THE REPUBLIC OF TURKEY
BAHCESEHİR UNIVERSITY

SIMULATION BASED OPTIMIZATION IN TRANSPORTATION PRICING MODEL

Master's Thesis

HİLAL GÜLAY

İSTANBUL, 2016

THE REPUBLIC OF TURKEY
BAHCESEHİR UNIVERSITY

GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES
INDUSTRIAL ENGINEERING

SIMULATION BASED OPTIMIZATION IN TRANSPORTATION PRICING MODEL

Master's Thesis

HİLAL GÜLAY

Supervisor: Assist. Prof. DR. Ethem ÇANAKOĞLU

İSTANBUL, 2016

THE REPUBLIC OF TURKEY
BAHCESEHIR UNIVERSITY

GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES
INDUSTRIAL ENGINEERING

Name of the thesis: Simulation Based Optimization in Transportation Pricing Model
Name/Last Name of the Student: Hilal Gülay
Date of the Defense of Thesis:

The thesis has been approved by the Graduate School of Natural and Applied Sciences.

Assoc. Prof. Dr. Nafiz ARICA
Graduate School Director
....

I certify that this thesis meets all the requirements as a thesis for the degree of Master of Sciences.

Assist. Prof. Dr., Ethem ÇANAKOĞLU
Program Coordinator
....

This is to certify that we have read this thesis and we find it fully adequate in scope, quality and content, as a thesis for the degree of Master of Sciences.

Examining Comitee Members	Signature
Thesis Supervisor Assist. Prof. Dr., Ethem ÇANAKOĞLU	--
Member Assist. Prof. Dr., Demet Ö. ÜNLÜAKIN	--
Member Assoc. Prof. Dr., Alp ÜSTÜNDAĞ	--

ABSTRACT

SIMULATION BASED OPTIMIZATION IN TRANSPORTATION PRICING MODEL

Hilal Gülay

Industrial Engineering

Thesis Supervisor: Assist. Prof. Dr. Ethem Çanakoğlu

August 2016, 105 pages

In consequence of the rapid developments in information and communication technologies, “e- commerce” concept has become important in economy and new business models have been consisted. This thesis deals with modelling requests from by way of a system which includes truckers search jobs via mobile applications. Complete new business process is developed and experimented with unique simulation rules based optimization techniques. Request of the truckers are generated and evoulated with these algorithms. Expectations of the firm and customers that purchase prices and sales prices for these types of request should be lower than regular market prices are observed. Moreover it is seen that job volume of the firm has big effects on the profit.

Keywords: Electronic transportation, simulation based optimization, collaboration, full truckload

ÖZET

SIMULATION BASED OPTIMIZATION IN TRANSPORTATION PRICING MODEL

Hilal Gülay

Endüstri Mühendisliği

Tez Danışmanı: Yrd. Doç. Dr., Ethem Çanakoğlu

August 2016, 105 sayfa

Bilgi ve iletişim teknolojilerindeki hızlı gelişmelerin sonucunda ekonomide "e-ticaret" kavramı önem kazanmış ve yeni iş modelleri oluşmuştur. Lojistik sektörü de bu değişimden etkilenmiştir. Mevcut iş modellerinin yerine inovasyon projeleri rotaya çıkmış; taşımacılık operasyonları mobil uygulamalar, online sistemlerle desteklenmeye başlanmıştır.Tezde, kamyoncuların mobil kanalıyla iş aradığı durumlarda bir sistem üzerinden bu isteklerin değerlendirilerek modellenmesi üzerinde çalışılmıştır. Tamamen yeni bir iş süreci geliştirilmiş ve özgün simulasyon kurallarına bağlı optimizasyon teknikleriyle denenmiştir. Müşterilerin ve firmanın, bu tarz istekler için satın alma ve satış fiyatlarının normal piyasa fiyatlarından az olması gerektiği inanışı gözlemlenmiştir. Ayrıca firmanın iş hacminin kar üzerinde büyük etkisi olduğu görülmüştür.

Anahtar Kelimeler: Elektronik taşımacılık, simulasyon bazlı optimizasyon, iş birliği, tam kamyon yükü

CONTENTS

TABLES

FIGURES

ABBREVIATIONS

FTL	:	Full Truck Load
RT	:	Request Type
TL	:	Turkish Lira

SYMBOLS

Administrative cost	: AC_i
Cancellation Percentage	: CP_i
Days of the period	: k
Optimization step size	: n
Request type number	: l
Simulation number	: j
Percentage of acceptance at i	: PA_i
Purchase price of requests at i	: PP_i
Price threshold of requests at i	: PT_i
Request at i	: R_i
Request type at i	: RT_i
Sales price of requests at i is offered at searching job	: CSP_i
Sales price of requests at i is existed at the system	: SP_i
Trucker request number	: i
Trucker cost	: TC_i

1. INTRODUCTION

Freight transportation is the process of delivering different types of goods from one point to another with a variety of transport modes. It is a significant ingredient of logistic sector and economy. One of the most common modes of freight transportation is road transport with trucks. Truckers may work directly with freight owners' or with a broker firm which finds loads. There may be a carrier firm that contracts or sells transport service to the freight owners and purchase transport service from a broker firm or directly from the trucker.

In truckload operations, the vehicles move in response the demand simultaneously without any base terminals or fixed schedules. Usually, freight volumes in different locations are unbalanced and change throughout the seasons. These randomness in demand may cause inefficiency such that truckers may go from point A to B without any load which is described as empty kilometers. Hence, minimizing empty kilometers is an important issue for truckers. In addition, truckers want to plan their shipment times. In order to achieve these objectives truckers search for extra jobs from carrier companies through different channels. These truckers may offer freight prices lower than market.

On the other hand, carrier firms want to evaluate extra job request from truckers. Since the requests are lower than market, carrier firms may offer these prices as special prices to freight owners. In this business model, the carrier firm need to analyze truckers' requests, find new loads and organize the truckload operations.

An important management concern is dealing with the risk of the trucker that does not show up. If the requests are sold to a customer but trucker does not show up there are two types of loss for the carrier firm: the revenue and the reputation. Since the shipment is sold to the customer, carrier firm has to find another trucker which it will cost at least the market price or higher. Also if the carrier firm may not find any trucker even at higher prices, customer may see these situation as unreliable operation and may not prefer the carrier firm again.

This thesis aims to create a business solution with e-procurement techniques, where the objective is to model the carrier problem of profit maximization over the truckers requests by deciding in sales prices and calculate the risks related to the event trucker not showing up.

The thesis consists of six chapters and is structured as follows:

Chapter 1 involves the introduction to the research and gives details the importance of this thesis.

Chapter 2 summarizes the literature review about pricing models freight transportation and modeling techniques used for truckers and buyers responses.

Chapter 3 describes problem definition which includes data gathering and analyzing, formulation of optimization model under risk constraints in truckload operations.

Chapter 4 gives model development and identifies assumptions, decision variables and parameters and model components.

Chapter 5 develops the optimization model to find optimal truckers' requests possible market environment and the consequences in the system.

Chapter 6 discusses computational results, analyzing prices and observing the changes of expected profit.

Chapter 7 gives the discussion and conclusion based on the findings of the research.

2. LITERATURE REVIEW

This study aims to model a business process with two different types of customers (truckers and freight owners) and maximize profit of the system. The system is affected by behaviors of truckers, freight pricing, decision making and optimization throughout the process. Hence, some studies from different areas like freight pricing, truckers' route choices, pricing decisions in fleet management, e supply chain modeling etc are examined in order to obtain information about pricing strategies in transportation sector.

Basu, Subramanian and Cheikhrouhou (2015) presented a review study that shows different type of problems, objectives and techniques for FTL transportation service procurement literature. Authors classified problem types as Bid Generation, Carrier Assignment, Collaboration whereas problem objectives are cost objectives and non-price objectives. In these study, we summarise the papers related to our problem below.

Powell (1988) developed a new system in order to match drivers to loads optimally and maximize customer service and total expected profits. In the first stage of the study they specify the truckers' issues like minimizing empty miles and assigning truckers to loads. Hence the first problem was to decide how to evaluate the contribution of a movement, given all its possible ramifications. They develop time series models updated daily and estimate of what will happen to a truck once it is sent into a region. After, they try to determine how to optimally dispatch the trucks to maximize both customer service and total expected profits over the planning horizon. This problem was represented by a time/ space network model in which each node shows a particular area on a given day. They used Monte Carlo simulation and noted that the model produces 8-10 percent profit increase.

Inaba and Wallace (1989) considered theoretical model for freight transportation demand and maximizing firms' profit. In this study, firms' decisions of how much to ship, destination and node type have been considered and a freight demand model have been developed as a switching regression model. Authors validated that market boundary should be a significant predictor of node choice because it affects the firm's profit. They noted that model is appropriate for analyzing spatial policy problems like forecasting interregional freight flows or taxes or infrastructure policies.

Gorman (2002) studied a hypothesis that if freight transportation companies represent the cost of empty equipment repositioning cost and implement into prices, they can improve their profit. Authors developed a heuristic identifies market conditions in the network and compounds repositioning cost into the profit function. They used Monte Carlo simulation and verified a strong positive correlation of price change and externality when the cost is introduced to the pricing decision. Level of net profits is increased with 95% confidence by their algorithm.

Sheffi (2004) interested in benefits of combinatorial auctions and reports that shippers who are using this type of auctions may select carriers who provide good service. Besides, shipper may match right network to related customer and decrease their operational cost.

Abad (2007) developed a model of freight costs using the freight tariffs and define a algorithm in order to identify the optimal purchase lot size for the buyer in answer to the temporary price reduction quoted by supplier. Author noted that a buyer may want to check incoming costs of freight since the supplier may only allow for orders that are free on the board but the buyer may evaluate a chance in order to dispose freight and may want to organize freight himself or outsourced its logistics activities. In the result of this study, objective function is non-smooth and the author addressed that the buyer is act like a reseller and the demand would be sensitive.

Caplice (2007) studied a review paper that researched electronic markets in the truckload transportation sector. Author gave details in the elements and process of the truckload operations. Caplice described the major three factors of the electronic markets are auctions, catalogs and exchanges. Author examined fifferent bid types, features of the catalogs and exchanges.

Ergun, Kuyzu and Savelsbergh (2007) studied on a collaboration problem which based on creating continuous truckload flow with minimum repositioning cost. They emphasized timing issues for their system. The problem is defined as finding a minimum cost set of cycles that cover all of scheduled truckload movements (which referred as “lanes”). They developed an optimization algorithm using a heuristic approach for this problem and noted that they were unable to find any literature especially interested in lane covering problem with time considerations.

Lee, Kwon and Ma (2007) developed a unique optimization model which includes generation and selections of routes for carrier bid generation problem. In order to maximize revenue the algorithm finds a set of lanes that presents the most profit. They state that is not necessary to minimize repositioning costs. They model the problem as an integer program and used a decomposition approach by column generation and Lagrangian relaxation for solution.

Topaloglu and Powell (2007) constructed a model to get sample path-based directional derivatives of the profit function regarding to the prices. The carrier decides on the prices at the beginning of a definite time horizon and the load arrivals over this horizon depend on the presented prices in the system. They noted that correct prices have to depend on the empty vehicles and repositioning cost. Authors assumed that the underlying fleet management policy is Markovian.

Confessore, Corini and Stecca (2008) considered a delivery problem where freights’ must be delivered to customers in a definite time window. They realized number of vehicles and transportation cost increases when there are numerous time constraints. So they concluded that a logarithmic regression function presents relationship between total transportation cost and weighted mean time window width. In order to validate prediction of the regression function they created scenarios as Vehicle Routing Problem with Time Window and solve them using Solomon Algorithm. After they made an interaction protocol which includes cost function based on orders and discounts for the customers, they simulated the interaction protocol and compare cost function. They noted that their cost function is higher than Solomon Algorithm which means algorithm always generates higher than real cost, so there aren't any loss to the distributor.

Tsung-Sheng Chang (2009) studied a bidding advisor to help truckload(TL) carriers for one shot combinatorial auctions as a network flow problem. Author used synergetic shortest path algorithm which includes a column generation approach to solve the problem. Advisor compounds information about the shipments, load details from e-markets and current fleet management strategies and presents preferred load bundles.

Wei-Hua and Chung-Yee (2009) studied in developing pricing treatment of firms in a two location market with empty equipment repositioning cost. In the study, there are two types of cost; the first one is transportation cost of loaded equipment, the second one is repositioning cost of empty equipment. They assumed that unit costs are constant. Objective of a firm is to maximize profit of firms by deciding the appropriate prices. They found the optimal prices of the firms using a Bertrand duopoly model. Besides they showed that higher unit empty equipment repositioning cost may create more profit to the firms. Their work is mostly related Gorman's (2002) study by objectives but different from Topaloglu and Powell (2007) since Wei-Hua and Chung-Yee considered competition outcome of firms.

Berger and Bierwirth (2011) interested in daily operations of the carriers and inefficient matches between carriers and requests. They considered a system that carriers and customers share informations with centralized planning approach and also decentralized planning. Authors developed a framework which aim to maximize profit of the all system and each carrier as possible they share the information. They used Vickrey Auction algorithm and a combinatorial auction. They defined the problem as the Colloborative Carrier Routing Problem. Computational results shows that there is significant potential fot these method to maximize the profit of the network against to individual planning while assuming real informations are shared by carriers.

Ozener, Ergun and Savelsbergh (2011) studied carrier collobartion approaches like Berger and Bierwirth and developed an optimization model, a lane exchange mechanism, which finds the maximum utility from collaboration. This study is different from other centralized collaboration approaches since carriers are selfish and their objective is to minimize their cost while they only collaborate by defining the rules of the lane-exchange mechanism. Results shows that this mechanism performs well while determination the synergies between the lanes of the the carriers.

Toptal and Bingöl (2011) considered a problem that includes a retailer, a truckload carrier and a less than truckload carrier. They focused in case where the truckload carrier knows the less than truckload carriers tariff schedule. Their objective is maximize revenue of truckload carrier by determining the price for a single truck. First they model and generate a solution to the retailers' replenishment problem which is finding quantity of the order that will maximize expected profit of retailer. Afterward they found the solution for the general demand distribution. Authors noted that the retailer and the truck load carrier may increase their revenue by coordinating the pricing and the replenishment decisions.

Feng, Arentze and Timmermans (2013) examined about the heterogeneous features of truck drivers for their route choice preferences. Research implemented in Eindhoven, Netherlands at 2009 and there were fifteen freight transportation firms. In total a hundred drivers and one planner per firm played a part in these experiment. Questions were asked about two hypothetical routes with different attribute levels and contextual variables. In the analysis authors used latent class model and multinomial logit model. MNL model shows the choice preferences of road. Drivers/planners are most sensitive to travel time. They noted drivers do not like local roads especially when this includes passing through residential area. In the result of LCM they found that light truck drivers are more sensitive to congestion and pricing but heavy truck drivers are more sensitive to road pricing, road category and urban area.

Verdonck, Caris, Ramaekers and Janssens (2013) presents a literature review of logistic collaboration about capacity sharing and order sharing. They notes that sharing orders may decreases transportation cost, improves reposition of the vehicles. They described solution techniques in five types as auctions based mechanisms, bilateral lane exchanges, load swippiğng, joint route planning and shipment discpatching policies. On the other hand carriers may share their vehicles. Hence, utilization of the capacities may be increase. Mathematical programming and negotiation protocals are presented as general methods in the literature in order to find the most effective way for capacity sharing.

Yang and Bin (2013) generated a pricing model for two-level logistics service supply chain which includes a logistics service provider and a manufacturer. Their objective is to maximize the revenue of supply chain. In order to achieve they found function of manufacturer's expected profit, the function of logistic service provider's expected profit. Later they calculated the overall expected profit function. Consequently, they noted that when the logistics service provider and manufacturer maximize their profit, over all income of supply chain may maximize.

3. PROBLEM DESCRIPTION

3.1 PROBLEM DESCRIPTION

In this study, a system has been considered that includes truckers and freight owners. The system is an online platform that provides transportation service. Freight owners make their orders by entering information about route, truck type, loading time, freight amount, freight type etc. After a shipment request made by a freight owner, the system start to work, a pricing model in the system generate quote price and offers the sales price to the freight owner. If freight owner accept the sales price and buy the shipment; system finds the closest available truckers which matches the truck requirements of the freight owner and makes offer to the truckers. At this stage an auction starts with bid price and truckers may accept bid price or offers lower than bid price / higher than bid price. After auctions a trucker may accept the shipment and the shipment is assigned to the trucker. Consequently, shipment process is started. hence, flow of the operations start with freight owners and reach to the truckers.

Since truckers act simultaneously and they want to plan their working times, truckers make job requests from the system. Truckers choose *x* different routes and purpose their prices to each route by a mobile application which is part of the system. Requests have to be process in a specific commitment time. Process of these requests is a new business approach to the existing system. This problem is reverse of the system. Flow starts with trucker and reaches to the customers. Hence, development of process is mainly a problem. In order to evaluate requests and transform them into a shipment requires searching/ creating new shipment which means reaching to the customers and persuade them to buy shipments. So it is important to identify right requests which match shipment portfolio of the system. After deciding requests to process, the question is what is the sales prices will be? Sales prices are critical since they affect customers. For these type of requests, customers usually expect lower price than regular market prices. Sales price should be lower than market but the system need to make profit. Later on calculation sales prices and offer them to customers, if the customer buy a shipment that means system have to supply a vehicle which matches to customer's needs. If the trucker who is owner of that job request give up that job and does not show up to operation, it becomes new problem. Since the sales price are lower than market price, either system lose money during finding new vehicle or may not find vehicle and lose the customer. Therefore, it is very important to determine sales prices in order to maximize profit. To be able to do that sub problems of these business process must be solved.

Main problem: What will be sales prices? (Maximize profit such a way that presents special prices)

List of the sub problems:

a. Are the truckers' prices reliable?
b. Which requests are appropriate to evaluate?
c. How to decide which job may maximize profit?
d. What if trucker does not show up?
    i. Risk of loss in revenue (finding expensive truck)
    ii. Not finding a vehicle (reputational loss)

3.2 OBJECTIVES

Aim of this study is to develop a business process including solutions of the problems defined in the previous section. We will try to find some understanding of these business problems in the transportation sector.

At the beginning we will create a workflow of business model so it makes easier to manage these kind of operations. This workflow includes all of the problems which defined and aims to maximize profit of system. We will be able to minimize employee cost with decision criteria in the model and also we will be able see the risks and consequences in the operations.

In the analysis we will be generate some numerical results about the impact of the conditions in the market to profit of the system.

4. SIMULATION MODEL

4.1 ASSUMPTIONS

All of the shipments are operated as FTL (Full Truck Load) in the system. That means a trucker only carries load which belongs to one customer, he must not unite loads from different customers at one shipment.

Historical data is provided by a confidential transportation company. Data divided by route (departure and arrival city) and vehicle type. Differences in the prices from freight amount, freight type, freight loading type and other reasons have been ignored. Also, status of shipments are examined and shipments that financial process have been executed are used in this study. Time period of the data begins with January 2014 and ends with February 2016.

Prices which been offered by truckers are assumed as known. Since the problem is a complete new business model and aim of the study is modelling whole process, prices are generated from original purchase prices of the company. Hence they are represent behavior of the truckers, generally.

Trucker requests are generated from the route and vehicle type combination which is will be explained in “Section 4.4”. There are 169 different combinations but top 100 combinations according to quantity of shipments are used in the request generation process.

4.2 DECISION VARIABLES AND PARAMETERS

a. **Price Threshold and α:** Price threshold is the first sub problem that “How can we decide a price of request is worthwhile to searching job?” as mentioned before, since the truckers are seeking jobs expectation of companies is prices of the requests are lower than regular prices. In this manner they may draw attention of freight owners and sell shipments. Hence to determine acceptance of requests is the one of the important problems. Therefore price threshold variable is generated as multiplication of mean of RT_l and a decision variable called "α". It is the first decision variable and used in the optimization algorithm. α is given a start value in the beginning simulation algorithm and better values are searched with optimization algorithm.

b. In the top routes and β: Searching job for every request may decrease profit since the shipment numbers change according to the route types. Hence to minimize unnecessary searching cost and speed up the algorithm a decision variable named as β is generated. β is given a star value and good solutions are searched with optimization algorithm like α.

c. Customer Price and γ: Determination of the sales prices which will be offered to the customer is the second sub problem in these business model. Companies have to find such a sales price that it is under the market prices enough to catch the attention of the customers and maximize profit somehow. Because if they offer too low from the market and if the trucker does not show up that mean they may not find another trucker immediately and lose the customer; or they may find another trucker higher than market prices lose money. Therefore customer sales price CSP_i, is calculated as multiplication of mean of RT_l and a decision variable called "γ". γ is the second decision variable which is given a start value in the simulation algorithm and better values searched in optimization step.

Parameters that calculated from historical data are presented in the below:

a. $\boldsymbol{RT_l}$ **:** Request type is departure & arrival city combination at *l* which is number of different combinations.

b. $\boldsymbol{PP_i}$ **:** Purchase price which is offered by trucker at request *i*.

c. $\boldsymbol{PT_i}$**:** Price threshold value for determining PP_i is reliable or not at request *i*.

d. $\boldsymbol{SP_i}$ **:** Sales price of the jobs that are already existed in the system.

e. $\boldsymbol{CSP_i}$ **:** Sales price which will be offered to the customer in the searching process at request *i*.

f. $\boldsymbol{PA_i}$**:** percentage of acceptance is probability that customer accept job offer/ CSP_i at request *i*.

g. $\boldsymbol{AC_i}$ **:** Administrative cost that caused by searching processed at request *i*.

h. $\boldsymbol{TC_i}$ **:** Trucker cost is extra cost of finding another trucker in case of trucker who owns the request does not show up at request *i*.

The objective of this problem is profit maximization. Profit function in the problem is non linear probabilistic function. It can be summarized as follows:

$$\text{P}(\alpha.\mu_i > PP_i \text{ \& job type i is avalaible}) . (PP_i - SP_i) \quad \textbf{(4.1)}$$

$$+ \text{ P}(\alpha.\mu_i < PP_i \text{ \& job type i is not avalaible \& top route }).$$

$$*[AC_i + PA_i . \text{P(show up)} .(PP_i - SP_i) + PA_i \text{P(not show up)} . (PP_i - SP_i - TC_i)]$$

where P(.) is the probability function. First part corresponds to the case where existing job is avalaible and second part includes the cases where job is found after searching process for both of the cases where trucker shows up or does not show up. Since this non linear function may not be solved with mathematical programming techniques, it is solved with simulation algorithm in this study.

4.3 BUSINESS WORKFLOW

In this section workflow which created in order to solve the problems described previous part will be explained.

i. Workflow starts with requests of truckers. Truckers may want *n* different routes and propose their prices for each of them.

ii. System compares the prices of truckers with pricing model prices which come from dynamic pricing system. For the prices of truckers above the threshold values, related requests are eliminated from the system.

iii. For remaining requests, system checks existing shipments which haven't assign to a trucker yet.

a. If there is a matching with an existing job and request, trucker are assigned to the shipment and process ends.

b. If there isn't any matching process continues.

iv. Quantity of shipments for each route are calculated and top routes are identified.

a. If route of request is not in the top route list, process end in order to minimize employee cost and cost of probable reputational loss.

b. If route of request is not in the top route list, process continues.

