordination, suggested by Cachon and Lariviere (2005), which will explain the principles of the model in general supply chain environment.

The revenue sharing base model has a supplier, who is interacting with a single retailer.

There are two decisions to be made by the retailer in order to forecast the total revenue generated over a single selling period. Those are: the number of units to purchase from a supplier and the retail price. There are two points of view on the method to determine the revenue function. From marketing standpoint (Lilien et al, 1992) the revenue function is derived on the basis of a deterministic demand curve, while the operations point of view (Tsay et al, 1998) reflects the idea that

it is derived from stochastic demand with a fixed retail price, i.e. a newsvendor model. The formulation, proposed by Cachon and Lariviere (2005) embraces both of these revenue functions. It illustrates that the revenue sharing contracts coordinate the supply chain, meaning, that the retailer makes decisions concerning quantity and price (supply chain optimal actions) and the total profit of the chain may be arbitrary divided between the firms. Moreover, a single revenue sharing contract can coordinate a supply chain with several noncompeting retailers even if the retailers have different revenue functions.

According to Cachon and Lariviere (2005), revenue-sharing contracts are very effective in a broad variety of supply chains. However, there, of course, are some limitations. Firstly, revenue sharing does not coordinate competing retailers, if each retailer's revenue is dependent on its quantity, its price and the actions of other retailers. Secondly, revenue sharing lays down the administrative burden on the firms. In order to ensure that the revenues are split appropriately, the supplier must control retailer's revenues. These costs are sometimes that significant that gains from coordination might not always cover them. Thirdly, the chain is not coordinated, if the demand is influenced by noncontractable and costly retailer effort.

Now let's move to the supply chain coordination with revenue-sharing contracts. Let $\{q^0, p^0\}$ be a quantity-price pair that maximizes (q, p). We assume that (q, p) is upper semicontinuous in q and p, so $\{q^0, p^0\}$ exists, but it need to be unique. Revenue-sharing contracts achieve supply chain coordination by making the retailer's profit function an affine transformation of the supply chain's profit function; hence, $\{q^0, p^0\}$ maximizes $\pi_r(q, p)$.

Let's consider the set of revenue-sharing contracts with

$$w = \psi c - c_r \tag{22}$$

and $\psi \in (0, 1]$. With those contracts, the firms' profit functions are:

$$\Pi_r(q, p) = \psi \Pi(q, p). \tag{23}$$

Furthermore, $\{q^0, p^0\}$ is the retailer's optimal quantity and price; i.e., those contracts coordinate the supply chain (Cachon, Lariviere, 2005).

Given the profit function (23), it follows that $\{q^0, p^0\}$ maximizes the retailer's profit when $\psi > 0$. To obtain (23), substitute $w = \psi c - c_r$ into (1) and simplify. The supplier's profit function follows from (23) and $\pi_s(q, p) = \pi_r(q, p) - \Pi(q, p)$;; $\psi \leq 1$ ensures and $\pi_s(q, p) \geq 0$.

The theorem indicates that ψ is the retailer's share of the supply chain's profit in addition to its share of revenue. Therefore, revenue-sharing contracts coordinate the supply chain and arbitrarily allocate profit. The certain profit split chosen probably depends on the firms' relative bargaining power. With the strengthening of the retailer's bargaining position, one would anticipate ψ increases. As a proxy for bargaining power, each firm may have an outside opportunity profit, $\pi_i > 0$, that the firm requires to include in the relationship; i.e., $\pi_i(q, p) \geq \pi_i$ is required to gain firm i's participation. It is possible to satisfy both firms' requirements when $\pi_r + \pi_s < (q^0, p^0)$, but the feasible range for ψ will be more limited.

Extreme ψ values raise two other issues. First, the retailer's profit function becomes quite flat as $\psi > 0$; while q^0 remains optimal for the retailer, a deviation from q^0 imposes little penalty on the retailer. Second, from (22), the coordinating

wholesale price is actually negative when $\psi < c_r/c$. In other words, if the retailer's share of the channel's cost is high, the retailer is already in a low-margin business before the supplier cuts its part of revenue. If the supplier wants to claim a large portion of revenue, he must subsidize the retailer's purchase of product. If one wishes to rule out negative wholesale price, then a positive retailer cost establishes a floor on retailer profit under coordinating contracts.