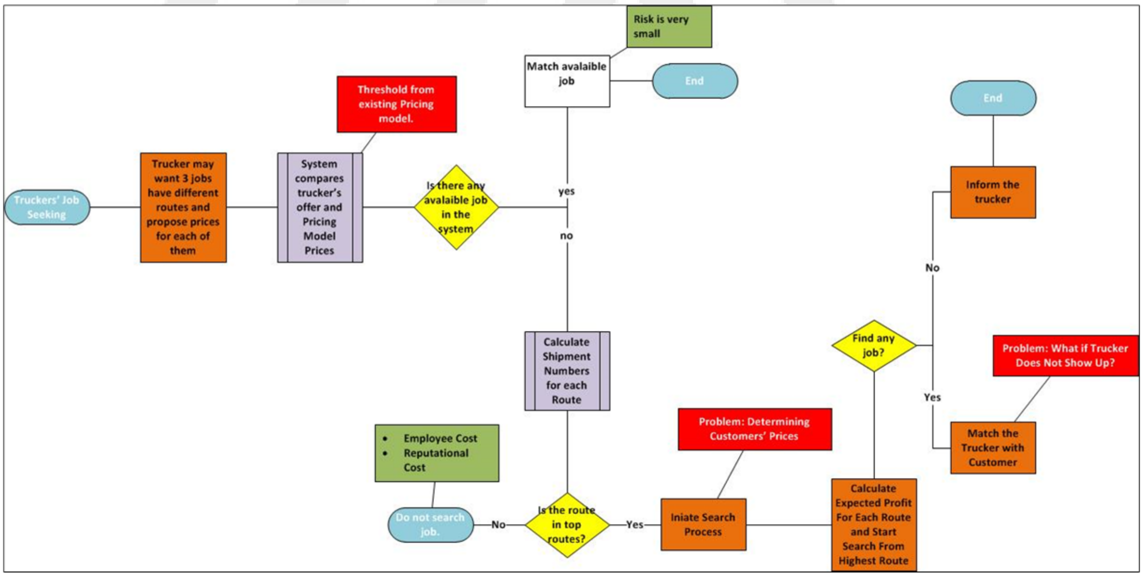
v. System initiate search process.

vi. To order the routes of the request, system calculates expected profit for each route and start from the route which has the highest profit

a. If any job isn't found throughout the commitment time, information is given to the trucker and process ends.

b. If a job is found, trucker is assigned to the job.

Figure 4.1 Workflow of the business model



4.4 REQUEST GENERATION AND PROFIT CALCULATION ALGORITHM

A simulation algorithm is developed in order to create and model the workflow which is explained above. The algorithm generates requests, produces purchase and sales prices, calculates thresholds and evaluates the requests according to the thresholds.

First, necessary values for simulation is calculated from historical data. Route and vehicle type combination is accepted as request type. In other words, request type is comprised of departure city, arrival city and vehicle type.

For all RT, mean, variance and standard deviation of PP_i and SP_i, number of shipments are calculated. Also, percentage of RT, are determined as;

$$percentage\ of\ RT_l = \frac{s_l}{\sum_l s_l} \quad \textbf{(4.2)}$$

Steps of the algorithm is explained as follows:

Step 1: Generate R_i

i. Generate random number from (0, 1).

ii. Random value is compared with cumulative percentage of all RT, find the closest value and corresponding RT_l.

iii. R_i is recorded as selected route and vehicle type.

Step 2: Generate PP_i of R_i

i. Generate random number from standart normal distribution, Z_i.

ii. Calculate PP_i,

$$PP_i = Z_i * \sigma_i + \mu_i \quad \textbf{(4.3)}$$

iii. Record purchase price for R_i.

Step 3: Decision of acceptance of R_i

i. Compare PP_i with Price Threshold which is defined as

$$PT_i = \alpha.\mu_i \qquad \textbf{(4.4)}$$

If $PP_i > PT_i$, stop the algorithm. Record R_i is eliminated because of Price Threshold and profit is "zero".

Else, resume the algorithm.

Step 4: Find SP_i for existing jobs

i. Calculate SP_i,

$$SP_i = \alpha.\mu_i \qquad \textbf{(4.5)}$$

ii. Record sales price for R_i.

Step 5: Find if any existing jobs and match

i. Generate random number from (0, 1).

ii. Calculate job frequency. Whether any shipments is done or not is controlled; if a shipments is occurred for R_i recorded as "1" for that day; otherwise recorded as "0".

$$Frequency = \frac{\sum_k \begin{Bmatrix} 1, s_l > 0 \\ 0, s_l \leq 0 \end{Bmatrix}}{\sum k} \qquad \textbf{(4.6)}$$

s_l is number of shipments for R_i and k represents days of the period.

iii. Compare random value with frequency,

If random value > frequency, there is not any existing job to match, resume algorithm in order to find job.

Else, an available job is found; record sales price as $SP_{i,}$, match the system and the trucker.

$$Profit = SP_i - PP_i \quad \textbf{(4.7)}$$

There is no administrative cost since there isn't any searching process.

Step 6: Determine if R_i is in the top routes

i. Find cumulative percentage of corresponding R_i.

ii. Compare cumulative percentage with β.

a. If cumulative percentage > β, corresponding R_i. is not in the top route, stop the algorithm.

b. Else, continue search process.

Step 7: Determine CSP_i

i. Calculate CSP_i,

$$CSP_i = \gamma\mu_i \quad \textbf{(4.8)}$$

ii. Record customer sales price for R_i.

Step 8: Search job and control if any job is accepted by customers

i. Generate random number from (0, 1).

ii. Calculate PA_i

$$PA_i = 0{,}9 - 3(\gamma - 0.8) \quad \textbf{(4.9)}$$

iii. If random value > PA_i , job is not found. Inform the truckers.

a. Calculate administrative cost as

$$AC_i = -\text{PPi} * 0{,}05 \quad \textbf{(4.10)}$$

Record profit as

$$Profit = -AC_i \quad \textbf{(4.11)}$$

Else, job is found.

Step 9: If any job is found, determine the operation scenarios and profit

i. Generate random number from (0, 1).

ii. Calculate trucker cancellation percentage from historical data.

iii. If random value > CP_i trucker does not show up.

b. Find another truck with %15 higher prices. Calculate trucker cost TC_i ,

$$TC_i = -\text{PPi} * 0{,}15 \quad \textbf{(4.12)}$$

$$Profit = CSP_i - PP_i - TC_i - AC_i \quad \textbf{(4.13)}$$

iv. Else, trucker shows up; shipment accomplished.

$$Profit = CSP_i - PP_i - AC_i \quad \textbf{(4.14)}$$

In step 1, the requests are generated. R_i is represents *"i'*th request and i=1,...,100. In order to prevent bias and produce the requests randomly; a random number generated from uniform distribution. It is compared with cumulative percentage of request types RT_l . *"l"* is index number for request types and l=1,..,100. The closest value of cumulative percentage and corresponding request type are found. Type of "i"th R_i is record as found RT_l.

Since R_i is generated, second step is to produce truckers' prices. To do that a random number generated from Z, standard normal distribution. Later, it is multiplied with standard deviation of RT_l. and added to mean of RT_l. Result of these formula is recorded as truckers' price in another word purchase price $PP_{i..}$

With these two steps above, requests of truckers are created. In next step, whether that R_i is appropriate for searching process or not is determined. Purchase price of requests $PP_{i.}$ are compared with price threshold $PP_{i..}$ recall that price threshold is calculated as multiplication of mean of RT_l and α. If $PP_i > PT_i$, it means price of the trucker is higher than average market prices. R_i is recorded as eliminated and profit is "zero". Else, for R_i process continues.

In step 4, $SP_{i,}$ sales price of request is calculated as mean of RT_l and recorded.

If there is an accepted request, first thing to do is checking existing jobs of the system. Because if there is an available job to corresponding request, shipment is organized for regular market prices and PP_i it means making more profit. First a random number is generated from (0,1). In order to determine whether there is an available job or not, job frequency of corresponding request type is calculated from historical data as "number of days when at least a shipments as operated" / "total number of days". So, "if a shipments is occurred for RT_l of R_i recorded as "1" for that day; otherwise recorded as "0" and summation of these binary coding represents the days of jobs are occurred. The frequency is found when these summation divided by number of days in the period. Then the random is compared with the frequency: if random value is greater than frequency, there is not any existing job to match, algorithm continued in order to find job. Else, an available job is found; sales price SP_i which is calculated at Step 4 recorded. The trucker and the shipment is matched. Profit is recorded as "Equation 4.7".

In order to avoid extra cost in the searching process, whether route type of corresponding R_i is in the top routes or not is controlled. Therefore, if route type for R_i is not in the top routes that shows there are few shipments data and finding job possibility is small. So searching job for these kind of instances will increase cost. If cumulative percentage > β, corresponding R_i is not in the top route, the algorithm stops for R_i

For the requests which are in the next step of the algorithm, customer sales price CSP_i, is calculated as multiplication of mean of RT_l and a decision variable γ. It is very important to find “right” sales prices which will be offered to the customer since it affects buying decision of the customer right away.

In real life, company experience reaction of the customers simultaneously. To be able to actualize that scenario acceptance percentage of the customers calculated and whether the customer accept offered prices or not created randomly in step 7. First, a random number generated from uniform distribution. Percentage of acceptance is calculated with the “Equation 4.9”.

PA_i is related with customer sales price CSP_i, and γ. Since the companies offers won’t be interested in the offer, since they ask for job for the trucks on the hand, customers expect prices under the market places. Therefore it is very important to determine γ and CSP_i, . In step 8, in order to simulate scenarios decision rule is : If random value > PA_i , job is not found. Inform the truckers as there is no job that found and there is no revenue. However there is an administrative cost which is since searching process are done. It is calculated with “Equation 4.10” and profit recorded equals to the loss of the administrative cost value with “Equation 4.11”. Else, job is found, continue with step 9.

In step 9, shipment operation scenarios are examined. There are two possibility; first is the trucker come and the shipment operated. Second is the trucker does not come and company finds another trucker with extra cost. To simulate these scenarios a random number generated from uniform distribution and compared with CP_i. If random value > CP_i trucker does not show up. So company finds another trucker with trucker cost TC_i which calculated as 15 percent of PP_i by “Equation 4.12” . Profit is subtraction of purchase price PP_i and trucker cost TC_i and administrative cost AC_i from customer sales price CSP_i in the “Equation 4.13”. Else the trucker comes and the shipment is operated. So profit is subtraction of purchase price PP_i and administrative cost AC_i from customer sales price CSP_i in the “Equation 4.14”.

5. OPTIMIZATION MODEL

5.1 STEEPEST DESCENT

In nonlinear programming problems solution studies, many different techniques like Newton's method, conjugate gradients method, steepest descent etc. is used. In this study, since the first derivative may be numerically estimated even when the closed form is unknown; steepest descent method is preferred. It is classified as part of continuous parametric optimization techniques. The problem of continuous parametric optimization can be described formally as:

$$\text{Minimize } f(x(1), x(2), \ldots, x(N)), \qquad \textbf{(5.1)}$$

where *x(i)* presents the *i*th decision variable, *N* presents the number of decision variables, and *f(.)* presents the objective function. (Gosavi 2015, p.72). In this study objective function is maximize profit, hence it may written by reversing sign of minimization problem:

$$-\text{Minimize } f(x(1), x(2), \ldots, x(N)), \qquad \textbf{(5.2)}$$

Steepest descent method for maximization problem use these rules when moving one iteration to the next one (Gosavi 2015, pp.73-74):

1. m is an iteration number and $\vec{x}^m$ presents the solution vector at the *m*th iteration. x^m *(i)* is updated for *i*=1, 2, …N.

$$x^{m+1}(i) \leftarrow x^m(i) + \mu \left.\frac{\partial f(\vec{x})}{\partial x(i)}\right|_{\vec{x} = \vec{x}^m} \qquad \textbf{(5.3)}$$

$\frac{\partial f(x)}{\partial x(i)}$ presents partial derivative of *f(.)* with respect to *x(i)* and also named as gradient. µ is a step size (sometimes called learning rate).

2. If all the partial derivatives equal zero or are sufficiently close to zero, STOP. Else increase m by 1 and return to 1.

It is seen from step 2 that when all the partial derivatives is zero, method cannot find further value for decision variables and that point may be accepted as local optimum. When function has more than one local optimum, it is not clear that corresponding point is real optimum called as "global optimum" or just a local optimum. Hence, in this situation algorithm may stuck in a local optimum and may not reach the global optimum.

In this study to be able to avoid getting stuck in local optimum and search in more solution points, simulation processed for *l* route types.

5.2 OPTIMIZATION ALGORITHM

Aim of the optimization algorithm is try to find optimum values for decision variables *α, β, γ* in order to maximize profit. The algorithm based on steepest descent method.

Optimization algorithm work with request generation and profit calculation algorithm. When *i* request are created and finished the process, related profit values are used to determine new *α, β, γ* values.

In this principles of the optimization algorithm is presented, complex usage of the system and numerical examples are explained in next chapter.

For *n*,

Step 1: Determine starting points

Initiate variables $\alpha^0, \beta^0, \gamma^0$.

Step 2: Search for neighborhood

Calculate

$$P^A = (\alpha^n, \beta^n, \gamma^n) \quad \textbf{(5.4)}$$

$$P^{B} = (\alpha^{n} + \varepsilon_{n}, \beta^{n}, \gamma^{n}) \quad \textbf{(5.5)}$$

$$P^{C} = (\alpha^{n}, \beta^{n} + \varepsilon_{n}, \gamma^{n}) \quad \textbf{(5.6)}$$

$$P^{D} = (\alpha^{n}, \beta^{n}, \gamma^{n} + \varepsilon_{n}) \quad \textbf{(5.7)}$$

Step 3: Find gradient

$$\boldsymbol{\nabla f} \, (\boldsymbol{x_n}) = \left(\frac{\partial P^{B}}{\partial \alpha}, \frac{\partial P^{C}}{\partial \beta}, \frac{\partial P^{D}}{\partial \gamma}\right) \quad \textbf{(5.8)}$$

Step 3: Update decision variables

Calculate

$$\boldsymbol{\alpha^{n+1}} = \alpha^{n} + \mu . \frac{\partial P^{B}}{\partial \alpha} \quad \textbf{(5.9)}$$

$$\boldsymbol{\beta^{n+1}} = \beta^{n} + \mu . \frac{\partial P^{C}}{\partial \beta} \quad \textbf{(5.10)}$$

$$\boldsymbol{\gamma^{n+1}} = \gamma^{n} + \mu . \frac{\partial P^{D}}{\partial \gamma} \quad \textbf{(5.11)}$$

Update

$$\boldsymbol{n = n + 1} \quad \textbf{(5.12)}$$

If *n* < 300, continue with updated n from step 1;

If *n*=300 end the algorithm.

When n=0 , α^0, β^0, γ^0 values of decision variables are specified by manually in this study. After next steps are proceed, new *α, β, γ* values determined with the algorithm.

In step 2, profits of neighborhood values are calculated in order to search better solution. Neighborhood is determined by adding ε_n to decision variables respectively. Later, effects of changes in the decision variables for profit are analyzed by using gradients. Gradients are derivatives of profits to respective decision variable. In step 3, new *α, β, γ* values are calculated with "Equation 5.3" in the steepest descent algorithm. Learning size μ is calculated as:

$$\mu = \frac{10^{-5}}{1+\frac{n-1}{11}} \qquad \textbf{(5.13)}$$

Learning size μ is formulated according to optimization step size *n.* Optimization size is given "300" to make the algorithm work fastly as possible for this study. In the numerical experiments it has been discovered that when $\mu = 10^{-5}$ as a constant, causes bigger steps and breaks the searching process. So this formulation is generated to balance this steps in "Equation 5.9, 5.10, 5.11".

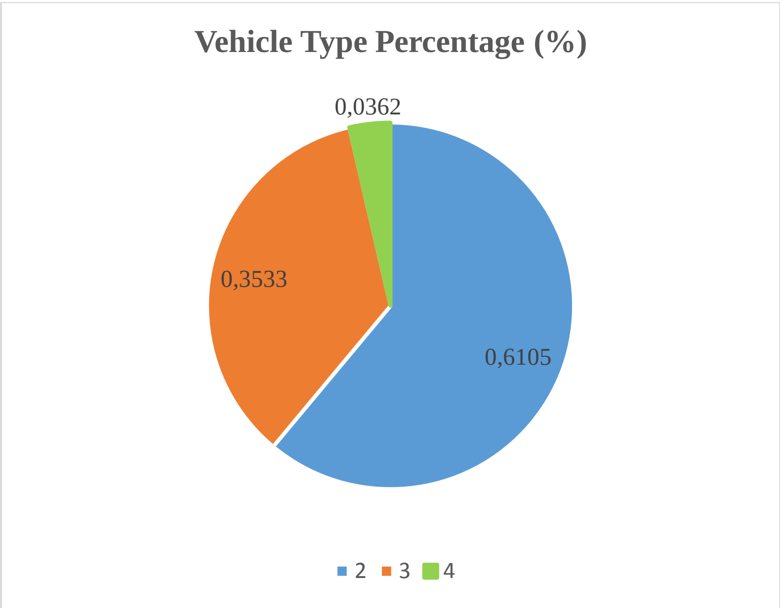
6. RESULTS

6.1 STATISTICAL ANALYSIS

In the first step truckers' requests are examined and matched with the routes of the shipments in the system. Time period of the data begins with January 2014 and ends with February 2016. 169 routes are identified according to the assumptions and calculated quantity of the shipments for each route.

There are 4 different vehicle type in the market however Type 1 is barely used especially when a customer needs for a specific occasion. Therefore, three different vehicles are selected as baseline. In figure 6.1. distribution of the vehicle types are presented. Type 2 is used for 61 percent of all shipments, whereas Type 3 is used for 35 percent and Type 4 is only used for 0,36 percent of the shipments.

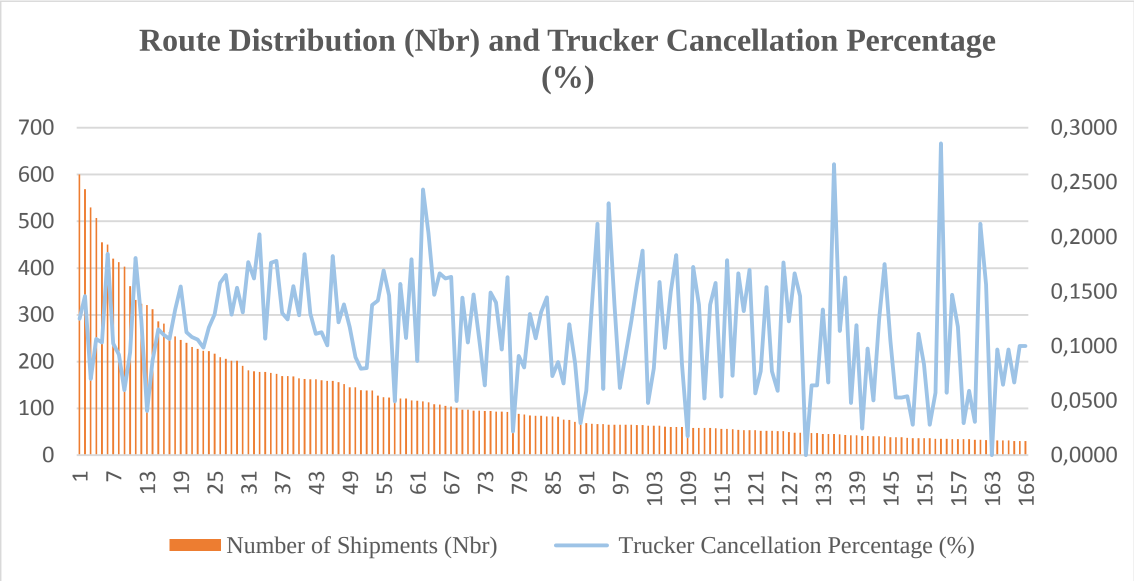
Figure 6.1: Vehicle type percentage



To get information about the no show up rate, shipments are labelled by shipment status. If the shipment status is supplier cancellation that means trucker give up the shipment.

Hence, trucker cancellation percentage calculated for each route. In figure 6.1. calculations can be seen as box plot and line graphic with two different vertical axis. Existence of any liner relationship is examined with correlation analysis and there is not a linear relationship between quantity of shipments for each route and trucker cancellation percentages.

Figure 6.2: Route distribution and trucker cancellation percentages



In table 6.1. these statistics are represented for top 20 route. Route Number shows a route including departure and arrival information. As it can be seen in the table for first route, supplier cancellation has been made 10 percent of the shipments.

Table 6.1: Number of shipments and cancellation percentages of top 20 routes

Route Number	Vehicle Type	Number of Shipments (Nbr)	Request Type Percentage (%)	Number of Trucker Cancellation (Nbr)	Trucker Cancellation Percentage (%)
1	2	600	0,0288	75	0,1250
2	3	569	0,0273	83	0,1459
3	3	530	0,0255	37	0,0698
4	2	507	0,0243	54	0,1065
5	3	455	0,0219	47	0,1033
6	2	450	0,0216	83	0,1844
7	2	420	0,0202	43	0,1024
8	2	413	0,0198	38	0,0920
9	3	403	0,0194	24	0,0596
10	3	361	0,0173	34	0,0942
11	2	332	0,0159	60	0,1807
12	3	324	0,0156	40	0,1235
13	2	321	0,0154	13	0,0405
14	2	312	0,0150	27	0,0865
15	2	286	0,0137	33	0,1154
16	2	281	0,0135	31	0,1103
17	3	263	0,0126	28	0,1065
18	2	254	0,0122	34	0,1339
19	2	246	0,0118	38	0,1545
20	3	240	0,0115	27	0,1125

Shipments are grouped by Route and Vehicle Type in order to calculate statistics of freight prices. Mean of PP, standard deviation of PP, minimum PP and maximum PP are can be seen in the below. These values are represented for top 20 routes in the Table 6.2. For this analysis, shipments which have only a departure city and arrival city (without any way station) are used. However there are big differences in between minimum prices and maximum prices.

Table 6.2: Number of shipments and pricing statistics for top 20 routes

Route Number	Vehicle Type	Number of Shipments (Nbr)	Shipment Frequency (%)	Average PP (TL)	Std Dev PP (TL)	Average SP (TL)	Std Dev SP (TL)
1	2	600	0,6635	1172,71	83,58	1240,12	86,08
2	3	569	0,4541	305,10	109,76	333,03	110,38
3	3	530	0,2565	254,11	195,06	288,95	215,46
4	2	507	0,6259	621,79	62,60	673,53	41,85
5	3	455	0,5576	358,37	53,52	368,72	50,21
6	2	450	0,5153	1250,62	118,87	1281,36	134,96
7	2	420	0,5647	472,70	60,56	524,89	35,33
8	2	413	0,4306	504,40	41,09	536,41	26,63
9	3	403	0,3435	319,71	51,10	348,19	45,43
10	3	361	0,4824	567,53	58,22	589,18	52,05
11	2	332	0,3388	1194,20	90,22	1227,53	105,87
12	3	324	0,4776	548,71	93,52	577,87	97,34
13	2	321	0,2400	356,36	60,20	347,90	60,13
14	2	312	0,4565	603,65	84,97	634,38	67,82
15	2	286	0,3600	680,88	57,85	738,27	57,23
16	2	281	0,4306	1241,58	108,07	1294,84	100,11
17	3	263	0,3953	891,31	78,51	925,14	64,56
18	2	254	0,2918	436,11	230,75	462,27	256,10
19	2	246	0,3412	1214,56	122,61	1226,88	129,33
20	3	240	0,3835	891,46	65,92	917,84	49,65

6.2 OPTIMIZATION RESULTS

In this part, numerical experiments for the algorithms have been developed are presented. To be able find optimal values of decision variables, all of the algorithms which has been explained previous chapter are integrated in the numerical experiments.

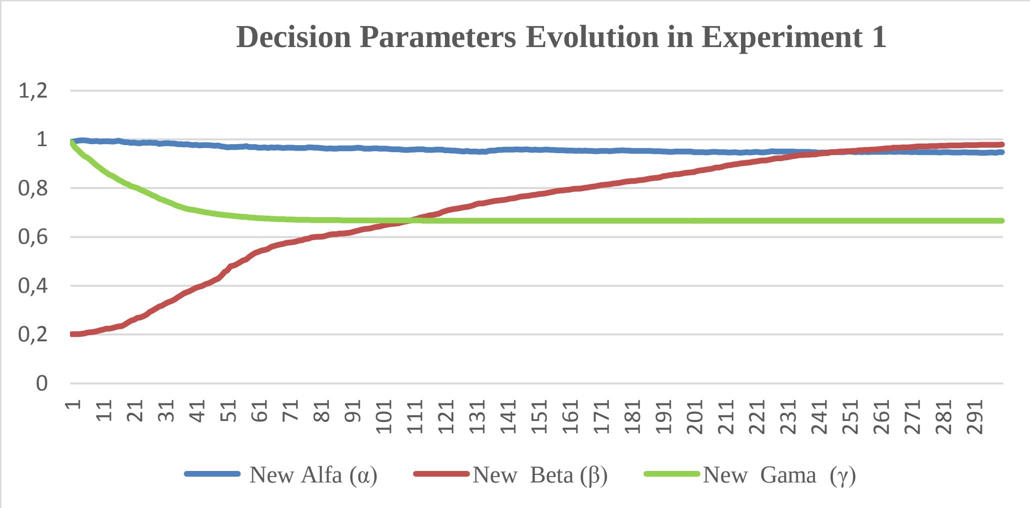
A system which is a combination of simulation and optimization algorithm is generated by using .Net Framework 4.5. This coding system is made of three parts. First, parameters are calculated from historical data and recorded. After, a simulation process starts and trucker requests are created with Request Generation and Profit Calculation Algorithm which explained in “Section 4.4”. In the first step α^0, β^0, γ^0 values specified as 1, 0,2, 1 respectively. When α and γ is given “1”, it means prices are accepted as original values in the market for the beginning. It offers a chance to see how the movements changes throughout the process without any effect of hypothesis. For β it is given 20 percent of routes may create sufficient job potential with Pareto insight.

By using these values of decision variables algorithm runs for simulation number, j=100 and for each simulation i=100 requests are generated and total profits are recorded. On the other hand to be able to run optimization algorithm, gradients must be calculated. Gradients are calculated for each simulation with their respective generated requests. For calculation of P^A , P^B , P^C , P^D same requests are used in order to decrease variance and to analyze real effect of decision parameters. Because if different requests are used for calculation of profits, any changes in the profits may come from in the random parts in the generation algorithm. Namely, in one gradient there may be more accepted jobs and profit whereas in the other one there may be lots of profit loss and not finding jobs.

In the third part, optimization method finds new α, β, γ values and these values are used in the first of the simulation algorithm. This process continue until optimization step size are reached. Eventually this system has to work 300 (n) x 100 (j) x 100 (i) x 4 (gradients) times. This process has been run different times in order to observe the effects of randomness in data. So, these different processes are named as "experiment". Results of experiments, profits, and values of gradients are presented in Appendices since the number of elements are numerous to show in this section. Alternatively, differences in behaviors of the decision elements, trend of the gradients, optimum profits and related values of decision variables when starting values are changed are summarized in below.

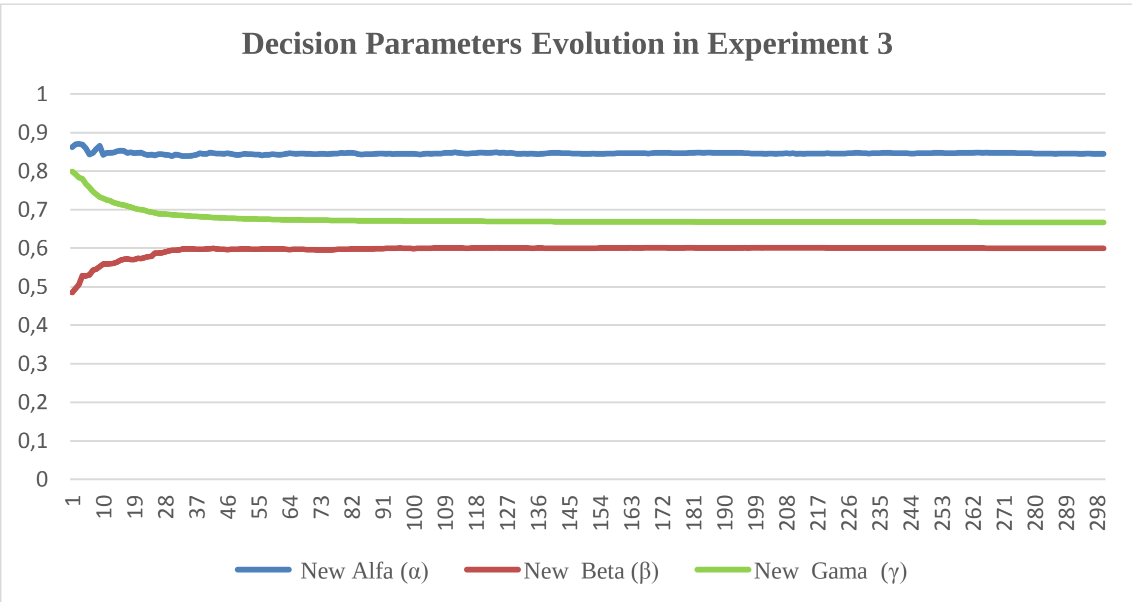
Result of experiment 1 may be seen in Figure 6.3. Remember that α^0, β^0, γ^0 values accepted as 1, 0,2, 1. This figure presents changes in the decision parameters after one circle ends. Values of α, γ are fixed after n=100 but value of β is in continuous tendency of increase. Experiment 2 which is calculated with the same starting values in experiment 1 gives the same graphic. These results prove that the hypothesis which is mentioned in the problem description, customers usually expect lower price than regular market prices. Besides, companies expect lower prices from the truckers when they ask for a job. Behavior of β actually shows the fact that the company must increase the number of shipments. Because, even the starting value is given as top 20 route, it is decreased in every iteration. Quantity of shipments in the historical data is not sufficient to maximize profit.

Figure 6.3: Decision parameters evolution in experiment 1



Experiment 3 is optimization process with α^0, β^0, γ^0 values accepted as 0,95, 0,5, 0,8 Values of α, β, γ are fixed specific numbers. Behavior of β is very different from experiment 1. It is quite constant at 0,66 but profit values which will be seen later are effected from this changes. These decision values are more stable than experiment 1 but values of profit are less. Tis situation shows that quantity of shipments for route types is very important to satisfy the requests with more profit.

Figure 6.4: Decision parameters evolution in experiment 3



As mentioned in part 5.1 Steepest Deepest Algorithm, it is important that all derivatives must be zero or sufficiently equal to zero in order to whether move another point or not. These two figures 6.5 and 6.6 presents values of derivatives are sufficiently equal to zero at experiment 1 and experiment 3, respectively. There may bee seen that even optimization size *n* is a constant as 300, it is still satisfy the rules of the algorithm.

Figure 6.5: Gradient*Mu evolution in experiment 1

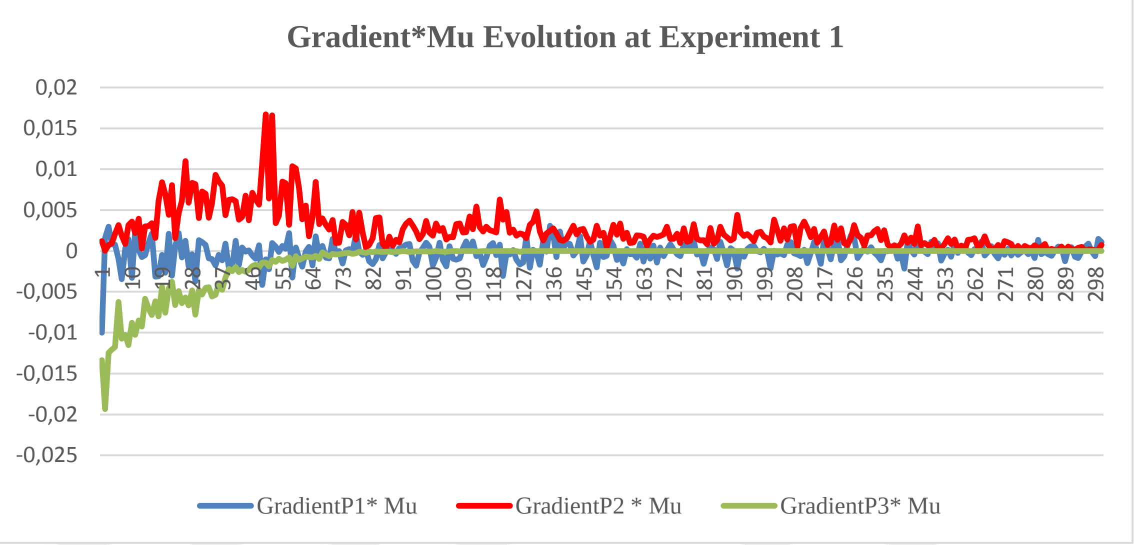
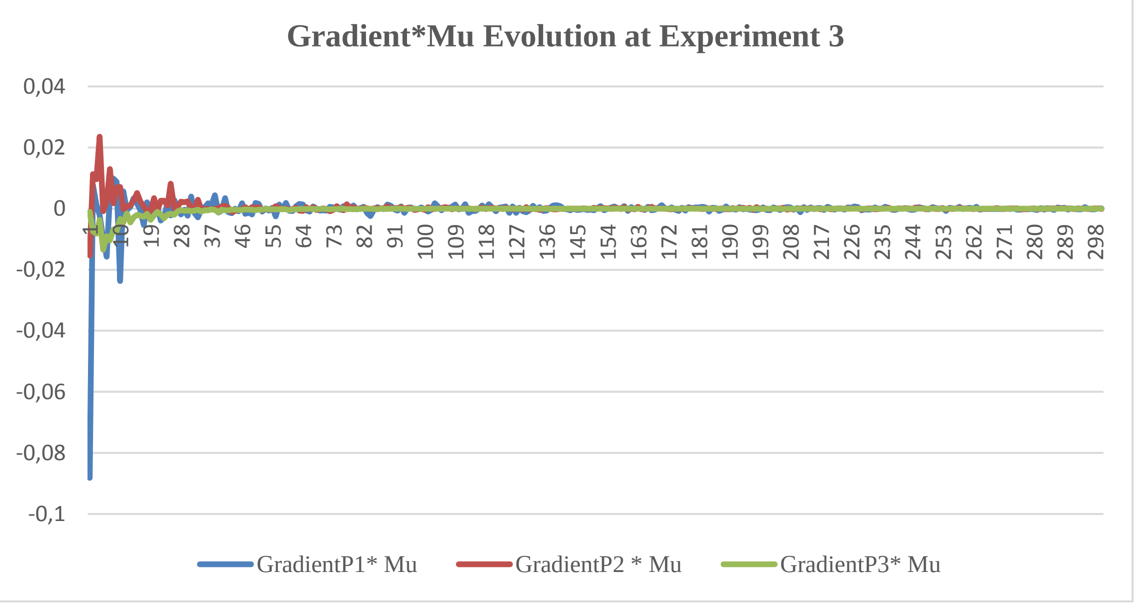


Figure 6.6: Gradient*Mu evolution in experiment 3



In table 6.3 optimum results of the optimization are presented. Optimum results are determined as maximum profit value between 300 profits in the one experiment . Average of profits are mean of 100 simulation for each optimization step. *n* shows the optimization step number belongs to related maximum profit. Lower limit of profit and upper limit of profit is confidence interval at 0,05 significance level. Experiment 1 and 2 is started with α^0, β^0, γ^0 values specified as 1, 0,2, 1 whereas Experiment 3 and 4 is started with α^0, β^0, γ^0 values specified as 0,95, 0,5, 0,8. Changes in the starting values of decision variables are effected values of profit and there is a big decrease. These results show the affects of different behaviors of β at experiments with different starting values. When β move with rapid increase tendency profits are bigger while using more job potential with more routes at experiment 1,2. However, when β move constantly, uses less routes and this decrease in the job potential is reflected as decrease in the profit at experiment 3,4.

Table 6.3: Confidence intervals for optimum profits

Experiment	***n***	**Lower Limit of Profit (TL)**	**Average of Profit (TL)**	**Upper Limit of Profit (TL)**	**Alfa (α)**	**Beta (β)**	**Gama (γ)**
1	218	2628,5096	4566,93	6505,3504	0,94649	0,90321	0,66667
2	217	2780,8076	4310,47	5840,1324	0,95366	0,83048	0,66669
3	213	319,5128	1663,23	3006,9472	0,84539	0,60112	0,66765
4	43	418,666	1811,54	3204,414	0,84411	0,59616	0,67529

7. DISCUSSION AND CONCLUSION

Technological developments in the information and telecommunication sector have affected lives of communities. Ever growing and renewed mobile phones, computers and various applications has created substantial changes in behaviors of the people all around the world. Hence e commerce and online platforms are become crucial for the companies to create more usable, faster, smart business models.

In this study new business model is created for a transportation operation. A system which is an online platform that first freight owners make shipment orders and system finds truckers whom satisfy requirements of the freight owners is considered. Since truckers want to plan their working times, truckers make job requests from the system. In this scenario there are many problems that “Is trucker’s price reliable?”, “What will be sales price?”, “What if trucker does not show up?” are investigated and a business workflow is constructed in order to solve these problems and create an operational system. It is critical to determine right requests which match shipment portfolio of the system to be able to profit. Beside decision of the sales prices is a difficult period customers usually expect lower price than regular market prices for these type of requests. Request generation and profit calculation algorithm is developed for solve these problem and simulate this business model. Algorithm generates requests of truckers, produces purchase and sales prices, makes decisions. On the other hand there is an optimization algorithm which is based on Steepest Descent method is constructed to maximize profit. These two algortihms are integrated in a system that generated by using .Net Framework 4.5.

It is accepted that all of the shipments are FTL in the system. Data which is divided by route (departure and arrival city) and vehicle type is provided by a confidential transportation company. Differences in the prices from freight amount, freight type, freight loading type and other reasons have been ignored. Prices which been offered by truckers are assumed as known. Purchase prices are generated from original purchase prices of the company. Hence, behavior of the truckers at the market is included to system, generally.

In the numerical experiments, starting values α, γ are given as 1, 1 to see how the movements changes throughout the process without any effect of hypothesis. For β it is given 20 percent of routes may create sufficient job potential with Pareto insight. Consequently, it is seen that β increases continuously. Later, started values are changed as 0,95, 0,5, 0,8 by using results of previous experiments. This change creates enourmous decrease in the profit. From these results, expectations of the firm and customers that purchase prices and sales prices should be lower than regular market prices are observed. Moreover, job volume of the firm has big effects on the profit. Selection of the request using β, if it is in the top routes, causes unrestrained changes in the profit. Even changing the starting value of β reverse the movement of the decision variable and creates less profits. So it may be useful to expand data size, to try different starting values or to find new criteria for volume potential to understand effect of job potential of the firm.

Main contribution of this thesis is generation of a complete new business process for an operational problem in the transportation sector. Generally, flow of the operations start with freight owners and reach to the truckers. However, the business model is reverse of existing business models in the market. How to model process which truckers are trigger is examined in this study. This study shows that model is be practicable. Since parameters train more, model may work better. The model provide benefit to minimize deadhead miles so truckers are minimize their cost and it may create decrease in freight prices. Hence, truckers, carrier firm and freight owners may make more profit. Also, minimizing deadhead miles may create diminiton in carbon emissions.

REFERENCES

Books

Gosavi, A., 2015. *Simulation Based Optimization: Parametric Optimization Techniques and Reinforcement Learning*. New York: Springer.

Periodicals

Abad, P. L., 2007. Buyer's response to a temporary price reduction incorporating freight costs. *Eurepoean Journal Of Operational Research.* **182** (3), pp.1073-1083.

Basu, J. R. & Subramanian, N. & Cheikhrouhou, N., 2015. Review of full truckload transportation service procurement. *Transport Reviews.* **35** (5), pp.599-621.

Berger, S. & Bierwirth, C., 2010. Solutions to the request reassignment problem in collaborative carrier networks. *Transportation Research Part E*. **46** (5), pp.627-638.

Caplice, C., 2007. Electronic markets for truckload transportation. *Production & Operations Management.* **16** (4), pp.423-436.

Chang, T., 2009. Decision support for truckload carriers in one-shot combinatorial auctions. *In Transportation Research Part B.* **43** (5), pp. 522-541.

Confessore, G., Corini D. & Stecca, G., 2008. A computational method for pricing of delivery service in a logistics network. *International Journal of Production Resarch.* **46** (5), pp. 1231-1242.

Ergun, O. & Kuyzu, G. & Savelsbergh, M., 2007. Reducing truckload transportation costs through collaboration. *Transportation Science.* **41** (2), pp.206-221.

Feng, T. & Arentze, T. & Timmermans, H., 2013. Capturing preference heterogeneity of truck drivers' route choice behavior with context effects using a latent class model. *European Journal of Transport and Infrastructure Research*. **13** (4), pp.259-273.

Gorman, Michael F., 2002. Pricing and market mix optimization in freight transportation. *Transportation Quarterly.* **56** (1), pp.135-148.

Inaba, Fred S. & Wallace, N. E., 1989. Spatial price competition and the demand for freight transportation. *Review of Economics & Statistics.* **71** (4), p.614.

Lee, C. & Kwon, R. H. & Ma, Z., 2007. A carrier's optimal bid generation problem in combinatorial auctions for transportation procurement. *Transportation Research Part E.* **43** (2), pp.73-191.

Özener, O. Ö. & Ergun, Ö. & Savelsbergh, M., 2011. Lane-Exchange mechanisms for truckload carrier collaboration. transportation science. *Transportation Science.* **45** (1), pp.1-17.

Powell, W. B. & Sheffi, Y. & Nickerson, K. S. & Butterbaugh, K. & Atherton, S., 1988. Maximizing profits for north american van lines' truckload division: a new framework for pricing and operations. *Interfaces.* **18** (1), pp.21-41.

Sheffi, Y., 2004. Combinatorial auctions in the procurement of transportation services. *Interfaces*. **34** (4), pp.245-252.

Topaloglu, H. & Powell, W., 2007. Incorporating pricing decisions into the stochastic dynamic fleet management problem. *Transportation Science.* **41**(3), pp. 281-301.

Toptal, A. & Bingöl, S. O., 2011. Transportation pricing of a truckload carrier. *European Journal of Operational Research.* **214**(3), pp. 559-567.

Verdonck, L. & Caris, A. & Ramaekers, K. & Janssens, G. K., 2013. Collaborative logistics from the perspective of road transportation companies. *Transport Reviews.* **33** (6), pp.700-719.

Wei-Hua, Zhou & Chung-Yee, Lee, 2009. Pricing and competition in a transportation market with empty equipment repositioning. *Transportation Research Part B.* **43**(6), pp. 677-691.

Yang, Shenyan & Bin, Hu, 2013. Research on the pricing model for information logistics service products. *Information Technology Journal*. **12**(20), pp. 5626-5630.

APPENDICES

APPENDICES 1: Route Base Statistics

Route Number	Vehicle Type	Number of Shipments (Nbr)	Shipment Frequency (%)	Average PP (TL)	Std Dev PP (TL)	Average SP (TL)	Std Dev SP (TL)
1	2	600	0,6635	1172,71	83,58	1240,12	86,08
2	3	569	0,4541	305,10	109,76	333,03	110,38
3	3	530	0,2565	254,11	195,06	288,95	215,46
4	2	507	0,6259	621,79	62,60	673,53	41,85
5	3	455	0,5576	358,37	53,52	368,72	50,21
6	2	450	0,5153	1250,62	118,87	1281,36	134,96
7	2	420	0,5647	472,70	60,56	524,89	35,33
8	2	413	0,4306	504,40	41,09	536,41	26,63
9	3	403	0,3435	319,71	51,10	348,19	45,43
10	3	361	0,4824	567,53	58,22	589,18	52,05
11	2	332	0,3388	1194,20	90,22	1227,53	105,87
12	3	324	0,4776	548,71	93,52	577,87	97,34
13	2	321	0,2400	356,36	60,20	347,90	60,13
14	2	312	0,4565	603,65	84,97	634,38	67,82
15	2	286	0,3600	680,88	57,85	738,27	57,23
16	2	281	0,4306	1241,58	108,07	1294,84	100,11
17	3	263	0,3953	891,31	78,51	925,14	64,56
18	2	254	0,2918	436,11	230,75	462,27	256,10
19	2	246	0,3412	1214,56	122,61	1226,88	129,33
20	3	240	0,3835	891,46	65,92	917,84	49,65
21	2	231	0,3035	1821,74	119,02	1953,89	74,72
22	2	227	0,2565	750,81	57,55	786,71	45,57
23	3	223	0,4141	437,30	65,23	461,42	51,49
24	3	222	0,3529	414,91	56,19	433,26	47,75
25	3	217	0,2541	858,02	129,89	904,40	157,68
26	2	209	0,3059	803,89	206,80	871,29	225,03
27	2	206	0,2682	520,61	69,62	567,98	63,63
28	2	202	0,3129	1134,68	108,68	1187,22	98,70
29	2	202	0,3176	851,21	85,14	894,81	90,96
30	3	191	0,3153	356,11	58,41	377,28	47,25
31	3	181	0,2518	335,34	40,10	352,75	36,07
32	2	179	0,1224	497,61	254,25	558,73	286,16
33	2	178	0,2447	847,97	69,20	883,05	67,92
34	3	178	0,2729	482,98	54,70	512,74	53,50
35	2	176	0,2447	687,10	180,50	722,83	193,74

36	2	174	0,2329	1184,81	133,19	1242,90	118,87
37	2	169	0,1694	471,06	449,36	520,22	510,03
38	3	169	0,1906	335,99	73,58	357,11	70,45
39	2	168	0,2588	870,78	98,66	913,79	98,58
40	2	164	0,2447	675,77	37,79	715,53	43,42
41	2	163	0,2706	1106,98	85,00	1184,61	57,87
42	2	162	0,2965	782,04	66,78	826,80	111,78
43	2	162	0,1435	367,19	65,32	398,66	63,32
44	2	160	0,2518	759,39	103,26	774,68	66,95
45	4	159	0,2824	693,23	66,27	706,55	58,30
46	2	159	0,1765	545,01	353,50	587,56	407,60
47	2	156	0,1906	587,63	88,39	574,84	48,62
48	3	152	0,2118	546,14	174,01	593,46	203,14
49	2	145	0,2376	1192,74	124,05	1271,68	132,95
50	2	145	0,1553	1042,66	62,59	1045,16	46,30
51	2	139	0,2282	862,73	101,37	879,38	57,04
52	2	138	0,1694	1426,38	47,97	1438,86	55,52
53	2	138	0,2659	1333,30	163,09	1358,26	140,98
54	3	127	0,1718	775,72	58,35	844,07	41,65
55	2	124	0,1459	420,85	73,57	438,23	71,05
56	2	123	0,2071	1210,07	106,36	1256,80	106,35
57	2	122	0,1600	1224,99	137,52	1031,69	136,40
58	2	121	0,1835	1100,74	108,44	1078,05	62,59
59	2	121	0,1929	762,97	61,37	792,02	53,79
60	2	117	0,1153	1243,69	87,09	1274,83	50,21
61	2	116	0,1929	768,16	82,44	785,53	62,78
62	2	115	0,1459	1091,97	84,28	1166,12	109,87
63	2	113	0,0259	487,08	44,31	527,65	12,32
64	3	109	0,1835	627,88	79,87	662,57	53,92
65	2	108	0,1459	598,68	50,17	637,57	37,39
66	2	105	0,1765	1239,43	294,12	1306,25	323,65
67	2	104	0,1529	478,03	51,54	504,07	63,10
68	3	101	0,0965	241,77	145,82	268,70	168,65
69	2	97	0,1271	1793,73	184,08	2257,72	10,56
70	2	97	0,1600	669,31	64,96	710,75	47,52
71	2	95	0,1412	1047,33	97,44	1069,17	119,87
72	2	95	0,1576	515,29	306,83	517,27	307,30
73	3	94	0,1812	755,53	68,73	781,09	68,72
74	2	94	0,1600	2316,39	128,08	2496,66	103,76
75	2	93	0,1576	1044,96	100,13	1044,96	114,83
76	2	93	0,1788	1340,67	107,02	1371,37	62,06

77	2	92	0,1812	1344,70	109,92	1412,82	82,16
78	3	92	0,1906	620,64	73,89	638,42	69,82
79	2	88	0,1459	760,28	102,29	795,94	79,89
80	4	87	0,1835	872,87	78,74	913,66	65,10
81	3	85	0,1506	460,75	103,38	479,21	103,26
82	3	84	0,1624	982,92	81,03	995,46	82,67
83	2	84	0,1459	672,05	53,27	714,36	38,10
84	3	83	0,1506	950,52	212,70	966,58	259,00
85	3	83	0,1624	414,55	47,72	446,90	40,59
86	3	82	0,1529	664,22	64,30	679,73	48,86
87	3	76	0,1553	523,42	77,26	546,81	54,93
88	2	75	0,1200	1447,49	71,77	1505,44	54,96
89	2	71	0,1247	816,38	128,38	862,70	86,23
90	3	68	0,1412	401,90	39,69	432,13	35,71
91	3	68	0,1412	655,35	66,04	676,32	62,75
92	2	67	0,0541	389,69	250,99	404,96	254,84
93	2	66	0,0894	1961,08	169,72	2039,38	112,38
94	3	66	0,1365	1065,82	177,21	1112,24	177,21
95	2	65	0,1059	909,34	96,14	952,38	66,55
96	2	65	0,1129	1000,55	86,02	1002,65	115,33
97	2	65	0,1129	651,91	124,94	683,40	94,43
98	2	65	0,1082	1886,85	97,92	1998,62	62,08
99	3	65	0,1224	495,80	95,20	524,25	103,90
100	4	64	0,1106	1087,44	134,63	1080,61	85,71