A prerequisite for coordination is a wholesale price below the supplier's cost of production c_s. The supplier loses money in selling the product and only makes money by participating in the retailer's revenue. Selling below cost is necessary because revenue sharing systematically drops the retailer's marginal revenue curve below the integrated supply chain's. In order to have marginal revenue equal marginal cost at the desired point, the retailer's marginal cost must also be less than the integrated system's.

Given that the set of coordinating contracts is independent of the revenue function, it follows that a single revenue-sharing contract can coordinate the actions of multiple retailers with different revenue functions as long as each retailer's revenue is independent of the other retailer's actions (i.e., they do not compete) and they have the same marginal cost, c_r.

3.2. Coordinating contracts in movie value chain

After studying the general concepts of coordination and examining the principles of coordinating contracts functioning we can conclude that they are applicable to the motion picture industry. There are three players: producer, distributor and exhibitor. The producer gives to the distributor the good (q), which are the rights for the movie ($q = 1$, since they are not quantifiable). There is no price for the movie rights, which the distributor pays to the producer, because their income is the share of the revenue generated by the movie after release: $w_d = 0$. In this model we take the sales period as exogenously specified. Both parties have their costs with c_{pr} being the costs of the producer and c_d - the costs of the distributor. The distributor expects to generate some income for the movie (P), and he needs to estimate it. Then the distributor makes the copies in some predetermined by the arrangement with the exhibitor quantity ($q \geq 0$) and transfers them to the exhibitor. There is again no wholesale price ($w_e = 0$), which the exhibitor could have paid to the distributor for each copy. They only share the total income generated by the exhibitor after releasing this movie. This income is $R\ (p,\ q)$, where q is the quantity of copies, ordered by the exhibitor and p is the income generated by each single copy. The exhibitor has costs c_e.

Coordination is possible, when there is cooperation. Basically, the decisions are made on two stages, and two different cooperation relationships can be distinguished. So it is suggested to introduce sharing contracts on two stages. We will consider them step-by-step. Let's start with the producer-distributor relationships.

Producer and distributor divide the income generated by the movie in some shares with φ being the share of the distributor and $(1 - \varphi)$ being the share of the producer. Basically, they cooperate, since only working together they maximize their income, which they later share. However, it is possible to say that they do not coordinate, because there is no sharing contract between them, since $w_d = 0$. Meaning, they only split the final income in some shares, but there is still room for cheating of the parties (in our case distributor cheats on producer, since he has larger power and more mechanisms to do so), since there is no contract coordination. So the

author suggests introducing the price for the movie rights w_d, which would allow to avoid opportunistic behavior, because all the parties are interested in minimization of the costs in order to maximize the total gain, thus they are motivated to act fairly. The price w_d is calculated according to the formula: $w_d = \psi c_{pr} - c_d$.

The second step is the second level of cooperation. We have already coordinated the first stage, but it is possible to move further and coordinate the whole chain. The thing here is that we will consider the producer and the distributor as a single player now, which cooperates with the exhibitors for the realization of the movie. This is done due to the fact that to the time when the distributor makes deals for a certain movie with the exhibitors he already cooperates with the producer. When selling the movie for exhibition the distributor is obliged to later share the revenue with the producer, thus, it is logical to consider them as a single entity at this level of coordination. The costs of the compounded player are $c_{prd} = c_{pr} + c_d$ and the costs of the exhibitor are c_e, which are the costs incurred by the exhibitor in consideration each single copy. Since the costs of the exhibitor are considered per copy, we need to normalize the costs of the producer and the distributor in order to account them per copy as well. Thus, we need to divide the costs of the producer and the distributors by number of copies (q): $c_{prd} = (c_{pr} + c_d)/q$. Since in the US all the major movie theater chains have already switched to the digital equipment, meaning that there is no more need for buying several copies of the movie per theater, if the movie is to be shown on more than one screen. One copy is ordered by the exhibitor per theater, and then it is uploaded to the data server and transmitted to as many screens of the specific theater, as needed. Thus, for calculating the number of copies in our research we take the number of the theaters in a chain, assuming that it will be shown in all of them, since only the huge blockbusters are considered in the paper.