APPENDICES 2: Optimization Results at Experiment 1

Simulation Number (Nbr)	Average of Profit (TL)	StdDev of Profit (TL)	Alfa (α)	Beta (β)	Gama (γ)
1	1578,23	483,36	1	0,2	1
2	1869,76	550,53	0,99	0,2012	0,986643
3	1573,95	534,95	0,99159	0,20123	0,96728
4	1621,63	486,24	0,99455	0,20196	0,9548
5	1809,21	560,86	0,99535	0,20289	0,942714
6	1463,08	548,47	0,99611	0,20497	0,930945
7	1826,24	487,76	0,99511	0,20812	0,924713
8	1716,54	530,73	0,99164	0,20999	0,913986
9	1766,91	570,95	0,99193	0,21083	0,903728
10	1756,8	553,81	0,99339	0,21399	0,892215
11	1881,71	538,86	0,99009	0,21758	0,88342
12	1873,98	535,33	0,99249	0,21978	0,873144
13	1836,05	563,96	0,9926	0,22373	0,864639
14	1689,18	507,18	0,99185	0,22403	0,855399
15	1794,13	529,42	0,99131	0,22704	0,849558
16	2189,19	570,63	0,99232	0,23007	0,842516
17	1821,13	454,79	0,99443	0,23348	0,834673
18	2009,94	631,94	0,99129	0,23505	0,828522
19	1991,15	585,82	0,98817	0,24114	0,820532
20	2040,02	626,18	0,98769	0,24954	0,816183
21	1774,01	528,1	0,98503	0,25651	0,808608
22	1929,09	645,53	0,98713	0,26091	0,804018
23	2025,19	571,19	0,98409	0,26896	0,800249
24	1911,27	535,53	0,98461	0,27051	0,793607
25	1833,5	474,5	0,98678	0,27515	0,788698
26	1991,02	615,58	0,98599	0,2813	0,782289
27	1890,11	527,91	0,98722	0,2923	0,776599
28	1702,2	472,08	0,98532	0,2982	0,769926
29	2377,22	539,68	0,98491	0,30654	0,765083
30	1831,54	541,13	0,98117	0,31473	0,757274
31	1996,63	462,25	0,9825	0,31876	0,752493
32	1945,81	506,12	0,98357	0,32604	0,747161
33	1989,46	515,97	0,98432	0,33302	0,742638
34	2338,8	535,51	0,9834	0,33709	0,738209
35	2342,36	642,73	0,98242	0,3429	0,732648
36	2082,28	530,96	0,98067	0,35219	0,72728
37	2668,24	687,27	0,98018	0,36071	0,723235

38	2186,96	587,61	0,97903	0,3687	0,718467
39	2072,08	598,16	0,97991	0,37307	0,71521
40	2178,53	549,45	0,97773	0,3793	0,712995
41	1919,39	531,28	0,97576	0,38562	0,710524
42	2206,63	591,42	0,977	0,3917	0,708554
43	2095,76	572,33	0,97528	0,39551	0,705952
44	2212,2	539,25	0,97571	0,39964	0,703613
45	2280,33	574,64	0,97563	0,4064	0,70107
46	2246,72	514,46	0,97568	0,41016	0,698736
47	2073,83	531,16	0,9751	0,41728	0,696873
48	2327,04	521,58	0,97416	0,42359	0,695158
49	2272,7	581,55	0,97487	0,42925	0,693132
50	2138,68	568,46	0,97071	0,44009	0,691721
51	2269,04	595,2	0,9697	0,45678	0,690283
52	2211,33	637,71	0,96743	0,46319	0,688409
53	2280,11	535,06	0,96842	0,47979	0,687293
54	2114,91	496,92	0,96894	0,48318	0,685939
55	2544,38	563,33	0,96879	0,48746	0,684982
56	2340,3	526,56	0,96941	0,49596	0,68377
57	2421,75	624,48	0,96967	0,50423	0,682714
58	2961,48	682,04	0,97183	0,50741	0,6819
59	2572,47	605,06	0,96856	0,51776	0,680083
60	2610,13	555,66	0,96899	0,52786	0,679439
61	3084,85	741,07	0,96816	0,53553	0,678332
62	2835,4	606,08	0,96623	0,53938	0,677411
63	2725,04	661,15	0,96618	0,54493	0,676752
64	2521,17	609,82	0,96665	0,54671	0,67601
65	2385,7	653,98	0,96488	0,55086	0,675231
66	2920,82	629,13	0,96668	0,5593	0,674646
67	2347,7	509,45	0,96602	0,56259	0,673642
68	2973,62	653,04	0,96664	0,56656	0,673464
69	2915,15	662,47	0,9658	0,56972	0,673033
70	2862,91	674,12	0,96487	0,57231	0,672402
71	2762,84	568,54	0,96634	0,57608	0,672053
72	2788,65	633,91	0,96599	0,57703	0,671609
73	3008,65	655,79	0,96597	0,57803	0,67122
74	2652,28	571,64	0,96442	0,58158	0,670911
75	2898,94	598,13	0,96447	0,58477	0,67067
76	2996,43	623,79	0,9647	0,58666	0,670407
77	3556,49	726,33	0,96454	0,59144	0,670039
78	2421,61	595,05	0,96669	0,59282	0,669753

79	2764,66	675,2	0,96658	0,59752	0,669654
80	2924,31	591,5	0,9661	0,59971	0,669468
81	2547,36	567,03	0,96626	0,60013	0,669229
82	2133,65	482,51	0,965	0,60086	0,669155
83	2559,86	598,1	0,96339	0,60242	0,668983
84	2823,1	744,07	0,96236	0,60643	0,668915
85	2631,78	541,29	0,96308	0,61053	0,668812
86	2797,09	577,25	0,96219	0,61142	0,668699
87	2757,96	600,76	0,96205	0,61177	0,668601
88	3075,56	731,84	0,96289	0,61353	0,668519
89	2629,69	619,93	0,96295	0,61419	0,668334
90	2828,57	664,54	0,96257	0,61553	0,668259
91	2709,89	663,61	0,96292	0,61657	0,668186
92	2958,22	723,55	0,96343	0,61921	0,668173
93	2814,22	612,65	0,96422	0,62252	0,668122
94	2787,11	636,52	0,96507	0,62623	0,668
95	2673,5	591,97	0,96389	0,62934	0,667895
96	2587,57	644,25	0,96207	0,63172	0,667857
97	2665,4	588,33	0,96185	0,63316	0,667794
98	3024,78	673,74	0,96222	0,63522	0,667754
99	3482,46	789,38	0,96321	0,63888	0,667687
100	2774,18	660,75	0,96373	0,64113	0,667597
101	2556,66	660,26	0,96198	0,64299	0,667543
102	2627,52	574,23	0,96116	0,64636	0,667519
103	2924,48	639,22	0,96216	0,64881	0,667463
104	2871,02	641,53	0,96105	0,65161	0,667373
105	3166,65	657,27	0,95916	0,65299	0,667299
106	2408,49	647,57	0,95972	0,6547	0,667229
107	2920,34	672,93	0,95879	0,65637	0,667229
108	2643,76	635,03	0,95771	0,65965	0,667229
109	3290,89	670,95	0,9568	0,66299	0,667194
110	2728,59	555,89	0,95715	0,66524	0,667168
111	2469,52	528,5	0,95829	0,66754	0,667159
112	2861,86	639,32	0,95833	0,67178	0,667163
113	3163,49	651,22	0,9595	0,67444	0,667148
114	3586,1	780,98	0,95885	0,67985	0,667087
115	3334,39	855,49	0,95867	0,68277	0,667017
116	3182	764,79	0,95692	0,68512	0,667003
117	3032,6	658,33	0,95614	0,6881	0,666982
118	2983,47	647,3	0,95681	0,69064	0,666914
119	3220,77	723,33	0,95776	0,69306	0,666914

120	2937,14	710,12	0,95726	0,69532	0,666901
121	3146,53	723,93	0,95801	0,70163	0,666875
122	3202,69	716,97	0,95493	0,70547	0,666875
123	2764,21	688,04	0,95463	0,71022	0,666875
124	2782,05	657,28	0,95417	0,71244	0,666875
125	3078,13	726,22	0,95426	0,71505	0,666848
126	2949,4	666,24	0,9532	0,71692	0,666848
127	2942,01	715,3	0,95156	0,71905	0,666732
128	3052,73	774,72	0,95015	0,72107	0,666732
129	3510,43	820,37	0,95195	0,72263	0,666732
130	2669,05	584,36	0,9499	0,72584	0,666732
131	2895,14	654	0,95006	0,72939	0,666732
132	2674,45	640,11	0,9498	0,73424	0,666732
133	3679,72	786,43	0,94811	0,73665	0,666732
134	3003,94	653,59	0,94939	0,73794	0,666732
135	3303,32	752,94	0,94931	0,7401	0,666732
136	2859,74	636,38	0,9524	0,74255	0,666732
137	2726,52	637,98	0,95448	0,74533	0,666732
138	3972,08	855,03	0,95374	0,74745	0,666732
139	3328,75	711,22	0,95611	0,74881	0,666732
140	3103,29	644,65	0,95648	0,75007	0,666732
141	3346,35	624,05	0,95739	0,75158	0,666725
142	3349,66	699,64	0,95824	0,75384	0,666717
143	3630,8	819,03	0,9577	0,75692	0,666717
144	3541,88	760,66	0,95766	0,75896	0,666711
145	3273,94	776,4	0,95944	0,76155	0,666711
146	3389,16	821,77	0,95813	0,76423	0,666711
147	4313,91	1008,64	0,95761	0,76592	0,666711
148	3277,42	654,08	0,95886	0,76704	0,666704
149	2925,98	651,78	0,95841	0,76838	0,666704
150	3914,63	802,61	0,9564	0,77146	0,666704
151	3177,57	654,63	0,95741	0,77333	0,666704
152	3918,79	744,54	0,95666	0,77554	0,666704
153	3669,57	915,96	0,95606	0,77604	0,666704
154	3633,49	822,59	0,95736	0,77788	0,666698
155	3311,63	746,86	0,95802	0,78107	0,666698
156	3006,33	717,92	0,9569	0,78306	0,666698
157	3136,51	658,61	0,95639	0,78639	0,666698
158	3844,01	961,6	0,95486	0,78785	0,666698
159	3401,07	764,12	0,95508	0,79008	0,666697
160	3263,94	662,11	0,9547	0,79105	0,666697

161	3104,47	742,96	0,95434	0,79208	0,666692
162	2992,65	725,55	0,95351	0,79397	0,666692
163	3137,08	680,81	0,95438	0,79584	0,666692
164	3249,11	726,34	0,95309	0,79759	0,666692
165	3149,9	741,13	0,95376	0,79822	0,666692
166	3712,04	764,91	0,95281	0,79963	0,666692
167	3343,59	701,01	0,95344	0,8015	0,66668
168	3315,19	754,05	0,95201	0,8032	0,66668
169	3019,05	601,17	0,95243	0,80502	0,66668
170	2664,44	586,4	0,95178	0,80703	0,66668
171	3293,62	739,58	0,9519	0,81001	0,666673
172	3481,29	755,04	0,95271	0,8115	0,666673
173	3043,88	794,22	0,95291	0,81299	0,666673
174	4070,82	954,82	0,95249	0,8151	0,666673
175	2914,14	734,63	0,95186	0,81607	0,666673
176	3183,41	758,42	0,95258	0,81884	0,666673
177	3480,53	735,02	0,95342	0,81995	0,666673
178	3515,96	779,01	0,95348	0,82119	0,666673
179	3248,73	717,62	0,95465	0,82446	0,666673
180	3553,92	752,25	0,95419	0,82594	0,666673
181	2492,27	609,64	0,95406	0,82724	0,666673
182	3488,13	736,43	0,95248	0,82854	0,666673
183	3511,75	650,57	0,95249	0,82937	0,666673
184	3384,94	677,56	0,95291	0,83218	0,666673
185	3463,37	674,17	0,95311	0,83308	0,666673
186	3636,28	796,14	0,95212	0,83439	0,666673
187	4001,31	1010,17	0,95323	0,83737	0,666673
188	3511,67	765,48	0,95297	0,83935	0,666673
189	3244,73	704,67	0,9512	0,84102	0,666673
190	3760,61	718,79	0,95155	0,84231	0,666673
191	3081,42	621,87	0,95157	0,84383	0,666673
192	3200,52	715,54	0,9494	0,84824	0,666673
193	3706,38	756,31	0,94938	0,85056	0,666673
194	3352,34	682,36	0,94865	0,85237	0,666673
195	3144,54	787,9	0,94887	0,85442	0,666673
196	3990,32	853,55	0,94942	0,85612	0,666673
197	3495,33	802,99	0,95004	0,85734	0,666673
198	3349,34	678,29	0,95004	0,85958	0,666673
199	3223,08	715,19	0,94987	0,8619	0,666673
200	3643,36	686,3	0,95014	0,86364	0,666673
201	3294,82	688,75	0,94998	0,86518	0,666673

202	3562,55	796,68	0,94784	0,8662	0,666673
203	3390,1	793,47	0,94789	0,87003	0,666673
204	4104,12	895,77	0,94746	0,87262	0,666673
205	2796,56	624,28	0,94719	0,87386	0,666673
206	4110,38	804,24	0,94667	0,87662	0,666673
207	3649,68	781,8	0,94745	0,87801	0,666673
208	3596,26	783,68	0,94854	0,88096	0,666673
209	3647,82	761,77	0,94824	0,884	0,666673
210	3351,83	765,11	0,9478	0,88454	0,666673
211	2985,94	682,99	0,94717	0,88735	0,666673
212	3297,08	729,88	0,94732	0,89094	0,666673
213	3325,19	774,65	0,94584	0,89371	0,666673
214	3190,75	631,57	0,94563	0,89539	0,666673
215	3663,01	757,92	0,94671	0,89808	0,666673
216	3825,22	815,93	0,94667	0,8991	0,666673
217	3768,42	860,07	0,94509	0,90083	0,666673
218	4566,93	988,99	0,94649	0,90321	0,666673
219	3453,16	629,92	0,94681	0,90393	0,666673
220	3609,47	800,78	0,94577	0,90499	0,666673
221	3941,46	759,58	0,94673	0,90811	0,666673
222	3795,2	916,73	0,94828	0,90945	0,666673
223	3678,12	747,38	0,94714	0,9122	0,666673
224	3015,81	586,5	0,94645	0,91312	0,666673
225	3768,97	857,48	0,94708	0,91385	0,666673
226	4114,1	885,63	0,94897	0,91538	0,666673
227	3455,88	748,15	0,95064	0,91855	0,666673
228	3366,63	724,44	0,94976	0,92044	0,666673
229	3994,3	839,91	0,94948	0,92208	0,666673
230	3459,52	782,13	0,94981	0,92268	0,666673
231	4298,19	874,97	0,94971	0,92459	0,666673
232	2972,82	632,89	0,95017	0,92649	0,666673
233	3198,06	730,03	0,94998	0,92889	0,666673
234	3586,21	784,07	0,94941	0,93156	0,666673
235	3940,73	770,25	0,94827	0,9329	0,666673
236	3828,09	851,94	0,94825	0,93541	0,666673
237	3618,9	706,88	0,94818	0,93618	0,666673
238	3969,02	855,93	0,94828	0,93661	0,666673
239	3694,6	657,21	0,94873	0,9373	0,666673
240	3553,48	771,24	0,94778	0,93777	0,666673
241	2799,67	623,06	0,94734	0,93867	0,666673
242	3686,37	939,66	0,94519	0,94056	0,666673

243	3849,42	863,65	0,9462	0,94158	0,666673
244	3655,35	802,16	0,94626	0,94321	0,666673
245	3564,07	776,04	0,94581	0,94405	0,666673
246	3877,38	876,78	0,94707	0,94707	0,666673
247	3589,03	795,42	0,94731	0,94776	0,666673
248	3360,51	671,51	0,94722	0,94873	0,666673
249	3854,95	905,29	0,94684	0,94941	0,666673
250	4311,9	905,38	0,94794	0,95019	0,666673
251	3977,04	817,22	0,94851	0,95156	0,666673
252	3986,81	834,33	0,94941	0,95193	0,666673
253	3369,73	771,37	0,94825	0,95229	0,666673
254	3454,21	694,96	0,94788	0,9531	0,666673
255	3661,05	761,72	0,94801	0,95463	0,666673
256	3566,51	739,11	0,94728	0,95547	0,666668
257	3754,42	999,88	0,94821	0,95686	0,666668
258	4148,44	787,05	0,94796	0,95715	0,666668
259	3981,03	970,04	0,94844	0,9578	0,666668
260	3854,25	828,53	0,94904	0,95787	0,666668
261	3690,98	807,38	0,94883	0,95923	0,666668
262	3910,64	686,79	0,9483	0,96063	0,666668
263	4307,04	948,31	0,94853	0,96217	0,666668
264	4232,62	902,09	0,94847	0,96264	0,666668
265	3669,08	710,95	0,94959	0,9634	0,666668
266	3494,95	924,46	0,94902	0,96519	0,666668
267	3990,9	794,05	0,94891	0,96598	0,666668
268	4219,2	890,37	0,94948	0,96621	0,666668
269	3614,15	848,21	0,94913	0,96643	0,666668
270	3946,94	825,38	0,9482	0,96716	0,666668
271	3528,82	839,85	0,94831	0,96725	0,666668
272	3630,43	672,57	0,94784	0,96846	0,666668
273	3796,59	725,8	0,94811	0,96951	0,666668
274	3741,46	784,48	0,94756	0,97037	0,666668
275	3292,8	605,73	0,94767	0,97037	0,666668
276	4528,44	950,33	0,9472	0,97098	0,666668
277	3882,67	754,41	0,94707	0,97105	0,666668
278	3261,46	729,99	0,94713	0,97166	0,666668
279	3466,15	718,75	0,94672	0,97202	0,666668
280	3238,66	738,03	0,9468	0,97233	0,666668
281	4157	870,81	0,94594	0,97301	0,666668
282	3850,87	886,95	0,94732	0,97339	0,666668
283	4284,43	967,12	0,94689	0,97387	0,666668

284	3457,82	657,29	0,94681	0,97473	0,666668
285	3486,42	786,77	0,94643	0,97473	0,666668
286	3933,6	780,55	0,94584	0,97498	0,666668
287	4182,43	877,23	0,94588	0,97504	0,666668
288	4094,42	821,13	0,94641	0,97519	0,666668
289	4006,54	818,9	0,94684	0,97573	0,666668
290	3931,85	779,63	0,94557	0,97579	0,666668
291	3819,63	806	0,94578	0,9763	0,666668
292	4347,62	848,93	0,94624	0,97655	0,666668
293	3626,37	835,88	0,94552	0,9767	0,666668
294	3613,34	703,81	0,94465	0,97707	0,666668
295	3954,47	889,43	0,94459	0,97755	0,666668
296	4361,77	1096,16	0,94507	0,97755	0,666668
297	3408,72	712,07	0,94595	0,97775	0,666668
298	3853,28	809,74	0,9459	0,97793	0,666668
299	4270,41	882,13	0,94527	0,97801	0,666668
300	4432,19	992,83	0,94676	0,97817	0,666668

APPENDICES 3: Optimization Results at Experiment 2

Simulation Number (Nbr)	Average of Profit (TL)	StdDev of Profit (TL)	Alfa (α)	Beta (β)	Gama (γ)
1	1430,02	503,61	1	0,2	1
2	1633,29	466,09	0,99305	0,19698	0,990486
3	1816,07	515,94	0,9923	0,19455	0,978019
4	1649,8	524,22	0,99219	0,19502	0,965743
5	1850,68	598,06	0,99254	0,19466	0,955341
6	1619,91	559,7	0,99697	0,19701	0,939605
7	1517,79	515,66	0,99122	0,19922	0,929239
8	1743,39	550,08	0,98728	0,20033	0,920575
9	1803,76	570,32	0,99133	0,20269	0,910857
10	1759,15	571,38	0,99256	0,20402	0,899977
11	1654,77	493,9	0,99334	0,20769	0,893177
12	1722,31	539,06	0,99188	0,21151	0,884265
13	1903,95	573,87	0,99179	0,21307	0,877677
14	1870,32	566,25	0,99208	0,21618	0,868898
15	1934,74	599,78	0,99231	0,2188	0,863443
16	1749,39	569,65	0,99138	0,22237	0,856596
17	1704,98	507,04	0,99016	0,22392	0,84912
18	1957,08	597,27	0,9896	0,22812	0,84387
19	1926,13	644,62	0,99041	0,23096	0,837458
20	1778,01	483,12	0,99087	0,2331	0,82891
21	1947,25	579,28	0,99115	0,23707	0,824243
22	1979,62	524,6	0,991	0,24089	0,817502
23	1844,16	587,09	0,99108	0,24479	0,810315
24	2043,5	520,86	0,98729	0,25039	0,804144
25	1959,69	538,85	0,98662	0,25289	0,798977
26	2080,01	551,55	0,98451	0,25881	0,791715
27	2034,96	597,67	0,98696	0,26095	0,785745
28	1922,01	501,91	0,98651	0,26621	0,78055
29	1871,61	562,49	0,98578	0,2727	0,774396
30	1809,16	539,83	0,98428	0,27958	0,770145
31	1881,66	540,43	0,98364	0,28563	0,766303
32	2152,92	714,84	0,98407	0,29117	0,761069
33	1950,91	510,48	0,98441	0,29729	0,756238
34	2453,69	608,56	0,98354	0,30554	0,751815
35	2051,52	523,68	0,98362	0,30919	0,745401
36	1873,69	549,46	0,98269	0,31421	0,74077

37	2112,88	534,54	0,9843	0,32177	0,737671
38	1667,5	447,12	0,98309	0,32648	0,733101
39	2136,93	575,16	0,98186	0,33166	0,730907
40	2214,27	536,05	0,98293	0,33482	0,727357
41	2444,5	551,13	0,98376	0,34046	0,723887
42	2108,5	582	0,98191	0,34316	0,719787
43	1988,08	562,31	0,98118	0,3492	0,717316
44	2153,86	588,93	0,98173	0,35259	0,71496
45	2594,88	510,55	0,98062	0,35764	0,712172
46	1918,86	569,52	0,97772	0,35972	0,708741
47	2029,57	496,28	0,97816	0,36735	0,707189
48	2436,94	484,04	0,97783	0,37335	0,70518
49	2158,83	576,69	0,9776	0,37817	0,70279
50	1811,49	637,36	0,97674	0,38053	0,700877
51	2239,73	594,22	0,97825	0,38459	0,699816
52	2446,05	514,66	0,97819	0,3883	0,697686
53	2510,21	604,85	0,97731	0,39685	0,695925
54	2361,03	621,17	0,97721	0,40528	0,693714
55	2568,73	670,95	0,97737	0,41092	0,691893
56	2205,68	509,4	0,98095	0,41593	0,690982
57	2294,7	551,61	0,98073	0,41895	0,689938
58	2550,09	639,77	0,98029	0,42309	0,688598
59	2191,49	538,82	0,97797	0,42601	0,687381
60	2491,12	615,41	0,97623	0,43366	0,685919
61	2210,76	570,58	0,97411	0,44385	0,684457
62	2641,33	592,79	0,97574	0,45154	0,683596
63	2009,71	473,58	0,9736	0,45771	0,682519
64	2332,05	633,73	0,97345	0,46043	0,681834
65	2638,08	577,62	0,97334	0,46621	0,681
66	2404,02	592,72	0,97219	0,47225	0,680272
67	2203,3	521,7	0,97225	0,47759	0,679353
68	2370,52	610,05	0,97196	0,48074	0,67858
69	2415,99	590,86	0,9708	0,48909	0,677753
70	2410,36	677,79	0,97071	0,49238	0,676992
71	2513,28	654,21	0,97132	0,49827	0,676597
72	2700,93	708,98	0,97065	0,51	0,676091
73	2390,88	646,33	0,97006	0,51669	0,675174
74	2632,76	579,72	0,96909	0,52043	0,674766
75	2713,13	634,86	0,9679	0,52391	0,674123
76	2825,16	730,26	0,96902	0,52832	0,673711
77	3019,55	578,26	0,96921	0,53091	0,673337

78	2738,81	643,44	0,96921	0,53651	0,672531
79	3469,57	769,97	0,96956	0,53841	0,672105
80	2691,24	658,19	0,96775	0,54223	0,671694
81	2029,76	545,77	0,96746	0,54648	0,671397
82	2795,41	681,18	0,96779	0,55068	0,67126
83	3207,46	671,62	0,96824	0,55402	0,671052
84	2320,68	556,77	0,96839	0,55723	0,67076
85	3150,35	666,72	0,9686	0,56243	0,67064
86	2132,46	498,58	0,96798	0,56465	0,670318
87	3096,87	737,55	0,96967	0,56899	0,670151
88	2514,42	575,85	0,96854	0,57114	0,669973
89	2751,23	633,57	0,96758	0,57338	0,669851
90	2951,48	598,77	0,96685	0,57644	0,669576
91	3101,33	647,92	0,96517	0,57968	0,669362
92	2971,38	701,05	0,96567	0,58189	0,669261
93	2690,66	559,89	0,96603	0,58531	0,669105
94	3215,79	710,14	0,96539	0,58694	0,668943
95	2333,55	626,67	0,96601	0,59105	0,668737
96	2861,47	628,88	0,96581	0,59306	0,668581
97	2909,34	729,61	0,96571	0,59545	0,66851
98	2713,68	675,05	0,96606	0,59616	0,668383
99	3313,25	713,59	0,96693	0,59687	0,668267
100	2857,24	649,74	0,96648	0,59993	0,668174
101	3015,04	703,17	0,96698	0,60263	0,668127
102	2985,99	701,48	0,96694	0,60332	0,667915
103	2660,05	635,73	0,96586	0,60558	0,667882
104	3159,05	810,73	0,96488	0,6085	0,667843
105	2466,62	543,93	0,96416	0,60997	0,66778
106	2926,14	740,78	0,96493	0,61126	0,667754
107	2950,54	678,26	0,96599	0,61348	0,667724
108	2443,33	500,04	0,9649	0,61406	0,667699
109	3068,24	653,53	0,96578	0,61633	0,667657
110	3018,33	632,74	0,96601	0,61699	0,667639
111	3153,15	682,25	0,96701	0,61836	0,667593
112	3283,04	766,15	0,96706	0,6189	0,667452
113	2904,51	590,85	0,9652	0,62135	0,667429
114	3135,25	671,6	0,96523	0,62246	0,667413
115	3491,97	729,85	0,96567	0,62414	0,667352
116	2667,01	616,59	0,96567	0,62508	0,667313
117	2834,69	696,38	0,96514	0,62558	0,66729
118	3077,98	685,1	0,96437	0,62727	0,667253

119	2951,93	664,04	0,96336	0,62886	0,667224
120	2954,56	634,47	0,96248	0,62969	0,667181
121	2844,46	639,24	0,96198	0,63243	0,667117
122	3468,87	730,73	0,96122	0,63374	0,667111
123	3337,03	791,7	0,96186	0,63594	0,667104
124	3009,38	686,59	0,96254	0,63724	0,667094
125	2755,91	583,82	0,96205	0,63849	0,667084
126	2902,07	647,05	0,96228	0,64163	0,667084
127	3031,71	818,64	0,961	0,64564	0,667073
128	2980,52	745,01	0,96132	0,649	0,667073
129	3071,55	666,2	0,9616	0,65138	0,667065
130	3085,27	746,34	0,96085	0,6531	0,667063
131	2529,35	608,14	0,95987	0,65784	0,667034
132	3022,44	707,81	0,96002	0,6608	0,667034
133	2966,33	713,85	0,96077	0,66703	0,667023
134	3004,49	687	0,96065	0,67193	0,667009
135	2793,73	674,94	0,95974	0,67473	0,667009
136	2936,9	592,03	0,95872	0,67721	0,666991
137	3281,6	755,61	0,95814	0,68186	0,666981
138	3137,65	796,83	0,95843	0,68703	0,666981
139	2954,64	718,7	0,95827	0,69033	0,666959
140	3066,3	809,33	0,95722	0,69154	0,666943
141	2687,57	658,81	0,95583	0,69369	0,666932
142	2365,11	683,22	0,95551	0,69842	0,666926
143	2727,6	698,89	0,95277	0,70108	0,666926
144	2703,17	672,94	0,95226	0,70488	0,666926
145	3366,08	749,02	0,95188	0,70694	0,666926
146	2870,4	660,85	0,95177	0,70814	0,666895
147	3266,47	704,79	0,95148	0,7111	0,666889
148	2971,66	644,15	0,95258	0,71298	0,666887
149	2960,51	825,08	0,95306	0,71521	0,666858
150	2921,37	607,34	0,95306	0,7192	0,666858
151	3903,04	915,19	0,95382	0,7204	0,666858
152	2897,31	689,13	0,95351	0,72449	0,666851
153	2910,81	697,22	0,95299	0,72622	0,666827
154	3055,47	639,55	0,95324	0,72861	0,666823
155	2536,36	538,14	0,95142	0,73043	0,666823
156	3089,05	677,16	0,95025	0,73312	0,666813
157	3132,06	696,01	0,9517	0,73658	0,666813
158	3090,31	718,45	0,95282	0,7392	0,666813
159	3162,93	722,06	0,95237	0,74016	0,666803

160	3628,86	814,3	0,95155	0,7411	0,666803
161	3759,27	701,33	0,95351	0,74305	0,666803
162	2950,6	671,98	0,95447	0,74417	0,666803
163	3376,44	725,23	0,95398	0,74584	0,666791
164	3693,29	712,33	0,95386	0,74737	0,666784
165	3178,57	680,53	0,95436	0,74946	0,666774
166	3538,68	825,65	0,95395	0,7512	0,666774
167	3158,27	762,74	0,95475	0,75313	0,666758
168	2922,82	550,8	0,95434	0,75416	0,666759
169	3463,91	733,52	0,95495	0,75623	0,666759
170	3006,39	850,6	0,95509	0,75813	0,666759
171	3346,62	632,17	0,95357	0,75912	0,666749
172	3814,96	712,53	0,954	0,76095	0,666749
173	2846,03	672,01	0,95532	0,76219	0,666744
174	2885,05	652,18	0,95526	0,76357	0,666744
175	3412,12	882,22	0,95531	0,76606	0,666744
176	3053,63	739,05	0,95524	0,76687	0,666732
177	3275,15	680,19	0,95488	0,76913	0,666727
178	3848,11	812,31	0,9549	0,76992	0,666727
179	3436,23	851,76	0,95515	0,7706	0,666727
180	3303,02	728,84	0,95626	0,77143	0,666718
181	2920,65	658,37	0,95524	0,7731	0,666718
182	2846,6	672,85	0,95299	0,77587	0,666718
183	3626,63	768,65	0,95291	0,77856	0,666718
184	3740,55	899,83	0,95423	0,77963	0,666713
185	3119,43	703,61	0,9553	0,78171	0,666713
186	3399,79	781,42	0,956	0,78406	0,666713
187	3545,51	786,17	0,95626	0,78482	0,666713
188	3494,51	877,83	0,95711	0,78649	0,666713
189	4094,88	811,39	0,95816	0,78807	0,666713
190	3603,78	902,28	0,95828	0,79004	0,666706
191	3165,99	692,9	0,95797	0,79086	0,666706
192	3510,62	741,76	0,95704	0,79197	0,666703
193	3297,35	783,47	0,95537	0,79292	0,666695
194	3365,63	686,26	0,95573	0,79466	0,666695
195	3203,28	764,27	0,95595	0,79599	0,666695
196	3004,72	626,45	0,95539	0,7973	0,666695
197	4063,12	881,16	0,95592	0,79852	0,666695
198	3679,99	765,3	0,95498	0,7994	0,666695
199	4097,37	952,1	0,95496	0,8	0,666695
200	3138,56	818,04	0,95574	0,80189	0,666691

201	3306,62	777,5	0,95525	0,80455	0,666691
202	3061,45	743,09	0,95437	0,80558	0,666691
203	3058,13	667,96	0,95303	0,80707	0,666691
204	3569,13	794,04	0,95193	0,80832	0,666691
205	3213,86	764,89	0,95209	0,80991	0,666686
206	3335,59	688,2	0,95452	0,8116	0,666686
207	2897,7	664,93	0,95358	0,81266	0,666686
208	3760,06	799,28	0,95324	0,81393	0,666686
209	3481,74	657,08	0,9533	0,81637	0,666686
210	3278,83	696,62	0,95412	0,81818	0,666686
211	3808,35	771,31	0,9545	0,81977	0,666686
212	3061,46	802,89	0,95532	0,8208	0,666686
213	3451,36	712,4	0,95425	0,82307	0,666686
214	3694,31	883,29	0,95512	0,82572	0,666686
215	2953,35	790,55	0,95574	0,82681	0,666686
216	3955,71	827,42	0,95449	0,82913	0,666686
217	4310,47	780,44	0,95366	0,83048	0,666686
218	3197,88	661,7	0,95448	0,8319	0,666686
219	3072,2	673,07	0,95365	0,83321	0,666686
220	3307,9	778,02	0,95356	0,83573	0,666686
221	3240,05	779,76	0,95279	0,83722	0,666686
222	3400,49	676,47	0,95093	0,83854	0,666686
223	3880,1	920,6	0,95037	0,83961	0,666686
224	2873,18	710,83	0,95072	0,84079	0,666686
225	2862,88	732,14	0,94918	0,84187	0,666686
226	3094,2	573,96	0,9493	0,84346	0,666686
227	3394,59	771,02	0,94977	0,84457	0,666686
228	3651,55	785,77	0,94975	0,84639	0,666686
229	3449,38	709,88	0,95025	0,84784	0,666686
230	3150,13	616,12	0,95142	0,85032	0,666686
231	3503,89	812,21	0,95073	0,85195	0,666686
232	3290,35	775,14	0,95142	0,85315	0,666686
233	3310,12	710,1	0,95035	0,85485	0,666686
234	3397,75	732,95	0,94982	0,85603	0,666686
235	3601,26	863,61	0,94882	0,85749	0,666686
236	3925,57	807,62	0,94884	0,85999	0,666677
237	4261,58	894,99	0,94993	0,86239	0,666677
238	3540,45	754,53	0,94968	0,86289	0,666677
239	3663,77	786,57	0,95064	0,86445	0,666677
240	3332,83	701,65	0,95286	0,86682	0,666677
241	3166,56	737,65	0,95153	0,86793	0,666677

242	3765,55	923,81	0,95013	0,86886	0,666677
243	2594,16	643,74	0,9497	0,87136	0,666677
244	3091,14	771,9	0,95042	0,87388	0,666677
245	3345,36	687,76	0,95024	0,87505	0,666677
246	4037,25	960,33	0,9501	0,8758	0,666677
247	3984,61	867,14	0,95056	0,87701	0,666677
248	3651,81	765,76	0,94861	0,87784	0,666677
249	3535,95	781,04	0,94861	0,87905	0,666677
250	3532,04	743,18	0,94862	0,88043	0,666677
251	3670,5	750,94	0,94889	0,88315	0,666677
252	3478,43	719,67	0,94819	0,88414	0,666677
253	3243,12	767,55	0,948	0,88621	0,666677
254	3683,9	719,45	0,94739	0,88923	0,666677
255	3372,36	783,96	0,9474	0,89087	0,666677
256	3637,23	826,31	0,94743	0,89282	0,666677
257	3835,53	764,56	0,94768	0,89518	0,666677
258	3272,66	747,26	0,94816	0,89635	0,666672
259	3408,06	704,25	0,94695	0,89798	0,666672
260	3350,35	830,86	0,94563	0,89843	0,666672
261	3384,17	810,93	0,94512	0,90043	0,666672
262	3623,53	756,22	0,94558	0,90341	0,666672
263	3912,78	801,08	0,94642	0,90449	0,666672
264	3220,99	660,16	0,94761	0,9056	0,666672
265	4205,22	760,16	0,94739	0,90824	0,666672
266	3707,01	826,71	0,94668	0,90887	0,666672
267	3552,19	844,06	0,94711	0,90944	0,666672
268	3740,77	704,08	0,94832	0,91093	0,666672
269	3618,83	831,16	0,94848	0,91171	0,666672
270	3762	792,32	0,94812	0,91282	0,666672
271	3157,98	728,4	0,94779	0,9141	0,666672
272	3310,36	755,27	0,94815	0,91541	0,666672
273	3106,52	761,24	0,94801	0,91607	0,666672
274	3979,46	867,97	0,94833	0,91802	0,666672
275	3446,77	738,28	0,94773	0,91927	0,666672
276	3787,01	736,28	0,94815	0,92022	0,666672
277	3249,31	655,87	0,94837	0,9207	0,666672
278	3781,7	832,93	0,94864	0,92243	0,666672
279	3180,86	628,08	0,94975	0,92378	0,666672
280	3605,24	726,64	0,94942	0,92437	0,666672
281	3364,22	560,37	0,94912	0,9254	0,666628
282	3715,15	812,87	0,94935	0,92566	0,666628

283	3222,83	739,16	0,94918	0,92729	0,666628
284	3639,56	776,54	0,94899	0,9292	0,666628
285	3767,31	734,26	0,94871	0,92991	0,666628
286	3407,3	705,12	0,94905	0,93068	0,666628
287	3239,88	672,77	0,94952	0,93255	0,666628
288	3569,78	718,63	0,94901	0,93423	0,666628
289	3514,22	748,85	0,94889	0,93461	0,666628
290	3860,28	877,61	0,94776	0,93578	0,666628
291	3218,53	671,09	0,94777	0,93696	0,666628
292	3913,92	783,62	0,94736	0,93795	0,666628
293	3827,21	722,4	0,94734	0,93904	0,666628
294	3579,55	808,59	0,94757	0,93998	0,666628
295	3843,85	862,32	0,94735	0,94043	0,666628
296	3793,75	885,48	0,94833	0,94117	0,666628
297	3968,29	859,71	0,94814	0,94215	0,666628
298	4104,08	873,37	0,94851	0,94301	0,666628
299	3907,09	807,26	0,94881	0,94394	0,666628
300	3629,34	723,31	0,94901	0,94427	0,666628

APPENDICES 4: Optimization Results at Experiment 3

Simulation Number (Nbr)	Average of Profit (TL)	StdDev of Profit (TL)	Alfa (α)	Beta (β)	Gama (γ)
1	956,92	637,15	0,95	0,5	0,8
2	837,86	506,46	0,86178	0,48463	0,79894
3	925,98	427,25	0,8695	0,49598	0,791502
4	909,09	537,54	0,87078	0,50564	0,783323
5	1320,99	649,8	0,8687	0,52919	0,779649
6	889,66	474,04	0,85897	0,52837	0,766227
7	1182,38	551,05	0,84324	0,53046	0,757225
8	998,68	447,52	0,84718	0,5434	0,746817
9	1262,93	551,06	0,85696	0,54515	0,739974
10	950,15	499,47	0,8657	0,55207	0,732646
11	801,5	476,69	0,84202	0,55915	0,729277
12	612,84	395,05	0,84761	0,55907	0,724757
13	1188,37	517,39	0,84703	0,55976	0,723163
14	924,47	464,79	0,84768	0,5608	0,718596
15	706,51	384,81	0,85101	0,56343	0,715788
16	991,02	451,37	0,85267	0,56858	0,713783
17	1109,68	470,91	0,85226	0,57101	0,71148
18	904,12	492,02	0,84687	0,57176	0,708877
19	1098,61	511,3	0,84894	0,57089	0,70716
20	1056,02	450,34	0,84617	0,57009	0,703475
21	753,62	363,96	0,84694	0,57358	0,701214
22	1274,79	630,42	0,84792	0,57286	0,700137
23	1135,97	556,16	0,84399	0,57551	0,698256
24	1003,35	438,39	0,84122	0,57806	0,695097
25	1155,04	470,32	0,84302	0,57911	0,693151
26	1340,59	581,19	0,84074	0,58726	0,691458
27	951,55	469,04	0,8436	0,58752	0,689484
28	647,02	391,5	0,84372	0,58826	0,688581
29	863,98	397,21	0,84183	0,59051	0,688102
30	1052,66	528,14	0,84145	0,59254	0,687327
31	1258,61	560,5	0,83911	0,59492	0,686768
32	1092,6	437,45	0,84303	0,59497	0,685921
33	849,86	408,56	0,84163	0,59518	0,685219
34	1094,63	523,92	0,83876	0,59806	0,684865
35	1013,71	479,21	0,83877	0,59777	0,683929

36	870,36	516,65	0,8392	0,59762	0,683407
37	765,33	421,64	0,84095	0,59753	0,682848
38	1114,94	475,61	0,84194	0,59732	0,682613
39	1231,44	585,95	0,84634	0,5972	0,682148
40	822,67	354,03	0,84511	0,59735	0,680982
41	965,16	462,05	0,84449	0,59811	0,680661
42	1294,31	570,8	0,8479	0,59899	0,680121
43	732,8	374,72	0,84676	0,59928	0,679531
44	798,67	392,22	0,84527	0,5981	0,679182
45	1092,17	510,88	0,84529	0,5973	0,678882
46	1084,81	473,5	0,84438	0,59691	0,678484
47	885,24	382,5	0,84611	0,59664	0,678038
48	1168,65	560,14	0,84445	0,59714	0,677795
49	884,23	410,35	0,84314	0,59684	0,677481
50	1486,25	654,26	0,84123	0,59736	0,677164
51	887,11	462,86	0,84309	0,59759	0,676588
52	1183,46	528,74	0,84464	0,59809	0,676283
53	777,54	459,8	0,84368	0,59766	0,675923
54	1159,44	591,96	0,84379	0,59748	0,675851
55	1032,21	570,08	0,84318	0,59738	0,675632
56	1019,96	538,68	0,84348	0,597	0,67541
57	952,05	430,91	0,84093	0,59784	0,675216
58	977,87	469,9	0,84228	0,59804	0,674995
59	1121,52	552,15	0,84206	0,59799	0,674895
60	1515,97	668,88	0,84395	0,598	0,674689
61	1375,26	584,51	0,8432	0,59771	0,674162
62	1264,12	541,47	0,84245	0,59755	0,67397
63	771,78	445,77	0,8433	0,59781	0,67377
64	605,38	355,09	0,84485	0,5972	0,673653
65	883,29	409,65	0,84618	0,59644	0,673515
66	1105,05	546,94	0,84569	0,59694	0,673414
67	1027,28	525,69	0,84473	0,59674	0,673348
68	1219,77	615,6	0,84547	0,59719	0,673225
69	1311,49	652,24	0,84554	0,59674	0,673106
70	1009,47	457,75	0,84488	0,59645	0,672987
71	1081,85	496,34	0,84433	0,59651	0,67292
72	1538,76	579,31	0,84363	0,59638	0,672762
73	1010,39	496,24	0,8442	0,5955	0,672569
74	1075,29	471,95	0,84464	0,59501	0,672465
75	659,11	456,83	0,8446	0,59578	0,672372
76	873,65	442,31	0,84423	0,59574	0,67233

77	1114,11	508,02	0,845	0,59516	0,672265
78	1171,79	470,81	0,8458	0,59664	0,672084
79	1201,85	574,34	0,84595	0,59683	0,672004
80	916,2	450,95	0,84693	0,59736	0,671777
81	1029,77	500,02	0,84666	0,59721	0,671665
82	759,16	390,61	0,84687	0,59724	0,671584
83	750,73	387,53	0,84747	0,59753	0,671555
84	787,63	441,65	0,846	0,59763	0,671488
85	1070,58	469,48	0,84356	0,59754	0,671449
86	1613,07	634,01	0,84325	0,59761	0,671348
87	1143,72	503,21	0,84372	0,59778	0,67115
88	1314,93	634,47	0,84365	0,59771	0,67112
89	808,75	442,31	0,84352	0,59792	0,671065
90	923,43	435,42	0,84485	0,5987	0,67097
91	996,61	479,2	0,84576	0,59872	0,670907
92	541,43	362,15	0,84553	0,59893	0,670894
93	1013,58	479,13	0,84482	0,59917	0,670844
94	753,78	381,32	0,84558	0,5997	0,670796
95	1145,65	494,45	0,84421	0,59965	0,670751
96	1226,13	539,21	0,84449	0,59989	0,670652
97	1192,28	511,67	0,84493	0,60006	0,670636
98	1036,96	512,1	0,84458	0,59966	0,670584
99	738,64	390,76	0,84438	0,59948	0,670573
100	1180,07	477,14	0,84475	0,59943	0,670492
101	997,22	531,84	0,84455	0,599	0,670456
102	722,47	405,88	0,84355	0,59948	0,670431
103	539,23	321,24	0,84323	0,5994	0,670404
104	901,57	483,6	0,84496	0,59932	0,6704
105	1032,34	546,48	0,84552	0,59942	0,670376
106	940,94	430,43	0,84501	0,5996	0,670347
107	1303,19	536,51	0,84541	0,60009	0,670275
108	1459,03	530,43	0,84541	0,60035	0,670241
109	741,47	450,3	0,84598	0,60012	0,670171
110	971,19	457,07	0,84736	0,60021	0,670169
111	870,93	487,29	0,84708	0,60021	0,670132
112	908,23	478,17	0,84703	0,60017	0,670133
113	1328,35	560,15	0,8485	0,6001	0,670127
114	894,38	464,4	0,8471	0,60022	0,670099
115	982,96	494,13	0,84635	0,60005	0,670085
116	1351,33	527,29	0,84556	0,59997	0,669982
117	1218,23	552,71	0,84557	0,5999	0,669929

118	1343,59	640,2	0,84655	0,60028	0,66986
119	1089,17	480,59	0,84638	0,60016	0,669846
120	1529,91	667,65	0,84787	0,60035	0,66983
121	1313,87	530,82	0,84818	0,60062	0,669826
122	1100,35	486,35	0,84733	0,60056	0,669792
123	943,72	524,07	0,8476	0,60071	0,669727
124	1513,74	588,46	0,84811	0,60062	0,669691
125	1042,22	465,04	0,84877	0,60087	0,669677
126	846,37	492,38	0,84739	0,6008	0,669671
127	1008	415,89	0,8481	0,60053	0,669649
128	1268,84	503,96	0,84668	0,60065	0,669592
129	763	446,28	0,84695	0,60064	0,669567
130	1118,37	454,84	0,84609	0,60028	0,669494
131	1155,81	549,24	0,84496	0,6008	0,669481
132	1043,99	494,7	0,84442	0,60061	0,669456
133	1123,77	545,65	0,84536	0,60052	0,669366
134	1305,17	493,24	0,84509	0,60046	0,669343
135	1087,84	486,39	0,84558	0,59998	0,669303
136	877,89	559,59	0,8448	0,59996	0,669265
137	891,65	478,65	0,8441	0,6001	0,669194
138	1213,48	613,42	0,84443	0,60011	0,669107
139	952,52	403,43	0,84541	0,59991	0,669082
140	659,79	378,48	0,84658	0,59965	0,669073
141	1337,17	495,99	0,84735	0,59963	0,669071
142	1112,96	607,97	0,84729	0,59949	0,66895
143	752,05	458,86	0,8471	0,59944	0,668937
144	832,15	414,02	0,84651	0,59942	0,668933
145	1392,42	540,61	0,84651	0,59938	0,668898
146	994,7	475,54	0,84602	0,59938	0,668871
147	852,77	435,24	0,84564	0,59932	0,66887
148	1081,7	483,06	0,84556	0,59941	0,668848
149	1288,08	594,5	0,84515	0,59937	0,66883
150	1017,56	453,63	0,84483	0,59922	0,66883
151	963,38	455,69	0,84434	0,59954	0,66883
152	1352,06	569,05	0,84456	0,59948	0,668801
153	980,26	437,87	0,84533	0,59979	0,668745
154	1226,01	558,41	0,84477	0,59995	0,668737
155	1479,06	560,54	0,84472	0,60005	0,668707
156	957,12	499,17	0,84497	0,60003	0,668587
157	1040,64	508,75	0,84573	0,60034	0,668579
158	1141,21	552,93	0,8458	0,60053	0,668543