Another major difference with the first stage is that we already know the revenue allocation between the parties: as has been discussed in the first chapter, according to the accepted principles of the industry, the exhibitor retains 50% of the box-office. Thus, $\varphi = 1/2$. Since there is again no price w_e, there is no sharing contract, meaning that there are only share of the revenue allocation, which do not eliminate the possibilities for the parties to cheat. For instance, exhibitor can behave opportunistically towards distributor, thus, depriving him of a part of income. If we introduce the wholesale price for copies w_e, we will coordinate the chain, so this is exactly what is suggested to be done by the author. It is calculated as following: $w_e = \psi c_{prd} - c_e$.

We have considered a basic case of the movie value chain. However, it should be specified that in reality in the vast majority of cases there are several exhibitors involved, since the movie needs to be shown in as many locations, as possible, in order to get the maximum possible revenue.

The calculations of the transfer prices remain the same with the only difference that there augments the number of copies considered in the model, since the number of theaters increases. Thus, the costs of the distributor and the producer are dispersed over a larger number of copies. This scheme is the one, which is widely spread in the US, but even more broadly it is used in Europe, where there are almost no such powerful studios as Hollywood ones.

Another case should be considered as well. This is the case, when the producer is affiliated with the studio. In this case the studio (which is also a distribution

company) finances the movie and the producer acts as a manager and has a flat fee instead of participation in the revenues. Basically, what happens is that at some point the rights are transferred to the studio, if the latter finances the whole budget of the movie. This means that the distributor also bears the budget costs. So our chain reduces. This case is to a high extent spread in the US due to such factors as huge movie budgets and the industry domination by majors (six largest movie studios in Hollywood, which have astounding financial capabilities, since they are parts of huge media conglomerates).

So by introducing the sharing contracts in the chain, we achieve the task of coordination. The main result of this is the elimination of the costs of control, because every player is interested in maximizing the revenue of the chain. Otherwise there exist loopholes for opportunistic behavior. Currently, in the situation of the absence of the wholesale price, participants of the movie value chain frequently bloat their costs in order to retain a larger lump of the proceeds, thus diminishing the percentage base for the next players. Coordination is feasible to resolve this problem, and it is applicable to the situation, since the necessary precondition is cooperation, and cooperation does exist in the considered case.

It is needed to be mentioned that in the paper we consider the model, which is centralized in a sense that under exhibitor we consider some specific chain of movie theaters. However, in reality usually distributors work with many exhibitors, meaning, that the chain is decentralized. Such types of chains can also be coordinated, but the calculations are more complicated and larger amounts of data are needed in order to fulfill the task, thus, this is out of the scope of this research paper.

3.3. Case studies

In this part of the research paper the application of the elaborated method will be shown on specific examples. Cases will include movies "Inception" and "Alice in Wonderland" , both of which have already been considered earlier in the paper during the discussion of the cooperation problem.

Movie Alice in Wonderland. Let's start with the movie "Alice in Wonderland". On this example due to the availability of the data the author would like to demonstrate all possible situations of the relationships inside the chain, which will lead to different outcomes. For the purposes of the paper from all the participants involved in this movie creation we will consider the producer Richard D. Zanuk, the distributor Walt Disney Pictures and as an exhibitor we will consider the largest movie theater chain in the USA – Regal Entertainment Group. So basically, what process do we have now: the producer gives the rights for the movie release to Walt Disney Pictures, and it does not get anything in return for giving away the rights. They only agree on some percentage from the final proceeds of the movie. In our model we consider the budget of the movie as producer's costs. Then the distributor creates copies, elaborates and conducts marketing campaign (P&A) and then sets agreement on some number of copies with the exhibitor (Regal in our case). Regal estimates the demand and orders a specific number of copies from the distributor. The distributor does not get any transfer price immediately from the exhibitor. They will later share the revenue of the movie in a predetermined by the industry proportion of 50:50. Since the access to the data about the costs of each theater is limited, we will take industry averages. The average weekly expense of a theater is around $5000 per week. Regal Entertainment Group owns around 558 locations in the US, and they all have adopted the digital technology, which means that they