159	717,26	418,56	0,84591	0,60036	0,668535
160	883	495,58	0,84676	0,60081	0,668512
161	1321,42	587,66	0,84605	0,60061	0,668479
162	1138,72	607,07	0,84656	0,60049	0,668451
163	1219,89	481,94	0,84629	0,60033	0,668449
164	1564,57	688,05	0,84647	0,60089	0,668413
165	1424,6	609,08	0,84652	0,60065	0,668413
166	957,33	472,74	0,8461	0,60057	0,668395
167	1243,83	550,83	0,8467	0,60054	0,668379
168	743,77	389,05	0,84618	0,60113	0,668373
169	1147,68	495,82	0,84581	0,60117	0,668354
170	1026,83	475,46	0,84606	0,60126	0,668326
171	1100,3	552,75	0,84721	0,6012	0,668302
172	1367,38	569,43	0,84727	0,60115	0,668294
173	920,47	471,45	0,84714	0,60105	0,668265
174	1055,52	496,47	0,84756	0,60083	0,668241
175	1076	553,65	0,84721	0,60079	0,668228
176	1035,47	461,03	0,84648	0,60065	0,668181
177	1145,62	498,77	0,84673	0,60055	0,668176
178	1060,45	521,89	0,84604	0,6006	0,668179
179	631,62	327,99	0,84651	0,60069	0,668148
180	1373,15	707,34	0,84658	0,60092	0,668146
181	1083,4	472,24	0,84695	0,60089	0,668139
182	952,62	436,32	0,84734	0,60083	0,668132
183	1398,01	556,63	0,84795	0,60071	0,66813
184	929,59	447,35	0,84838	0,60066	0,668127
185	797,07	461,77	0,8474	0,60075	0,668091
186	855,01	464,55	0,84768	0,60077	0,668089
187	1625,8	646,33	0,84791	0,60066	0,668064
188	1416,19	690	0,84718	0,60061	0,668053
189	966,38	484,01	0,84686	0,60067	0,668053
190	1075,67	485,52	0,84759	0,60043	0,668048
191	1080,33	567,91	0,84733	0,60031	0,668042
192	984,15	473,07	0,84722	0,60045	0,668038
193	1378,65	624,46	0,84683	0,60036	0,668012
194	1360,92	655,46	0,84728	0,6005	0,668012
195	1043,89	462,85	0,84704	0,6008	0,667975
196	1042,75	506,88	0,84703	0,60081	0,667964
197	1175,69	495,1	0,84666	0,60106	0,667953
198	1122,04	500,81	0,84626	0,60077	0,667953
199	837,35	497,21	0,84577	0,60125	0,667941

200	1549,22	611,06	0,84557	0,60119	0,667917
201	692,58	361,38	0,84598	0,60121	0,667825
202	1082,96	457,46	0,84558	0,60122	0,667813
203	942,89	401,18	0,84502	0,60104	0,667813
204	1059,28	464,8	0,8454	0,60104	0,667811
205	1021,02	469,66	0,8455	0,60103	0,667779
206	1403,45	597,8	0,84502	0,60113	0,667766
207	706,87	361,11	0,84525	0,60145	0,667666
208	1019,96	473,63	0,84573	0,60113	0,667659
209	634,81	380,88	0,84613	0,60105	0,667665
210	1326,32	575,96	0,84585	0,60096	0,667664
211	1251,04	454,84	0,84604	0,60093	0,667653
212	1183,49	528,03	0,84491	0,601	0,667649
213	1663,23	685,57	0,84539	0,60112	0,667646
214	900,19	473,81	0,84497	0,6012	0,667619
215	1360,36	519,52	0,84541	0,60113	0,667619
216	1233,35	506,49	0,84527	0,60109	0,667601
217	1023,91	454,8	0,84549	0,6011	0,667588
218	979,7	492,67	0,84563	0,60089	0,66758
219	900,09	490,08	0,84519	0,60091	0,66757
220	1136,13	560,75	0,84582	0,60102	0,66757
221	1080,46	483,02	0,84599	0,60081	0,667565
222	1287,46	540,48	0,8456	0,60075	0,667562
223	894,87	401,51	0,84564	0,60075	0,667554
224	1266,41	519,17	0,84574	0,60071	0,667555
225	929,15	419,61	0,84536	0,6007	0,66753
226	1063,46	436,3	0,84579	0,60062	0,66753
227	833	506,98	0,84608	0,6006	0,667524
228	1133,29	557,47	0,84677	0,60066	0,667521
229	753,09	362,59	0,84731	0,60071	0,667509
230	1105,93	536,83	0,84681	0,60044	0,667505
231	893,3	374,44	0,84655	0,60034	0,667503
232	1171,48	438,95	0,84617	0,6004	0,667493
233	1042,63	543,86	0,84598	0,60053	0,667486
234	1059,88	448,83	0,84641	0,60031	0,667485
235	1216,71	649,46	0,84636	0,60015	0,667484
236	1050,1	573,46	0,84635	0,60011	0,667484
237	904,85	466,56	0,84693	0,6001	0,667475
238	1021,36	513,39	0,84725	0,60034	0,667474
239	1116,23	479,88	0,84689	0,60023	0,667474
240	1195,81	549,68	0,84641	0,60014	0,667469

241	1383,06	491,34	0,84643	0,60022	0,667469
242	948,33	470,82	0,84643	0,60019	0,667463
243	868,21	481,74	0,84666	0,60028	0,667461
244	671,42	361,22	0,84642	0,60037	0,667468
245	1000,44	492,6	0,84594	0,60024	0,667468
246	973,83	534,03	0,8457	0,60062	0,667468
247	1014,3	501,25	0,84626	0,60055	0,667463
248	874,02	465,9	0,84648	0,60072	0,667463
249	828,57	407,31	0,84646	0,60051	0,667458
250	1047,9	472,05	0,84622	0,60044	0,667461
251	1484,4	634,96	0,84677	0,60048	0,66745
252	577,13	399,82	0,84691	0,60038	0,667438
253	1307,21	606,65	0,84693	0,60023	0,667436
254	861,08	418,72	0,84712	0,60043	0,667436
255	801,29	412,55	0,84634	0,60016	0,667398
256	1032,93	531,3	0,84667	0,60017	0,667398
257	1294,93	536,78	0,84675	0,60004	0,667398
258	804,58	464,12	0,84673	0,60015	0,667396
259	874,61	498,74	0,84729	0,60029	0,667392
260	1340	629,37	0,84714	0,60036	0,667382
261	1102,15	668,56	0,84727	0,60029	0,66738
262	1145,79	610,96	0,84761	0,60032	0,667379
263	1369,92	620,88	0,84759	0,60017	0,667368
264	1338,71	569,35	0,84814	0,60012	0,667322
265	1068,49	453,52	0,84778	0,60001	0,667297
266	1160,4	429,87	0,84762	0,59999	0,667297
267	1176,77	460,3	0,84765	0,59983	0,667274
268	1145,15	525,62	0,84754	0,59977	0,667274
269	1299,65	637,24	0,84742	0,59979	0,667265
270	934,51	584,71	0,84727	0,59995	0,667264
271	1051,97	514,94	0,84716	0,59988	0,667264
272	1088,46	547,51	0,84715	0,59976	0,667264
273	1503,01	593,17	0,84715	0,59978	0,66726
274	797,19	447,97	0,84701	0,59983	0,66725
275	1267,38	534,42	0,84711	0,59988	0,667255
276	1158,63	496,98	0,84678	0,59997	0,667234
277	1075,94	489,9	0,84643	0,59985	0,667225
278	914,13	489,79	0,84645	0,59967	0,667223
279	836,16	409	0,84617	0,59953	0,66722
280	1258,01	522,08	0,84606	0,59947	0,667218
281	1221,66	625,27	0,84588	0,59953	0,667212

282	850,59	440,14	0,8454	0,59945	0,667209
283	861,75	557,24	0,84564	0,59937	0,667209
284	1109,61	464,35	0,84531	0,5994	0,667209
285	1266,75	691,8	0,84546	0,5993	0,667211
286	1018,76	430,84	0,84535	0,59936	0,667204
287	1084,04	577,02	0,84493	0,59943	0,667204
288	1248,64	607,57	0,84534	0,59942	0,667203
289	963,58	381,84	0,84543	0,59962	0,667203
290	1137,01	538,62	0,84571	0,59955	0,667198
291	1124,74	578,81	0,84541	0,59962	0,667191
292	1062,37	567,25	0,84548	0,59958	0,667182
293	1205,59	543,31	0,8453	0,59948	0,667182
294	873,6	457,03	0,84511	0,59956	0,66718
295	944,19	472,15	0,84486	0,59959	0,66718
296	1135,63	480,17	0,84534	0,59953	0,667179
297	1119,02	511,42	0,84529	0,59943	0,667167
298	1151,69	505,99	0,84504	0,59943	0,667167
299	969	452,88	0,84486	0,59947	0,667163
300	811,82	388,39	0,84494	0,5995	0,667162

APPENDICES 5: Optimization Results at Experiment 4

Simulation Number (Nbr)	Average of Profit (TL)	StdDev of Profit (TL)	Alfa (α)	Beta (β)	Gama (γ)
1	984,85	630,16	0,95	0,5	0,8
2	894,81	405,29	0,85872	0,51292	0,800294
3	899,01	388,06	0,85979	0,51546	0,790983
4	1090,09	444,69	0,8768	0,52352	0,780053
5	1120,22	557,04	0,86518	0,52418	0,771546
6	1362,72	610,48	0,86625	0,56384	0,7603
7	744,66	352,67	0,84265	0,57951	0,748498
8	942,23	466,44	0,84167	0,58136	0,744921
9	743,18	416,12	0,83942	0,58882	0,741482
10	1001,96	535,17	0,8446	0,59349	0,73756
11	961,77	423,82	0,84602	0,59583	0,730046
12	1013,75	496,55	0,8497	0,59483	0,723552
13	1163,65	586,65	0,84809	0,59477	0,71907
14	1269,57	589,2	0,84684	0,59801	0,714529
15	840,77	442,15	0,84192	0,59717	0,708883
16	924,14	495,66	0,83846	0,59689	0,706447
17	1447,29	643	0,84391	0,59589	0,704035
18	1114,39	491,98	0,84051	0,59528	0,701484
19	1396,84	583,41	0,84101	0,59648	0,69969
20	1550,51	600,1	0,84103	0,59754	0,696969
21	1292,74	612,83	0,84541	0,59851	0,694209
22	881,54	438,43	0,84493	0,59985	0,692475
23	1201,07	595,57	0,84559	0,59904	0,69184
24	1184,77	505,47	0,8424	0,5997	0,690305
25	1337,82	619,34	0,84521	0,59955	0,688473
26	841,51	469,96	0,84494	0,60024	0,686823
27	1254,63	634,95	0,84765	0,59989	0,686268
28	1410,59	585,13	0,84611	0,59921	0,684989
29	1111,22	516,09	0,84421	0,59784	0,683389
30	1138,29	487,41	0,84341	0,59761	0,682765
31	1298,56	527,61	0,84506	0,59743	0,681885
32	1151,76	424,48	0,84441	0,59731	0,680846
33	673,88	441,58	0,84514	0,59664	0,680476
34	1578,79	579,75	0,8426	0,59637	0,680138

35	1010,6	531,85	0,84229	0,59793	0,679322
36	1229,97	584,9	0,83886	0,59764	0,679179
37	1011,88	438,91	0,83967	0,59814	0,678576
38	1040,28	467,72	0,83946	0,59735	0,678117
39	1403,44	604,9	0,84097	0,59715	0,677586
40	1275,88	519,8	0,84086	0,59704	0,676717
41	1055,59	503,4	0,84193	0,59671	0,675894
42	803,67	455,94	0,84424	0,59645	0,67538
43	1811,54	710,65	0,84411	0,59616	0,675288
44	775,53	364,81	0,84559	0,59605	0,674674
45	732,32	458,23	0,84629	0,5958	0,674602
46	1185,14	555,66	0,84645	0,59544	0,674381
47	1063,13	582,63	0,84579	0,5954	0,674144
48	1000,01	576,17	0,84504	0,59518	0,674009
49	1063,72	543,96	0,84493	0,59876	0,673627
50	876,06	437,37	0,84619	0,598	0,673326
51	837,12	446,03	0,84826	0,5977	0,673225
52	1005,43	565,44	0,84727	0,59697	0,673048
53	1042,88	454,98	0,84632	0,59659	0,67283
54	712,88	403,85	0,84602	0,59667	0,672699
55	768,47	441,92	0,84771	0,59637	0,672615
56	1123,69	468,46	0,84677	0,5979	0,672559
57	1083,36	497,69	0,84863	0,59767	0,672129
58	1291,51	591,83	0,84863	0,59747	0,672056
59	1141,2	516,95	0,84945	0,5973	0,671767
60	1098,41	454,32	0,84971	0,59747	0,671683
61	1336,28	560,25	0,84956	0,59752	0,671483
62	1439,71	547,3	0,84873	0,59755	0,671233
63	1107,57	523,81	0,84947	0,59729	0,671144
64	1313,52	568,18	0,84787	0,59691	0,671043
65	1158,02	490,32	0,84616	0,59761	0,670963
66	1101,33	435,15	0,84586	0,59833	0,670912
67	964,67	479	0,84462	0,59903	0,670875
68	1137,48	585,13	0,84533	0,59899	0,670789
69	1317,65	482,71	0,84418	0,59865	0,67074
70	1107,5	449,2	0,84424	0,59887	0,670595
71	1135,43	507,61	0,84563	0,59856	0,670569
72	541,63	343,83	0,84562	0,599	0,670203
73	1087,17	508	0,84577	0,59886	0,670203
74	1088,93	542,56	0,84556	0,59885	0,67012
75	1116,53	547,14	0,84397	0,5983	0,670065

76	1252,45	548,17	0,84213	0,59856	0,670027
77	1033,15	479,97	0,84207	0,59876	0,66993
78	1055,56	492,54	0,84099	0,59866	0,669861
79	623,66	371,76	0,84176	0,59851	0,669762
80	1041,74	430,84	0,84139	0,59809	0,669646
81	915,7	410,79	0,84216	0,59787	0,669631
82	947,26	435,28	0,84328	0,59767	0,669596
83	955,78	465,96	0,84469	0,59758	0,669559
84	801,14	448,56	0,84665	0,59807	0,669526
85	1536,23	525,24	0,84526	0,59773	0,669411
86	1370,8	560,15	0,8465	0,59828	0,669286
87	1050,42	555,61	0,84654	0,5985	0,669137
88	1088,52	529,64	0,8478	0,59873	0,669099
89	974,52	479,17	0,84693	0,5988	0,669099
90	791,75	458,76	0,84721	0,59886	0,669091
91	975,78	478,02	0,84748	0,5989	0,669086
92	1070,37	548,95	0,84799	0,59923	0,669088
93	947,42	448,11	0,84835	0,5988	0,669074
94	1048,06	418,37	0,84811	0,5986	0,669037
95	739,29	446,63	0,84834	0,59855	0,669027
96	716,7	446,16	0,84936	0,59891	0,66895
97	1349,71	637,87	0,84713	0,59865	0,668947
98	1298,29	542,27	0,84852	0,59867	0,668955
99	1162,49	525,44	0,84781	0,59866	0,668952
100	844,76	474,92	0,84857	0,59869	0,668906
101	1082,09	473,29	0,84802	0,59846	0,668906
102	832,9	455,39	0,84742	0,59851	0,668883
103	1367,66	515,63	0,84755	0,59849	0,66887
104	1095,27	560,63	0,84628	0,59843	0,66879
105	1407,28	522,19	0,84489	0,59866	0,668771
106	973,7	404,69	0,84529	0,599	0,668771
107	893,64	429,13	0,84489	0,59918	0,668756
108	999,64	509	0,84633	0,59906	0,668716
109	1232,71	566,53	0,84671	0,59922	0,668701
110	747,39	421,84	0,84723	0,59896	0,668684
111	1249,23	527,32	0,84701	0,59887	0,668643
112	1254,5	467,92	0,84701	0,59914	0,668598
113	1176,77	537,63	0,84726	0,59903	0,668598
114	914,49	455,09	0,84759	0,59916	0,668534
115	1180,82	442,77	0,84813	0,59914	0,668493
116	1060,54	582,27	0,84926	0,59935	0,668448

117	1174,84	590,92	0,8484	0,59971	0,668432
118	1285,43	616,47	0,8495	0,59971	0,668432
119	686,59	344,88	0,8499	0,60011	0,668407
120	1679,57	727,25	0,85011	0,59994	0,668394
121	857,47	475,84	0,84954	0,5999	0,668343
122	1448,33	770,41	0,84862	0,59978	0,668311
123	1283,87	562,39	0,84848	0,5996	0,668286
124	1367,46	613,59	0,84904	0,59952	0,668232
125	1151,08	456,88	0,84891	0,59916	0,668123
126	1413,8	595,65	0,84776	0,59899	0,668082
127	792,26	402,79	0,84818	0,59884	0,668067
128	1305,52	586,27	0,84825	0,59861	0,66806
129	1324,65	626,35	0,84795	0,59856	0,66806
130	995,06	443,34	0,84811	0,59852	0,668027
131	704,19	392,58	0,8483	0,59855	0,668015
132	808,52	460,71	0,84717	0,59827	0,668009
133	1134,79	497,26	0,84639	0,59815	0,668009
134	986,75	478,74	0,847	0,59814	0,668003
135	1035,36	394,92	0,84684	0,598	0,667995
136	1109,82	623,68	0,84564	0,59837	0,66799
137	944,75	472,09	0,8454	0,59862	0,667942
138	1341,24	676,71	0,84527	0,59885	0,667894
139	1046,06	448,8	0,84466	0,59905	0,667849
140	1558,28	582,32	0,84427	0,59892	0,667849
141	1169,37	615,64	0,8442	0,59885	0,667834
142	861,13	473,86	0,84487	0,59877	0,667777
143	887,69	444,11	0,8443	0,5989	0,667764
144	932,12	577,92	0,84383	0,59865	0,667707
145	608,23	414,75	0,84349	0,59857	0,667703
146	975,72	434,44	0,84381	0,59854	0,667695
147	1079,66	492,55	0,84425	0,59866	0,667695
148	744,29	422,19	0,84393	0,5986	0,667689
149	918,17	522,66	0,84369	0,59861	0,667693
150	1005,81	557,73	0,84469	0,59848	0,667683
151	739,21	410,69	0,84362	0,59853	0,667681
152	1041,07	497,09	0,84414	0,59846	0,667676
153	1380,51	605,3	0,84296	0,5984	0,667675
154	877,57	447,65	0,84315	0,59844	0,667675
155	1421,89	521,15	0,84293	0,59862	0,667647
156	984,63	500,25	0,84331	0,59868	0,667622
157	1239,63	475,31	0,84316	0,5984	0,667616

158	771,62	410,56	0,84294	0,59848	0,667606
159	1230,67	594,05	0,84312	0,5988	0,667606
160	1011,66	442,5	0,84282	0,59892	0,667597
161	1599,44	626,78	0,84281	0,59888	0,667592
162	1258,82	602,64	0,84276	0,59882	0,667583
163	951,46	470,16	0,84247	0,59873	0,667572
164	669,24	400,61	0,84335	0,59892	0,667572
165	857,38	432,78	0,84297	0,59879	0,667569
166	886,23	456,59	0,84311	0,59924	0,667562
167	1122,15	485,44	0,84234	0,59903	0,667558
168	1019,74	454,3	0,84248	0,59901	0,667555
169	806,15	520,33	0,84242	0,59907	0,667546
170	1001,96	457,13	0,84249	0,59908	0,66754
171	976,62	465,62	0,84274	0,59911	0,66753
172	1168,32	539,36	0,84213	0,59907	0,667524
173	909,79	468,11	0,84163	0,59917	0,667522
174	1003,22	499,6	0,84298	0,59901	0,667512
175	1300,03	580,33	0,84246	0,599	0,667512
176	1010,71	496,81	0,84204	0,59895	0,667496
177	1286,49	550,63	0,8417	0,59896	0,667493
178	1032,41	468,32	0,8419	0,59877	0,667489
179	1135,73	480,4	0,84218	0,59875	0,667489
180	922,13	389,93	0,84282	0,59899	0,667486
181	1370,76	552,69	0,84292	0,59908	0,667475
182	923,39	387,85	0,8431	0,59904	0,667475
183	1047,55	481,98	0,84305	0,59886	0,667468
184	862,7	364,9	0,84302	0,59884	0,667445
185	959,02	480,95	0,84328	0,5988	0,667423
186	1152,45	521,22	0,84414	0,59888	0,667423
187	1006,28	508,19	0,84416	0,59872	0,667385
188	1026,78	571,2	0,84464	0,59916	0,667376
189	1137,27	569,74	0,84502	0,59913	0,667376
190	783,74	484,93	0,84489	0,59924	0,667356
191	982,61	485,24	0,84488	0,59918	0,667356
192	946,26	457,95	0,84435	0,599	0,66735
193	1045,83	559,56	0,84473	0,59912	0,66735
194	1083,03	544,22	0,84514	0,5991	0,667345
195	991,06	456,49	0,84553	0,59906	0,667332
196	801,62	412,59	0,84564	0,59896	0,667332
197	1214,9	530,41	0,84543	0,59892	0,667328
198	1062,87	455,45	0,84542	0,59905	0,667326

199	1034,04	459,02	0,84604	0,59939	0,667323
200	841,65	437,47	0,84576	0,59935	0,667319
201	642,94	337,49	0,84526	0,59952	0,667317
202	1258,91	604,56	0,84476	0,5994	0,667317
203	1281,46	494,92	0,84589	0,59935	0,667313
204	1372,54	566,76	0,84542	0,59942	0,667272
205	987,06	572,73	0,8454	0,59946	0,667272
206	1142,53	514,93	0,8461	0,5993	0,667272
207	1431,15	537,66	0,84609	0,59917	0,667251
208	1584,45	634,94	0,84635	0,59909	0,667251
209	1242,05	533,27	0,84649	0,59893	0,66725
210	741,86	397,74	0,84638	0,59881	0,667246
211	929,05	527,63	0,84683	0,59876	0,667241
212	1022,69	532,23	0,84546	0,59893	0,667241
213	864,7	495,62	0,84564	0,59905	0,667239
214	1227,91	571,83	0,84538	0,59904	0,667234
215	976,08	494,69	0,84498	0,59906	0,667234
216	1386,37	549,88	0,84508	0,59895	0,667234
217	1793,72	680,64	0,84445	0,59878	0,667194
218	1066,31	424,71	0,84407	0,59869	0,667185
219	835,95	475,54	0,84432	0,59861	0,667185
220	749,46	480,34	0,8444	0,59855	0,667186
221	1101,06	460,76	0,84426	0,59823	0,667184
222	1220,56	528,31	0,84398	0,59812	0,667184
223	735,83	464,81	0,84392	0,59823	0,667173
224	719,51	386,75	0,84394	0,5981	0,667172
225	779,87	361,89	0,84427	0,59822	0,667172
226	1244,18	648,98	0,84493	0,5982	0,667157
227	1385,9	599,89	0,84525	0,59806	0,667157
228	811,63	442,86	0,84516	0,59809	0,667155
229	921,46	459,34	0,84486	0,59822	0,667152
230	1182	575,15	0,84413	0,59816	0,667152
231	956,07	491,4	0,84413	0,5985	0,667152
232	1220,84	541,58	0,84405	0,59849	0,667146
233	1210,13	504,81	0,84428	0,59858	0,667137
234	967	416,36	0,84403	0,59856	0,667106
235	836,93	440,77	0,84468	0,59849	0,667106
236	1411,94	591,4	0,84498	0,59855	0,667106
237	1070,96	469,91	0,84448	0,59864	0,667101
238	1104,12	486,58	0,8438	0,59864	0,667095
239	1190,26	568,77	0,84425	0,59855	0,667095