do not use the hard copy prints of the movie, they have it in digital form. Those copies are usually distributed either on hard drive or via Internet and satellite. In either way only one copy per theatre is needed no matter how many screens in a single theatre will show the picture. So the number of copies in our calculations will equal the number of screens of the theatre chain. We assume that every theatre of the chain will order this movie, because this is a loud blockbuster with huge budget and star cast, as well as massive marketing campaign, thus, it is expected that it will be popular with public. Currently there is only a contract stipulating the proportion, in which the revenue will be divided, but there is no coordination of the contracts, meaning that the participants still have the motives to increase their costs on the books, because in this way they will be able to retain a larger lump of the proceeds. So the author suggests to introduce the transfer prices, which will mitigate the adverse effects of working in cooperation.

The costs of the producer equal \$200 mln. ($c_{pr} = 200000000$). The costs of the distributor are the P&A costs. Walt Disney Pictures conducted a huge marketing campaign, which cost \$75 mln. ($c_d = 75000000$). The share of the distributor was in line with industry averages and constituted 80% ($\varphi = 0,8$). With this data at hand we can calculate the possible transfer price w_d, which the distributor could pay the producer for the rights of the movie. With the introduction of this parameter, the contract would be transferred from simply participation contract to sharing contract. According to the formula $w_d = \psi c_{pr} - c_d$ we get $w_d = 0,8 * 200000000 - 75000000 = 85000000$. So it is suggested that the distributor pay \$85 mln. to the producer as a fee for having the opportunity to distribute the movie. Those \$85 mln. could serve as a recoupment of the incurred costs for getting the movie done for the producer.

Now we can move to the second level of coordination, where we will find the transfer price w_e, which is a price per copy, which the distributor can receive from the exhibitor. Importantly, at this point the producer and the distributor are considered as a single entity, because it is essential that they already have contract and work together. Since we are calculating a price per copy, we need to adjust all the costs. It has been stated that the average weekly costs per theatre are \$5000. It is assumed that such blockbuster as "Alice in Wonderland" can be shown by the movie theatre chain in the period of up to 17 weeks, thus the costs per theatre for the whole period of movie screening will equal to \$85000 ($c_e = 85000$). The costs of the distributor and the producer have to also be adjusted, since all the calculations are made per copy. So $c_{prd} = \frac{c_{pr}+c_d}{N}$, where N – number of copies. In our case it looks as following: $c_{prd} = \frac{275000000}{558}$. Using the coordinating formula $w_e = \varphi c_{prd} - c_e$ we get $w_e = 0,5 * \frac{275000000}{558} - 85000 = 161416$. Thus, the suggested price per copy for the movie theatre to pay is \$161416.

We have considered the case in the situation, where there is only one theater chain involved. In this situation the price per copy would be \$161416. However, in reality we have multiple theatre chains, which the distributor is working with, thus, the model should be slightly modified. Let's consider a situation, when the distributor has made agreements with several US theatre chains. For the purposes of the example let's say that the distributor have made deals with 5 largest theatre chains in the US. So, apart from Regal Entertainment Group with 558 locations, we will consider AMC Theatres with 346 locations, Cinemark Theatres with 334 locations, Carmike Cinemas with 278 locations and Bow Tie Cinemas with 55 locations.