240	743,62	437	0,84396	0,59845	0,667095
241	1048,12	480,38	0,84382	0,59836	0,667095
242	1272,43	557,78	0,8433	0,5984	0,667095
243	1423,5	639,78	0,84246	0,59831	0,667095
244	1343,61	596,47	0,84269	0,59827	0,667094
245	772,75	412,26	0,8427	0,59824	0,667094
246	1171,61	486,04	0,84306	0,59822	0,667085
247	1244,76	547,31	0,84306	0,59832	0,667085
248	1066,92	623,32	0,84328	0,59831	0,667085
249	1217,77	500,8	0,84429	0,59833	0,66707
250	1026,21	448,57	0,84452	0,59831	0,66707
251	988,87	514,36	0,8449	0,59823	0,66707
252	1038,81	528,64	0,84437	0,59821	0,66707
253	1273,3	627,18	0,84465	0,59819	0,66707
254	961,4	543,21	0,84512	0,59817	0,66707
255	1024,3	526,43	0,84499	0,59836	0,66707
256	914,89	409,33	0,84458	0,59831	0,66707
257	1123,12	490,9	0,84486	0,59864	0,66707
258	1557,36	573,44	0,84513	0,59861	0,667054
259	1006,1	523,79	0,84508	0,59887	0,667054
260	1385,8	521,43	0,84455	0,59903	0,667054
261	707,36	459,74	0,84474	0,59898	0,667048
262	1105,5	501,23	0,84503	0,59895	0,667046
263	759,7	436,49	0,84521	0,59886	0,667046
264	1666,01	658,11	0,84472	0,5989	0,667046
265	1217,63	521,82	0,84477	0,59888	0,667046
266	820,86	500,26	0,84465	0,59885	0,667033
267	830,49	421,95	0,84428	0,59874	0,667027
268	1586,28	686,31	0,84423	0,59867	0,667027
269	1211,33	590,34	0,84409	0,59884	0,667027
270	1201,14	516,92	0,84457	0,59887	0,667027
271	1089,53	536,97	0,84414	0,59864	0,667027
272	1134,89	542,27	0,84396	0,59854	0,667027
273	857,69	440,2	0,84379	0,59862	0,667027
274	1276,77	474,33	0,84414	0,59869	0,667026
275	833,44	423,87	0,84409	0,59876	0,667026
276	1362,1	622,37	0,84433	0,59876	0,667026
277	853,15	434,71	0,84427	0,59872	0,667023
278	1248,29	629,97	0,84455	0,59876	0,667023
279	913,53	459,5	0,84428	0,5987	0,667022
280	1083,75	602,37	0,84431	0,5987	0,667022

281	963,05	531,29	0,84428	0,59882	0,667006
282	1203,85	493,93	0,84429	0,5988	0,666986
283	884,95	394,68	0,84388	0,59866	0,666986
284	770,49	416,43	0,84419	0,5988	0,666982
285	1231,33	595,32	0,84414	0,59879	0,666982
286	1131,16	549,8	0,84465	0,59895	0,666982
287	700,53	439,45	0,84454	0,59895	0,666982
288	737,78	450,8	0,84395	0,59896	0,66698
289	801,18	453,68	0,84425	0,59904	0,666959
290	1519,75	642,4	0,84445	0,59895	0,666959
291	927,81	492,58	0,84482	0,59882	0,666959
292	1242,07	511,66	0,84484	0,59898	0,666959
293	1211,22	551,76	0,8448	0,59897	0,666959
294	1370,26	506,84	0,84483	0,59888	0,666959
295	1071,81	529,6	0,84472	0,59887	0,666959
296	877,53	404,74	0,84525	0,59905	0,666959
297	632,93	390,03	0,84594	0,59908	0,666959
298	1233,27	604,82	0,84603	0,59929	0,666959
299	1063,99	566,85	0,84642	0,59922	0,666958
300	817,75	407,58	0,84639	0,59918	0,66695

APPENDICES 6: Gradients and Decision Variables at Experiment 1

Optimization Number (Nbr)	Gradient P1* Mu	Gradient P2 * Mu	Gradient P3* Mu	New Alfa (α)	New Beta (β)	New Gama (γ)
1	-0,01	0,0012	-0,01336	0,99	0,201199	0,986643
2	0,001587	2,71E-05	-0,01936	0,99159	0,201226	0,96728
3	0,002954	0,00074	-0,01248	0,99455	0,201961	0,9548
4	0,000809	0,00093	-0,01209	0,99535	0,202889	0,942714
5	0,000757	0,00208	-0,01177	0,99611	0,204969	0,930945
6	-0,001	0,00315	-0,00623	0,99511	0,208123	0,924713
7	-0,00348	0,00186	-0,01073	0,99164	0,209988	0,913986
8	0,000299	0,00085	-0,01026	0,99193	0,210834	0,903728
9	0,001451	0,00315	-0,01151	0,99339	0,213986	0,892215
10	-0,0033	0,0036	-0,0088	0,99009	0,217583	0,88342
11	0,002403	0,0022	-0,01028	0,99249	0,219778	0,873144
12	0,000105	0,00395	-0,0085	0,9926	0,22373	0,864639
13	-0,00075	0,0003	-0,00924	0,99185	0,224034	0,855399
14	-0,00054	0,00301	-0,00584	0,99131	0,227042	0,849558
15	0,001008	0,00302	-0,00704	0,99232	0,230065	0,842516
16	0,002111	0,00341	-0,00784	0,99443	0,233475	0,834673
17	-0,00314	0,00157	-0,00615	0,99129	0,235049	0,828522
18	-0,00312	0,00609	-0,00799	0,98817	0,241142	0,820532
19	-0,00048	0,0084	-0,00435	0,98769	0,249539	0,816183
20	-0,00266	0,00697	-0,00757	0,98503	0,256508	0,808608
21	0,002095	0,0044	-0,00459	0,98713	0,260905	0,804018
22	-0,00304	0,00805	-0,00377	0,98409	0,268956	0,800249
23	0,000518	0,00156	-0,00664	0,98461	0,270511	0,793607
24	0,002173	0,00464	-0,00491	0,98678	0,275149	0,788698
25	-0,00078	0,00615	-0,00641	0,98599	0,281296	0,782289
26	0,001221	0,011	-0,00569	0,98722	0,292295	0,776599
27	-0,0019	0,00591	-0,00667	0,98532	0,2982	0,769926
28	-0,00041	0,00834	-0,00484	0,98491	0,306543	0,765083
29	-0,00374	0,00819	-0,00781	0,98117	0,314729	0,757274
30	0,001327	0,00403	-0,00478	0,9825	0,318759	0,752493
31	0,001071	0,00728	-0,00533	0,98357	0,326036	0,747161
32	0,000749	0,00698	-0,00452	0,98432	0,333018	0,742638
33	-0,00092	0,00407	-0,00443	0,9834	0,337089	0,738209
34	-0,00097	0,00581	-0,00556	0,98242	0,342897	0,732648
35	-0,00176	0,00929	-0,00537	0,98067	0,352192	0,72728
36	-0,00049	0,00852	-0,00405	0,98018	0,360713	0,723235

37	-0,00115	0,00798	-0,00477	0,97903	0,368696	0,718467
38	0,000883	0,00437	-0,00326	0,97991	0,373065	0,71521
39	-0,00218	0,00623	-0,00222	0,97773	0,3793	0,712995
40	-0,00197	0,00632	-0,00247	0,97576	0,385619	0,710524
41	0,00124	0,00608	-0,00197	0,977	0,391698	0,708554
42	-0,00172	0,00381	-0,0026	0,97528	0,395506	0,705952
43	0,00043	0,00414	-0,00234	0,97571	0,399642	0,703613
44	-7,99E-05	0,00676	-0,00254	0,97563	0,406402	0,70107
45	4,72E-05	0,00376	-0,00233	0,97568	0,410161	0,698736
46	-0,00057	0,00712	-0,00186	0,9751	0,417282	0,696873
47	-0,00094	0,00631	-0,00171	0,97416	0,423594	0,695158
48	0,000711	0,00565	-0,00203	0,97487	0,429246	0,693132
49	-0,00416	0,01085	-0,00141	0,97071	0,440092	0,691721
50	-0,00102	0,01668	-0,00144	0,9697	0,456777	0,690283
51	-0,00226	0,00641	-0,00187	0,96743	0,463187	0,688409
52	0,000984	0,0166	-0,00112	0,96842	0,479791	0,687293
53	0,000523	0,00338	-0,00135	0,96894	0,483176	0,685939
54	-0,00015	0,00428	-0,00096	0,96879	0,487457	0,684982
55	0,000619	0,0085	-0,00121	0,96941	0,495956	0,68377
56	0,000253	0,00827	-0,00106	0,96967	0,504227	0,682714
57	0,002167	0,00318	-0,00081	0,97183	0,50741	0,6819
58	-0,00327	0,01035	-0,00182	0,96856	0,517756	0,680083
59	0,000431	0,01011	-0,00064	0,96899	0,527861	0,679439
60	-0,00083	0,00767	-0,00111	0,96816	0,535526	0,678332
61	-0,00193	0,00385	-0,00092	0,96623	0,539375	0,677411
62	-5,03E-05	0,00555	-0,00066	0,96618	0,544926	0,676752
63	0,000477	0,00179	-0,00074	0,96665	0,546712	0,67601
64	-0,00178	0,00415	-0,00078	0,96488	0,550859	0,675231
65	0,001805	0,00845	-0,00058	0,96668	0,559304	0,674646
66	-0,00066	0,00329	-0,001	0,96602	0,56259	0,673642
67	0,000614	0,00397	-0,00018	0,96664	0,566564	0,673464
68	-0,00084	0,00316	-0,00043	0,9658	0,569722	0,673033
69	-0,00093	0,00259	-0,00063	0,96487	0,572313	0,672402
70	0,00147	0,00377	-0,00035	0,96634	0,576082	0,672053
71	-0,00034	0,00095	-0,00044	0,96599	0,577029	0,671609
72	-2,88E-05	0,00101	-0,00039	0,96597	0,578034	0,67122
73	-0,00155	0,00354	-0,00031	0,96442	0,581578	0,670911
74	4,71E-05	0,0032	-0,00024	0,96447	0,584773	0,67067
75	0,00023	0,00189	-0,00026	0,9647	0,586664	0,670407
76	-0,00015	0,00478	-0,00037	0,96454	0,591441	0,670039
77	0,002143	0,00138	-0,00029	0,96669	0,592821	0,669753

78	-0,0001	0,0047	-9,92E-05	0,96658	0,59752	0,669654
79	-0,00048	0,00219	-0,00019	0,9661	0,599708	0,669468
80	0,000158	0,00042	-0,00024	0,96626	0,600126	0,669229
81	-0,00126	0,00073	-7,43E-05	0,965	0,60086	0,669155
82	-0,00161	0,00155	-0,00017	0,96339	0,602415	0,668983
83	-0,00103	0,00401	-6,75E-05	0,96236	0,606426	0,668915
84	0,000717	0,00411	-0,0001	0,96308	0,610534	0,668812
85	-0,0009	0,00089	-0,00011	0,96219	0,61142	0,668699
86	-0,00014	0,00035	-9,84E-05	0,96205	0,611771	0,668601
87	0,000838	0,00176	-8,24E-05	0,96289	0,613534	0,668519
88	5,88E-05	0,00066	-0,00019	0,96295	0,614191	0,668334
89	-0,00037	0,00134	-7,48E-05	0,96257	0,615534	0,668259
90	0,000347	0,00104	-7,28E-05	0,96292	0,616572	0,668186
91	0,000505	0,00264	-1,25E-05	0,96343	0,619207	0,668173
92	0,00079	0,00332	-5,11E-05	0,96422	0,622523	0,668122
93	0,000852	0,0037	-0,00012	0,96507	0,626226	0,668
94	-0,00118	0,00311	-0,00011	0,96389	0,629336	0,667895
95	-0,00182	0,00238	-3,79E-05	0,96207	0,631716	0,667857
96	-0,00022	0,00144	-6,35E-05	0,96185	0,633155	0,667794
97	0,000366	0,00206	-4,04E-05	0,96222	0,635215	0,667754
98	0,000992	0,00366	-6,65E-05	0,96321	0,638876	0,667687
99	0,000522	0,00225	-8,99E-05	0,96373	0,641129	0,667597
100	-0,00176	0,00186	-5,37E-05	0,96198	0,642993	0,667543
101	-0,00082	0,00336	-2,37E-05	0,96116	0,646358	0,667519
102	0,001006	0,00245	-5,63E-05	0,96216	0,648809	0,667463
103	-0,00111	0,0028	-9,02E-05	0,96105	0,651607	0,667373
104	-0,00189	0,00138	-7,37E-05	0,95916	0,652992	0,667299
105	0,000563	0,00171	-7,04E-05	0,95972	0,654699	0,667229
106	-0,00094	0,00167	0	0,95879	0,656373	0,667229
107	-0,00108	0,00328	0	0,95771	0,659652	0,667229
108	-0,0009	0,00334	-3,46E-05	0,9568	0,66299	0,667194
109	0,000342	0,00225	-2,65E-05	0,95715	0,665242	0,667168
110	0,001149	0,0023	-9,04E-06	0,95829	0,667544	0,667159
111	3,42E-05	0,00423	3,70E-06	0,95833	0,671776	0,667163
112	0,001174	0,00266	-1,52E-05	0,9595	0,674435	0,667148
113	-0,00066	0,00541	-6,09E-05	0,95885	0,679849	0,667087
114	-0,00018	0,00292	-6,98E-05	0,95867	0,682767	0,667017
115	-0,00175	0,00236	-1,44E-05	0,95692	0,685124	0,667003
116	-0,00078	0,00297	-2,10E-05	0,95614	0,688098	0,666982
117	0,000672	0,00254	-6,77E-05	0,95681	0,690642	0,666914
118	0,000953	0,00242	0	0,95776	0,693057	0,666914

119	-0,00051	0,00227	-1,26E-05	0,95726	0,695322	0,666901
120	0,000754	0,0063	-2,55E-05	0,95801	0,701625	0,666875
121	-0,00308	0,00384	0	0,95493	0,705469	0,666875
122	-0,00029	0,00475	0	0,95463	0,710224	0,666875
123	-0,00046	0,00221	0	0,95417	0,712439	0,666875
124	8,75E-05	0,00261	-2,65E-05	0,95426	0,71505	0,666848
125	-0,00106	0,00187	0	0,9532	0,716924	0,666848
126	-0,00164	0,00213	-0,00012	0,95156	0,719049	0,666732
127	-0,00141	0,00202	0	0,95015	0,721073	0,666732
128	0,001802	0,00156	0	0,95195	0,722631	0,666732
129	-0,00205	0,00321	0	0,9499	0,725836	0,666732
130	0,000159	0,00355	0	0,95006	0,72939	0,666732
131	-0,00026	0,00485	0	0,9498	0,734237	0,666732
132	-0,00169	0,00241	0	0,94811	0,736651	0,666732
133	0,001284	0,00129	0	0,94939	0,737941	0,666732
134	-8,34E-05	0,00216	0	0,94931	0,740101	0,666732
135	0,003093	0,00245	0	0,9524	0,742549	0,666732
136	0,002077	0,00278	0	0,95448	0,745325	0,666732
137	-0,00074	0,00212	0	0,95374	0,74745	0,666732
138	0,002374	0,00136	0	0,95611	0,748813	0,666732
139	0,00037	0,00125	0	0,95648	0,750068	0,666732
140	0,00091	0,00151	-7,16E-06	0,95739	0,751582	0,666725
141	0,000849	0,00226	-7,69E-06	0,95824	0,753839	0,666717
142	-0,00054	0,00308	0	0,9577	0,756917	0,666717
143	-4,58E-05	0,00204	-5,80E-06	0,95766	0,758958	0,666711
144	0,001784	0,0026	0	0,95944	0,761554	0,666711
145	-0,00131	0,00268	0	0,95813	0,764229	0,666711
146	-0,00052	0,00169	0	0,95761	0,765921	0,666711
147	0,001247	0,00112	-7,43E-06	0,95886	0,767038	0,666704
148	-0,00045	0,00134	0	0,95841	0,768379	0,666704
149	-0,00201	0,00308	0	0,9564	0,771461	0,666704
150	0,001015	0,00187	0	0,95741	0,773333	0,666704
151	-0,00076	0,00221	0	0,95666	0,775539	0,666704
152	-0,0006	0,0005	0	0,95606	0,776044	0,666704
153	0,001301	0,00183	-6,26E-06	0,95736	0,777876	0,666698
154	0,000655	0,0032	0	0,95802	0,781072	0,666698
155	-0,00112	0,00199	0	0,9569	0,783058	0,666698
156	-0,00051	0,00334	0	0,95639	0,786393	0,666698
157	-0,00153	0,00146	0	0,95486	0,78785	0,666698
158	0,000224	0,00223	-9,74E-07	0,95508	0,790083	0,666697
159	-0,00039	0,00096	0	0,9547	0,791048	0,666697

160	-0,00036	0,00103	-4,72E-06	0,95434	0,79208	0,666692
161	-0,00083	0,00189	0	0,95351	0,793973	0,666692
162	0,000873	0,00187	0	0,95438	0,795843	0,666692
163	-0,00129	0,00174	0	0,95309	0,797588	0,666692
164	0,000678	0,00063	0	0,95376	0,798215	0,666692
165	-0,00096	0,00141	0	0,95281	0,799628	0,666692
166	0,000637	0,00187	-1,21E-05	0,95344	0,801501	0,66668
167	-0,00143	0,0017	0	0,95201	0,803203	0,66668
168	0,000416	0,00182	0	0,95243	0,805021	0,66668
169	-0,00065	0,00201	0	0,95178	0,807029	0,66668
170	0,000121	0,00298	-7,34E-06	0,9519	0,810009	0,666673
171	0,000807	0,00149	0	0,95271	0,811496	0,666673
172	0,000195	0,00149	0	0,95291	0,812985	0,666673
173	-0,00042	0,00211	0	0,95249	0,815099	0,666673
174	-0,00063	0,00097	0	0,95186	0,816071	0,666673
175	0,000724	0,00277	0	0,95258	0,818838	0,666673
176	0,000835	0,00111	0	0,95342	0,819951	0,666673
177	6,45E-05	0,00124	0	0,95348	0,82119	0,666673
178	0,001171	0,00327	0	0,95465	0,824461	0,666673
179	-0,00046	0,00148	0	0,95419	0,825942	0,666673
180	-0,00014	0,00129	0	0,95406	0,827235	0,666673
181	-0,00157	0,00131	0	0,95248	0,828544	0,666673
182	3,59E-06	0,00083	0	0,95249	0,82937	0,666673
183	0,000426	0,00281	0	0,95291	0,832184	0,666673
184	0,000197	0,00089	0	0,95311	0,833077	0,666673
185	-0,00099	0,00131	0	0,95212	0,83439	0,666673
186	0,001111	0,00297	0	0,95323	0,837365	0,666673
187	-0,00026	0,00198	0	0,95297	0,839346	0,666673
188	-0,00177	0,00168	0	0,9512	0,841022	0,666673
189	0,00035	0,00128	0	0,95155	0,842305	0,666673
190	2,28E-05	0,00153	0	0,95157	0,843834	0,666673
191	-0,00218	0,00441	0	0,9494	0,848241	0,666673
192	-1,55E-05	0,00231	0	0,94938	0,850555	0,666673
193	-0,00073	0,00182	0	0,94865	0,852371	0,666673
194	0,000222	0,00205	0	0,94887	0,854423	0,666673
195	0,000548	0,0017	0	0,94942	0,856124	0,666673
196	0,000626	0,00121	0	0,95004	0,857339	0,666673
197	-1,50E-06	0,00224	0	0,95004	0,859577	0,666673
198	-0,00017	0,00232	0	0,94987	0,861899	0,666673
199	0,000275	0,00174	0	0,95014	0,863643	0,666673
200	-0,00016	0,00154	0	0,94998	0,865178	0,666673

201	-0,00214	0,00103	0	0,94784	0,866203	0,666673
202	4,56E-05	0,00383	0	0,94789	0,870031	0,666673
203	-0,00042	0,00259	0	0,94746	0,87262	0,666673
204	-0,00027	0,00124	0	0,94719	0,873863	0,666673
205	-0,00052	0,00275	0	0,94667	0,876616	0,666673
206	0,000778	0,00139	0	0,94745	0,878009	0,666673
207	0,001091	0,00295	0	0,94854	0,880956	0,666673
208	-0,0003	0,00304	0	0,94824	0,884	0,666673
209	-0,00044	0,00054	0	0,9478	0,884539	0,666673
210	-0,00064	0,00281	0	0,94717	0,887349	0,666673
211	0,000155	0,00359	0	0,94732	0,890942	0,666673
212	-0,00149	0,00276	0	0,94584	0,893705	0,666673
213	-0,00021	0,00169	0	0,94563	0,895393	0,666673
214	0,001077	0,00269	0	0,94671	0,89808	0,666673
215	-3,41E-05	0,00102	0	0,94667	0,899103	0,666673
216	-0,00159	0,00173	0	0,94509	0,900829	0,666673
217	0,001406	0,00238	0	0,94649	0,90321	0,666673
218	0,00032	0,00072	0	0,94681	0,903929	0,666673
219	-0,00105	0,00106	0	0,94577	0,904992	0,666673
220	0,000964	0,00312	0	0,94673	0,90811	0,666673
221	0,001554	0,00134	0	0,94828	0,90945	0,666673
222	-0,00115	0,00275	0	0,94714	0,912198	0,666673
223	-0,00068	0,00093	0	0,94645	0,913124	0,666673
224	0,000624	0,00072	0	0,94708	0,913848	0,666673
225	0,001897	0,00154	0	0,94897	0,915383	0,666673
226	0,00167	0,00316	0	0,95064	0,918548	0,666673
227	-0,00088	0,00189	0	0,94976	0,920441	0,666673
228	-0,00028	0,00164	0	0,94948	0,922082	0,666673
229	0,000333	0,0006	0	0,94981	0,922681	0,666673
230	-0,0001	0,00191	0	0,94971	0,924593	0,666673
231	0,000465	0,0019	0	0,95017	0,926488	0,666673
232	-0,00019	0,00241	0	0,94998	0,928894	0,666673
233	-0,00057	0,00267	0	0,94941	0,931563	0,666673
234	-0,00114	0,00133	0	0,94827	0,932896	0,666673
235	-2,95E-05	0,00251	0	0,94825	0,93541	0,666673
236	-6,53E-05	0,00077	0	0,94818	0,936183	0,666673
237	9,48E-05	0,00042	0	0,94828	0,936608	0,666673
238	0,000459	0,00069	0	0,94873	0,937299	0,666673
239	-0,00095	0,00047	0	0,94778	0,937772	0,666673
240	-0,00044	0,00089	0	0,94734	0,938665	0,666673
241	-0,00215	0,00189	0	0,94519	0,940558	0,666673

242	0,001011	0,00102	0	0,9462	0,94158	0,666673
243	5,89E-05	0,00163	0	0,94626	0,943205	0,666673
244	-0,00045	0,00085	0	0,94581	0,944051	0,666673
245	0,001264	0,00302	0	0,94707	0,947068	0,666673
246	0,000237	0,0007	0	0,94731	0,947764	0,666673
247	-8,75E-05	0,00096	0	0,94722	0,948729	0,666673
248	-0,00039	0,00068	0	0,94684	0,94941	0,666673
249	0,001104	0,00078	0	0,94794	0,950185	0,666673
250	0,000564	0,00137	0	0,94851	0,951559	0,666673
251	0,000908	0,00037	0	0,94941	0,951929	0,666673
252	-0,00117	0,00036	0	0,94825	0,952294	0,666673
253	-0,00036	0,0008	0	0,94788	0,953095	0,666673
254	0,000131	0,00154	0	0,94801	0,954632	0,666673
255	-0,00073	0,00084	-4,95E-06	0,94728	0,955474	0,666668
256	0,000932	0,00138	0	0,94821	0,956859	0,666668
257	-0,00026	0,00029	0	0,94796	0,957147	0,666668
258	0,000484	0,00065	0	0,94844	0,957796	0,666668
259	0,000595	7,80E-05	0	0,94904	0,957874	0,666668
260	-0,00021	0,00136	0	0,94883	0,959231	0,666668
261	-0,00053	0,0014	0	0,9483	0,960631	0,666668
262	0,000228	0,00154	0	0,94853	0,962168	0,666668
263	-5,15E-05	0,00047	0	0,94847	0,962641	0,666668
264	0,001118	0,00076	0	0,94959	0,963404	0,666668
265	-0,00057	0,00179	0	0,94902	0,96519	0,666668
266	-0,00011	0,00078	0	0,94891	0,965975	0,666668
267	0,00057	0,00024	0	0,94948	0,966212	0,666668
268	-0,00035	0,00022	0	0,94913	0,966428	0,666668
269	-0,00093	0,00073	0	0,9482	0,967157	0,666668
270	0,000102	9,21E-05	0	0,94831	0,967249	0,666668
271	-0,00047	0,00121	0	0,94784	0,968462	0,666668
272	0,00027	0,00105	0	0,94811	0,969507	0,666668
273	-0,00055	0,00087	0	0,94756	0,970372	0,666668
274	0,000114	0	0	0,94767	0,970372	0,666668
275	-0,00047	0,00061	0	0,9472	0,970983	0,666668
276	-0,00013	6,87E-05	0	0,94707	0,971052	0,666668
277	5,98E-05	0,0006	0	0,94713	0,971656	0,666668
278	-0,00041	0,00037	0	0,94672	0,972021	0,666668
279	8,23E-05	0,00031	0	0,9468	0,972326	0,666668
280	-0,00086	0,00068	0	0,94594	0,97301	0,666668
281	0,001377	0,00038	0	0,94732	0,973391	0,666668
282	-0,00042	0,00048	0	0,94689	0,97387	0,666668