In this situation although the first step will be exactly the same as in the first case, the second step will be different. The idea now is that the unified costs of the distributor and the producer will be spread over a larger number of copies. Since we consider that each theater chain order the number of copies, which equal the number of the locations, we get that there are 1571 copies in total ($q = 1571$). The theater expenses are different in each chain and in the majority of locations, and they are not publicly available, so for the purposes of the example we will consider the industry averages. The period for which the copy is expected to be on screens is 17 weeks. Then we have:

$$q = 1571,$$

$$c_{e_1} = c_{e_2} = \cdots = c_{e_5} = 5000,$$

$$c_{prd} = 275000000,$$

$$\varphi = 0,5.$$

Then

$$w_e = 0,5 * \frac{275000000}{1571} - 85000 = 2524.$$

In the other words, the transfer price per copy is \$2524. This means that in case the theatres will be purchasing copies, the agreement between the distributor and the exhibitors will be sharing, i.e. no party will have objective reasons to manipulate their costs, because if they increase the costs on the books, they diminish the revenue, from which they have a share. So all the participants are motivated to maximize the possible revenue.

Basically, by introducing this methodology we do not only state that the transfer price should be implemented, but we also explain the way, how it should be calculated.

Movie Inception. Another example, which will demonstrate the methodology, is the movie "Inception", which has also been considered. This example is interesting, because in this case the producer and the distributor Warner Bros. act like a single entity from the first stage and the problem is a one-step problem. This happens, because the producer is affiliated with the studio (which is also the distributor), meaning that the producer gets the financing of the motion picture in return for the rights for the movie. So basically, in affiliation with the studio he ceases to be the ultimate claimant for all proceeds, generated by the movie. Therefore, the chain is as follows. The producer affiliates with the distributor and the rights are in the possession of the distributor from a certain point. The distributor in return fully finances the production of the picture. So, basically, all the decisions concerning movie (including some creative part corrections) are made by the distributor and the producer works for a flat fee and does not participate in the profit. Then the distributor sets deals with theater chains for the screening of the movie. When they share revenues from the box-office, the exhibitor takes 50% and then the distributor deals with talent, who participated in proceeds, from its 50%. So we have that the costs for production were at the level of \$160 mln. The costs

of the distributor for P&A equaled $100 mln. Thus, the compounded costs equal $260 mln. Let's assume that the deal for distribution was set with 5 largest movie theatre chains, and the total number of locations equals 1571 theatres. Thus, the number of copies released also equals 1571. The house expense per theatre is taken the same as in previous examples - $5000 per week per location. The movie was on screens for 16 weeks. Thus, we have the following solution.

$$q = 1571,$$

$$c_{e_1} = c_{e_2} = \cdots = c_{e_5} = 5000,$$

$$c_{prd} = 260000000,$$

$$\varphi = 0,5.$$

Then

$$w_e = 0,5 * \frac{260000000}{1571} - 80000 = 2750.$$

So the transfer price per copy is $2750 per copy, meaning that the each theatre chain, cooperating with the distributor, has to pay $2750 per each copy of the movie for the rights to show this movie in their movie theaters. In this case, again, the opportunistic behavior of the parties is eliminated. With the introduction of price per copy, there appears the dependence on the costs, because their value is used for calculation of transfer price. Thus, if a theater starts increasing its costs, then the transfer price will also enlarge, and this is certainly not favorable situation for exhibitors. So all parties are motivated to act fairly.

Peculiarities of the methodology. In this chapter the methodology has been developed, which incentivizes all of the participants of the value chain to maximize the gain of the chain, because unlike in the case of simply participation contracts, under which they share revenue, with the suggested methodology they share profit of the chain. This mitigates the opportunistic behavior in the chain, since the participnats do not have the incentives to increase their costs on the books anymore. With the introduction of transfer price, participants get the goods for a certain amount of money, which is in the direct dependence of the costs: the higher the costs, the higher will the price to pay be. There are no incentives to artificially diminish the costs as well, because the smaller the costs on the books are, the larger will be the sum of money to pay in accordance to the sharing contracts. Therefore, all the participants of the chain are motivated to, firstly, act fairly, and, secondly, to operate efficiently in order to have the costs at the optimal level to stay profitable.

The interesting thing here is that in the international context different schemes of the participants' relationship in the value chain are in practice. All of them have been discussed in the chapter. In the USA due to the large share of the blockbusters in production, which require extremely large investments, the case of the producer affiliation with the studio is more spread. This case was considered on the example of the movie "Inception". In Europe, especially in France and Italy, movies are predominantly independently financed, when the producer usually works with several institutional and private investors in order to finance the budget, therefore, the

case, where the producer and the distributor are separate legal entities, is applicable here. This case was considered on the example of the movie "Alice in Wonderland". Basically, most widely spread cases have been considered and the methodology has been adjusted for each of them.

4. Conclusion

The problem of cooperation in the movie value chain has been studied, and the methodology of box-office income allocation has been improved with the adaptation to the motion picture industry environment. Known to the literature methods of optimal revenue imputation have been investigated, which are Nash bargaining solution, the core (set of nondominant imputations), Shapley value and Shapley index. Due to drawbacks of those methods in application to motion picture industry, because of high specificity of the relationship among the parties involved, new approaches to the shares of movie revenue allocation computation have been introduced.

Coordination concept of supply chain has been studied and the possibility to apply it with some modifications to the motion picture industry has been elicited. Several types of value chains in movie industry have been considered for development of the methodology, which are in use in various countries. The peculiarity of the elaborated methodology is the introduction of transfer prices between the links of the chain, which allow transforming the participation contracts between the counteragents to sharing contracts. This innovation would motivate them to work for profit maximization and eliminate incentives for opportunistic behavior, since the transfer price is constructed on the basis of the costs of the participants and their shares in the final allocation of revenues. Therefore, with the introduction of the suggested methodology, the only optimal behavior for the participants becomes the fair one, since with the artificial increase of the costs the transfer price they need to pay will augment, and with the artificial decrease of the costs the amount of money they need to pay according to the sharing contracts will get bigger. Introduction of the transfer prices allows the producer reimburse a part of the costs connected with movie production almost immediately after setting the deal with the distributor, and avoid waiting long time till the theatrical release of the movie. The same logic applies to the distributor, since he is able to recoup a part of his costs with the transfer of copies to the exhibitors without waiting till the movie makes money in the theaters.

Acknowlegments. The authors express their gratitude to Professor Nikolay Zenkevich for useful discussions on the subjects and his support during the work.

References

Caves, Richard E. (2001). *Creative Industries: Contracts between Art and Commerce.* Harvard University Press, Cambridge: MA.

Chesbrough, H. W. (2004). *Managing Open Innovation.* Research Technology Management, **47(1)**, 23–26.

Chesbrough, H. W., Appleyard, M. M. (2007). *Open Innovation and Strategy.* California Management Review, **50(1)**, 57–76.

Chisholm, D. C. (1997). *Profit-Sharing versus Fixed-Payment Contracts: Evidence from the Motion Picture Industry.* The Journal of Law, Economics and Organization, **13(1)**, 169–200.

Cones, J. W. (1997). *The Feature Film Distribution Deal: A Critical Analysis of the Single Most Important Film Industry Agreement.* Carbondale: Southern Illinois Press.

Cook, K. (1977). *Exchange and power in networks.* The Sociological Quarterly, 18.

Cook, K. et al. (1983). *The distribution of power in exchange network.* American Journal of Sociology, 89.

Cox, A. et al. (2002). *Supply Chains, Markets and Power.* Routledge, London.

Cox, A., Sanderson, J. and Watson, G. (2000). *Power Regimes.* Earlsgate Press, Helpston.

Daniels, B., Leedy, D., Sills, S. D. (1998). *Movie Money: Understanding Hollywoodś (Creative) Accounting Practices.* Silman-James Press, Los Angeles, California.

De Vany, A., Walls, W. D. (1999). *Uncertainty in the Movie Industry: Does Star Power Reduce the Terror of the Box Office?* Journal of Cultural Economics, **23(4)**, 285–318.

De Vany, A., Walls, W. D. (2000). *Private Information, Demand Cascades, and the Blockbuster Strategy.* Working Paper, department of Economics, University of California at Irvine.

De Vany, A., Walls, W. D. (1996). *Bose–Einstein Dynamics and Adaptive Contracting in the Motion Picture Industry.* The Economic Journal, **106(11)**, 1493–1514.

Desai, M. A., Loeb, G. J., Veblen, M. F. (2002). *The Strategy and Sources of Motion Picture Finance.* Harvard Business School Case. 9-2-3-007.

Duarte, V., Sakar, S. (1998). *Separating the Wheat from the Chaff - a Taxonomy of Open Innovation.* European Journal of Innovation Management, **14(4)**, 435–459.

Eliashberg, J., Elberse, A., Leenders, M. (2005). *The motion picture industry: critical issues in practice, current research and new research directions.* Boston: Harvard Business School Press.

Emerson, R. (1962). *Power-dependence relations.* American Sociological Review, 27.

Epstein, E. J. (2011). *The Hollywood Economist: The Hidden Financial Reality Behind the Movies.* New York: E.J.E. Publications, Brooklyn.

Finney, A. (2010). *Value chain restructuring in the global film industry.* The International Film Business - a Market Guide Beyond Hollywood, 5.

Garon, J. M. (2009). *Film Financing and Distribution Deals.* Independent Filmmaking, The Law & Business Guide for Financing, Shooting & Distributing Independent & Digital Films (Second Edition). A Capella Books.

Hart, O., Holmstrom, B. (1987). *The Theory of Contracts. Advances in Economic Theory.* Fifth World Congress. Cambridge: Cambridge University Press.

Honthaner, E. L. (2010). *The Complete Film Production Handbook (Fourth Edition).* Elsevier Inc.

Lee, J. J. Jr., Gillen, A. M. (2011). *The Producer's Business Handbook. The Roadmap for the Balanced Film Producer (Third Edition).* Taylor & Francis.

Litman, B. R., Ahn, H. (1998). *Predicting Financial Success of Motion Pictures. The Motion Picture Mega-Industry.* Needham Heights, MA: Allyn & Bacon.

Litman, B. R., Kohl, L. S. (1989). *Predicting Financial Success of Motion Pictures: The '80s Experience.* Journal of Media Economics, **2**, 35–50.

Mazalov, V. V. (2010). *Game Theory and Appendices.* St. Petersburg: "Lan".

Petrosjan, L. A., Zenkevich N. A. (1996). *Game Theory (Series on Optimization; vol. 3).* World Scientific Publishing Co. Pte. Ltd.

Petrosjan, L. A., Zenkevich N. A. (2016). *Game Theory (Second Edition).* World Scientific Publishing Co. Pte. Ltd.

Quelch, J., Elberse, A., Harrington, A. (2004). *The Passion of the Christ (A).* Harvard Business School Case, 9-505-020.

Ravid, S. A. (1999). *Information, Blockbusters, and Stars: A Study of the Film Industry.* Journal of Business. **72(4)**, 463–492.

Rodnyansky, A. (2013). *The producer comes out.* Moscow: Mann, Ivanov & Ferber.

Ross, S. A. (1973). *The Economic Theory of Agency: The Principal's Problem.* American Economic Review, **63(2)**, 134–139.

Salancik, G. and Pfeffer, J. (1977). *Who gets power and how do they hold on to it: a strategic-contingency model of power.* Organizational Dynamics, 6.

Sochay, S. (1994). *Predicting the Performance of Motion Pictures.* Journal of Media Economics, **7(4)**, 1–20.

Vogel, Harold L. (2010). *Entertainment Industry Economics (Eighth Edition).* New York: Cambridge University Press, Cambridge.

Vogel, Harold L. (2015). *Entertainment Industry Economics (Ninth Edition).* New York: Cambridge University Press, Cambridge.

Wallace, W. T., Seigerman, A., Holbrook, M. B. (1993). *The Role of Actors and Actresses in the Success of Films: How Much is a Movie Star Worth?* Journal of Cultural Economics, **17(1)**, 1–27.

Wasko, J. (2003). *How Hollywood Works.* Sage Publications Inc.

Watson, G. (2004). *Uncertainty and Contractual Hazard in the Film Industry: Managing Adversarial Collaboration with Dominant Suppliers.* Supply Chain Management: An International Journal, **9(5)**, 402–409.

Weinstein, M. (1998). *Profit Sharing Contracts in Hollywood: Evolution and Analysis.* Journal of Legal Studies, **27(1)**, 67–112.