283	-7,94E-05	0,00086	0	0,94681	0,974734	0,666668
284	-0,00039	0	0	0,94643	0,974734	0,666668
285	-0,00059	0,00025	0	0,94584	0,974979	0,666668
286	3,95E-05	6,25E-05	0	0,94588	0,975042	0,666668
287	0,00053	0,00014	0	0,94641	0,975187	0,666668
288	0,000433	0,00054	0	0,94684	0,975729	0,666668
289	-0,00128	5,64E-05	0	0,94557	0,975785	0,666668
290	0,000213	0,00052	0	0,94578	0,976303	0,666668
291	0,000463	0,00024	0	0,94624	0,976545	0,666668
292	-0,00073	0,00016	0	0,94552	0,976703	0,666668
293	-0,00087	0,00036	0	0,94465	0,977065	0,666668
294	-5,71E-05	0,00048	0	0,94459	0,977546	0,666668
295	0,00048	0	0	0,94507	0,977546	0,666668
296	0,000874	0,0002	0	0,94595	0,977746	0,666668
297	-4,32E-05	0,00019	0	0,9459	0,977934	0,666668
298	-0,00063	7,53E-05	0	0,94527	0,978009	0,666668
299	0,001487	0,00016	0	0,94676	0,978168	0,666668
300	0,001074	0,00075	0	0,94784	0,978915	0,666668

APPENDICES 7: Gradients and Decision Variables at Experiment 2

Optimization Number (Nbr)	Gradient P1* Mu	Gradient P2 * Mu	Gradient P3* Mu	New Alfa (α)	New Beta (β)	New Gama (γ)
1	-0,00696	-0,003	-0,00951	0,99305	0,196978	0,990486
2	-0,00074	-0,0024	-0,01247	0,9923	0,194551	0,978019
3	-0,00011	0,00047	-0,01228	0,99219	0,195018	0,965743
4	0,000349	-0,0004	-0,0104	0,99254	0,194656	0,955341
5	0,004428	0,00236	-0,01574	0,99697	0,197013	0,939605
6	-0,00575	0,0022	-0,01037	0,99122	0,199216	0,929239
7	-0,00394	0,00111	-0,00866	0,98728	0,200326	0,920575
8	0,004053	0,00237	-0,00972	0,99133	0,202692	0,910857
9	0,001234	0,00133	-0,01088	0,99256	0,204022	0,899977
10	0,00078	0,00366	-0,0068	0,99334	0,207685	0,893177
11	-0,00146	0,00383	-0,00891	0,99188	0,211513	0,884265
12	-9,39E-05	0,00156	-0,00659	0,99179	0,213071	0,877677
13	0,000291	0,00311	-0,00878	0,99208	0,216179	0,868898
14	0,000228	0,00262	-0,00546	0,99231	0,218801	0,863443
15	-0,00093	0,00357	-0,00685	0,99138	0,222373	0,856596
16	-0,00122	0,00155	-0,00748	0,99016	0,22392	0,84912
17	-0,00056	0,0042	-0,00525	0,9896	0,22812	0,84387
18	0,000816	0,00284	-0,00641	0,99041	0,23096	0,837458
19	0,000458	0,00214	-0,00855	0,99087	0,233095	0,82891
20	0,000276	0,00397	-0,00467	0,99115	0,237066	0,824243
21	-0,00015	0,00383	-0,00674	0,991	0,240893	0,817502
22	7,90E-05	0,00389	-0,00719	0,99108	0,244785	0,810315
23	-0,00378	0,0056	-0,00617	0,98729	0,250385	0,804144
24	-0,00067	0,00251	-0,00517	0,98662	0,252892	0,798977
25	-0,00212	0,00591	-0,00726	0,98451	0,258805	0,791715
26	0,002458	0,00214	-0,00597	0,98696	0,260945	0,785745
27	-0,00045	0,00526	-0,00519	0,98651	0,266205	0,78055
28	-0,00073	0,00649	-0,00615	0,98578	0,272697	0,774396
29	-0,0015	0,00688	-0,00425	0,98428	0,279575	0,770145
30	-0,00065	0,00605	-0,00384	0,98364	0,285627	0,766303
31	0,000431	0,00554	-0,00523	0,98407	0,291169	0,761069
32	0,000339	0,00612	-0,00483	0,98441	0,297292	0,756238
33	-0,00086	0,00825	-0,00442	0,98354	0,305541	0,751815
34	7,53E-05	0,00364	-0,00641	0,98362	0,309186	0,745401
35	-0,00093	0,00502	-0,00463	0,98269	0,314209	0,74077
36	0,001613	0,00756	-0,0031	0,9843	0,32177	0,737671

37	-0,00121	0,00471	-0,00457	0,98309	0,326476	0,733101
38	-0,00123	0,00518	-0,00219	0,98186	0,331657	0,730907
39	0,001071	0,00316	-0,00355	0,98293	0,334819	0,727357
40	0,000825	0,00565	-0,00347	0,98376	0,340464	0,723887
41	-0,00185	0,0027	-0,0041	0,98191	0,343164	0,719787
42	-0,00073	0,00604	-0,00247	0,98118	0,3492	0,717316
43	0,000547	0,00339	-0,00236	0,98173	0,352589	0,71496
44	-0,00111	0,00505	-0,00279	0,98062	0,357642	0,712172
45	-0,0029	0,00207	-0,00343	0,97772	0,359715	0,708741
46	0,000441	0,00764	-0,00155	0,97816	0,367353	0,707189
47	-0,00032	0,00599	-0,00201	0,97783	0,373348	0,70518
48	-0,00023	0,00482	-0,00239	0,9776	0,378166	0,70279
49	-0,00086	0,00237	-0,00191	0,97674	0,380533	0,700877
50	0,00151	0,00405	-0,00106	0,97825	0,384586	0,699816
51	-6,62E-05	0,00371	-0,00213	0,97819	0,388296	0,697686
52	-0,00087	0,00856	-0,00176	0,97731	0,396853	0,695925
53	-0,00011	0,00842	-0,00221	0,97721	0,405278	0,693714
54	0,000161	0,00564	-0,00182	0,97737	0,41092	0,691893
55	0,003583	0,00501	-0,00091	0,98095	0,415932	0,690982
56	-0,00022	0,00302	-0,00104	0,98073	0,418948	0,689938
57	-0,00044	0,00414	-0,00134	0,98029	0,423086	0,688598
58	-0,00232	0,00293	-0,00122	0,97797	0,426013	0,687381
59	-0,00173	0,00765	-0,00146	0,97623	0,433663	0,685919
60	-0,00212	0,01018	-0,00146	0,97411	0,443847	0,684457
61	0,001627	0,00769	-0,00086	0,97574	0,451537	0,683596
62	-0,00213	0,00617	-0,00108	0,9736	0,457707	0,682519
63	-0,00015	0,00272	-0,00069	0,97345	0,460431	0,681834
64	-0,00011	0,00577	-0,00083	0,97334	0,466206	0,681
65	-0,00115	0,00604	-0,00073	0,97219	0,472247	0,680272
66	6,10E-05	0,00535	-0,00092	0,97225	0,477594	0,679353
67	-0,00029	0,00314	-0,00077	0,97196	0,480735	0,67858
68	-0,00116	0,00835	-0,00083	0,9708	0,489089	0,677753
69	-8,13E-05	0,00329	-0,00076	0,97071	0,492379	0,676992
70	0,000607	0,00589	-0,0004	0,97132	0,498269	0,676597
71	-0,00068	0,01173	-0,00051	0,97065	0,510001	0,676091
72	-0,00058	0,00669	-0,00092	0,97006	0,516691	0,675174
73	-0,00098	0,00374	-0,00041	0,96909	0,520427	0,674766
74	-0,00119	0,00348	-0,00064	0,9679	0,523909	0,674123
75	0,001122	0,00441	-0,00041	0,96902	0,528319	0,673711
76	0,000187	0,00259	-0,00037	0,96921	0,530905	0,673337
77	2,79E-06	0,0056	-0,00081	0,96921	0,536506	0,672531

78	0,000352	0,0019	-0,00043	0,96956	0,538408	0,672105
79	-0,00181	0,00382	-0,00041	0,96775	0,542232	0,671694
80	-0,00029	0,00424	-0,0003	0,96746	0,546477	0,671397
81	0,00033	0,0042	-0,00014	0,96779	0,550676	0,67126
82	0,000452	0,00334	-0,00021	0,96824	0,554019	0,671052
83	0,000148	0,00321	-0,00029	0,96839	0,557225	0,67076
84	0,000213	0,0052	-0,00012	0,9686	0,56243	0,67064
85	-0,00062	0,00222	-0,00032	0,96798	0,564648	0,670318
86	0,001691	0,00434	-0,00017	0,96967	0,568988	0,670151
87	-0,00113	0,00215	-0,00018	0,96854	0,571143	0,669973
88	-0,00096	0,00223	-0,00012	0,96758	0,573375	0,669851
89	-0,00074	0,00306	-0,00028	0,96685	0,57644	0,669576
90	-0,00167	0,00324	-0,00021	0,96517	0,579677	0,669362
91	0,000494	0,00221	-0,0001	0,96567	0,581885	0,669261
92	0,000366	0,00342	-0,00016	0,96603	0,585307	0,669105
93	-0,00065	0,00163	-0,00016	0,96539	0,586937	0,668943
94	0,000628	0,00411	-0,00021	0,96601	0,591051	0,668737
95	-0,00021	0,00201	-0,00016	0,96581	0,593059	0,668581
96	-0,0001	0,00239	-7,05E-05	0,96571	0,595451	0,66851
97	0,000352	0,00071	-0,00013	0,96606	0,59616	0,668383
98	0,000868	0,00071	-0,00012	0,96693	0,596871	0,668267
99	-0,00045	0,00306	-9,26E-05	0,96648	0,599926	0,668174
100	0,000502	0,00271	-4,70E-05	0,96698	0,602633	0,668127
101	-4,11E-05	0,00069	-0,00021	0,96694	0,603319	0,667915
102	-0,00108	0,00226	-3,28E-05	0,96586	0,605578	0,667882
103	-0,00098	0,00292	-3,86E-05	0,96488	0,608503	0,667843
104	-0,00072	0,00146	-6,30E-05	0,96416	0,609965	0,66778
105	0,000762	0,00129	-2,62E-05	0,96493	0,611255	0,667754
106	0,00106	0,00223	-3,02E-05	0,96599	0,613482	0,667724
107	-0,00108	0,00057	-2,46E-05	0,9649	0,614055	0,667699
108	0,000875	0,00227	-4,18E-05	0,96578	0,616329	0,667657
109	0,000236	0,00066	-1,85E-05	0,96601	0,616985	0,667639
110	0,000999	0,00138	-4,64E-05	0,96701	0,618363	0,667593
111	5,21E-05	0,00054	-0,00014	0,96706	0,618903	0,667452
112	-0,00187	0,00245	-2,33E-05	0,9652	0,621354	0,667429
113	3,84E-05	0,0011	-1,63E-05	0,96523	0,622455	0,667413
114	0,000434	0,00169	-6,12E-05	0,96567	0,624143	0,667352
115	2,92E-06	0,00094	-3,92E-05	0,96567	0,625083	0,667313
116	-0,00053	0,0005	-2,33E-05	0,96514	0,625583	0,66729
117	-0,00077	0,00169	-3,71E-05	0,96437	0,627271	0,667253
118	-0,00101	0,00159	-2,95E-05	0,96336	0,628859	0,667224

119	-0,00088	0,00083	-4,32E-05	0,96248	0,629686	0,667181
120	-0,0005	0,00275	-6,38E-05	0,96198	0,632432	0,667117
121	-0,00076	0,00131	-6,22E-06	0,96122	0,633739	0,667111
122	0,00064	0,0022	-7,42E-06	0,96186	0,635942	0,667104
123	0,000686	0,00129	-1,01E-05	0,96254	0,637235	0,667094
124	-0,00049	0,00125	-1,00E-05	0,96205	0,638486	0,667084
125	0,00023	0,00314	0	0,96228	0,641625	0,667084
126	-0,00128	0,00401	-1,08E-05	0,961	0,64564	0,667073
127	0,000327	0,00336	0	0,96132	0,649001	0,667073
128	0,00028	0,00238	-8,19E-06	0,9616	0,651381	0,667065
129	-0,00075	0,00171	-1,92E-06	0,96085	0,653096	0,667063
130	-0,00098	0,00474	-2,88E-05	0,95987	0,657836	0,667034
131	0,000152	0,00296	0	0,96002	0,660799	0,667034
132	0,000747	0,00623	-1,10E-05	0,96077	0,667032	0,667023
133	-0,00012	0,0049	-1,39E-05	0,96065	0,671932	0,667009
134	-0,00091	0,00279	0	0,95974	0,674726	0,667009
135	-0,00102	0,00248	-1,79E-05	0,95872	0,67721	0,666991
136	-0,00058	0,00465	-1,00E-05	0,95814	0,681858	0,666981
137	0,000296	0,00518	0	0,95843	0,687034	0,666981
138	-0,00017	0,0033	-2,15E-05	0,95827	0,690332	0,666959
139	-0,00104	0,00121	-1,62E-05	0,95722	0,69154	0,666943
140	-0,00139	0,00215	-1,09E-05	0,95583	0,693686	0,666932
141	-0,00032	0,00473	-6,29E-06	0,95551	0,698419	0,666926
142	-0,00274	0,00266	0	0,95277	0,701081	0,666926
143	-0,00051	0,0038	0	0,95226	0,704882	0,666926
144	-0,00038	0,00206	0	0,95188	0,706944	0,666926
145	-0,00011	0,00119	-3,07E-05	0,95177	0,708135	0,666895
146	-0,00029	0,00296	-5,56E-06	0,95148	0,711095	0,666889
147	0,001096	0,00189	-2,15E-06	0,95258	0,712983	0,666887
148	0,000484	0,00223	-2,89E-05	0,95306	0,715213	0,666858
149	-1,73E-06	0,00398	0	0,95306	0,719196	0,666858
150	0,000763	0,00121	0	0,95382	0,720402	0,666858
151	-0,00031	0,00408	-7,36E-06	0,95351	0,724486	0,666851
152	-0,00052	0,00174	-2,36E-05	0,95299	0,726223	0,666827
153	0,000252	0,00239	-4,19E-06	0,95324	0,728612	0,666823
154	-0,00182	0,00182	0	0,95142	0,730427	0,666823
155	-0,00117	0,00269	-1,03E-05	0,95025	0,733121	0,666813
156	0,001456	0,00346	0	0,9517	0,736584	0,666813
157	0,001116	0,00262	0	0,95282	0,739204	0,666813
158	-0,00045	0,00096	-1,01E-05	0,95237	0,740161	0,666803
159	-0,00082	0,00094	0	0,95155	0,741099	0,666803

160	0,00196	0,00195	0	0,95351	0,743051	0,666803
161	0,000954	0,00112	0	0,95447	0,744171	0,666803
162	-0,00049	0,00167	-1,19E-05	0,95398	0,74584	0,666791
163	-0,00012	0,00153	-7,40E-06	0,95386	0,747372	0,666784
164	0,000501	0,00209	-9,70E-06	0,95436	0,749462	0,666774
165	-0,00041	0,00173	0	0,95395	0,751196	0,666774
166	0,000801	0,00193	-1,55E-05	0,95475	0,75313	0,666758
167	-0,00041	0,00103	8,43E-07	0,95434	0,754163	0,666759
168	0,000605	0,00207	0	0,95495	0,756228	0,666759
169	0,000145	0,00191	0	0,95509	0,758133	0,666759
170	-0,00152	0,00098	-1,01E-05	0,95357	0,759117	0,666749
171	0,000429	0,00184	0	0,954	0,760954	0,666749
172	0,001323	0,00124	-5,43E-06	0,95532	0,762194	0,666744
173	-6,52E-05	0,00138	0	0,95526	0,763572	0,666744
174	5,46E-05	0,00248	0	0,95531	0,766056	0,666744
175	-6,74E-05	0,00081	-1,17E-05	0,95524	0,766869	0,666732
176	-0,00037	0,00226	-4,67E-06	0,95488	0,769125	0,666727
177	2,40E-05	0,0008	0	0,9549	0,769922	0,666727
178	0,000252	0,00068	0	0,95515	0,770601	0,666727
179	0,001112	0,00082	-8,70E-06	0,95626	0,771425	0,666718
180	-0,00103	0,00167	0	0,95524	0,773099	0,666718
181	-0,00225	0,00277	0	0,95299	0,775871	0,666718
182	-8,06E-05	0,00269	0	0,95291	0,778561	0,666718
183	0,001319	0,00107	-4,94E-06	0,95423	0,779631	0,666713
184	0,001076	0,00207	0	0,9553	0,781706	0,666713
185	0,000697	0,00235	0	0,956	0,784057	0,666713
186	0,000263	0,00076	0	0,95626	0,784816	0,666713
187	0,000845	0,00167	3,83E-07	0,95711	0,786485	0,666713
188	0,001052	0,00158	0	0,95816	0,78807	0,666713
189	0,000117	0,00197	-7,02E-06	0,95828	0,790038	0,666706
190	-0,0003	0,00082	0	0,95797	0,790861	0,666706
191	-0,00094	0,00111	-3,10E-06	0,95704	0,791968	0,666703
192	-0,00166	0,00095	-8,12E-06	0,95537	0,792918	0,666695
193	0,000358	0,00174	0	0,95573	0,794656	0,666695
194	0,000218	0,00133	0	0,95595	0,795986	0,666695
195	-0,00056	0,00131	3,32E-07	0,95539	0,797298	0,666695
196	0,000524	0,00123	0	0,95592	0,798524	0,666695
197	-0,00094	0,00087	0	0,95498	0,799399	0,666695
198	-2,16E-05	0,0006	0	0,95496	0,800001	0,666695
199	0,000785	0,00189	-4,19E-06	0,95574	0,801892	0,666691
200	-0,00049	0,00266	0	0,95525	0,80455	0,666691

201	-0,00089	0,00103	0	0,95437	0,805579	0,666691
202	-0,00134	0,00149	0	0,95303	0,807073	0,666691
203	-0,0011	0,00125	0	0,95193	0,808324	0,666691
204	0,00016	0,00159	-4,71E-06	0,95209	0,809914	0,666686
205	0,002434	0,00169	0	0,95452	0,811602	0,666686
206	-0,00094	0,00106	0	0,95358	0,812664	0,666686
207	-0,00034	0,00127	0	0,95324	0,813929	0,666686
208	5,72E-05	0,00244	0	0,9533	0,816374	0,666686
209	0,000821	0,0018	0	0,95412	0,818178	0,666686
210	0,000388	0,00159	0	0,9545	0,819772	0,666686
211	0,000814	0,00103	0	0,95532	0,820802	0,666686
212	-0,00107	0,00227	0	0,95425	0,823071	0,666686
213	0,000866	0,00265	0	0,95512	0,825724	0,666686
214	0,000619	0,00109	0	0,95574	0,82681	0,666686
215	-0,00125	0,00232	0	0,95449	0,829132	0,666686
216	-0,00083	0,00135	0	0,95366	0,83048	0,666686
217	0,00082	0,00142	0	0,95448	0,831899	0,666686
218	-0,00083	0,00131	0	0,95365	0,833213	0,666686
219	-9,45E-05	0,00252	0	0,95356	0,835733	0,666686
220	-0,00077	0,00148	0	0,95279	0,837216	0,666686
221	-0,00185	0,00132	0	0,95093	0,838539	0,666686
222	-0,00056	0,00107	0	0,95037	0,83961	0,666686
223	0,000344	0,00118	0	0,95072	0,840788	0,666686
224	-0,00154	0,00108	0	0,94918	0,841872	0,666686
225	0,000119	0,00159	0	0,9493	0,843459	0,666686
226	0,00047	0,00111	0	0,94977	0,844569	0,666686
227	-1,64E-05	0,00182	0	0,94975	0,846391	0,666686
228	0,0005	0,00145	0	0,95025	0,847836	0,666686
229	0,001169	0,00249	0	0,95142	0,850323	0,666686
230	-0,00069	0,00163	0	0,95073	0,851952	0,666686
231	0,000688	0,0012	0	0,95142	0,853147	0,666686
232	-0,00107	0,00171	0	0,95035	0,854853	0,666686
233	-0,00054	0,00117	0	0,94982	0,856027	0,666686
234	-0,00099	0,00146	0	0,94882	0,857491	0,666686
235	1,52E-05	0,0025	-9,07E-06	0,94884	0,859987	0,666677
236	0,001089	0,0024	0	0,94993	0,86239	0,666677
237	-0,00024	0,0005	0	0,94968	0,862885	0,666677
238	0,000951	0,00157	0	0,95064	0,864451	0,666677
239	0,002223	0,00237	0	0,95286	0,866817	0,666677
240	-0,00133	0,00111	0	0,95153	0,867926	0,666677
241	-0,0014	0,00093	0	0,95013	0,868856	0,666677

242	-0,00043	0,0025	0	0,9497	0,871358	0,666677
243	0,000723	0,00252	0	0,95042	0,873877	0,666677
244	-0,00018	0,00117	0	0,95024	0,875047	0,666677
245	-0,00013	0,00075	0	0,9501	0,875798	0,666677
246	0,000458	0,00121	0	0,95056	0,87701	0,666677
247	-0,00196	0,00083	0	0,94861	0,877842	0,666677
248	1,62E-06	0,00121	0	0,94861	0,879048	0,666677
249	1,49E-05	0,00138	0	0,94862	0,880432	0,666677
250	0,000265	0,00271	0	0,94889	0,883145	0,666677
251	-0,00069	0,00099	0	0,94819	0,884138	0,666677
252	-0,00019	0,00208	0	0,948	0,886213	0,666677
253	-0,00062	0,00301	0	0,94739	0,889225	0,666677
254	1,44E-05	0,00165	0	0,9474	0,890873	0,666677
255	2,87E-05	0,00195	0	0,94743	0,892819	0,666677
256	0,000249	0,00236	0	0,94768	0,895179	0,666677
257	0,000479	0,00117	-4,84E-06	0,94816	0,896349	0,666672
258	-0,0012	0,00163	0	0,94695	0,89798	0,666672
259	-0,00133	0,00045	0	0,94563	0,898428	0,666672
260	-0,00051	0,002	0	0,94512	0,900431	0,666672
261	0,000461	0,00297	0	0,94558	0,903405	0,666672
262	0,000847	0,00108	0	0,94642	0,904489	0,666672
263	0,001182	0,00111	0	0,94761	0,905601	0,666672
264	-0,00022	0,00263	0	0,94739	0,908235	0,666672
265	-0,00071	0,00063	0	0,94668	0,908865	0,666672
266	0,000437	0,00057	0	0,94711	0,909437	0,666672
267	0,001212	0,0015	0	0,94832	0,910934	0,666672
268	0,000152	0,00077	0	0,94848	0,911708	0,666672
269	-0,00036	0,00111	0	0,94812	0,912823	0,666672
270	-0,00033	0,00127	0	0,94779	0,914096	0,666672
271	0,000355	0,00131	0	0,94815	0,915408	0,666672
272	-0,00013	0,00066	0	0,94801	0,916066	0,666672
273	0,000312	0,00195	0	0,94833	0,918018	0,666672
274	-0,0006	0,00125	0	0,94773	0,919267	0,666672
275	0,000419	0,00095	0	0,94815	0,920215	0,666672
276	0,000224	0,00048	0	0,94837	0,920696	0,666672
277	0,000269	0,00173	0	0,94864	0,922431	0,666672
278	0,001108	0,00135	0	0,94975	0,923779	0,666672
279	-0,00033	0,00059	0	0,94942	0,924373	0,666672
280	-0,0003	0,00103	-4,42E-05	0,94912	0,9254	0,666628
281	0,000231	0,00026	0	0,94935	0,925658	0,666628
282	-0,00017	0,00163	0	0,94918	0,927286	0,666628

283	-0,00019	0,00191	0	0,94899	0,9292	0,666628
284	-0,00028	0,00071	0	0,94871	0,929912	0,666628
285	0,000335	0,00077	0	0,94905	0,930682	0,666628
286	0,000477	0,00187	0	0,94952	0,932552	0,666628
287	-0,00051	0,00168	0	0,94901	0,934231	0,666628
288	-0,00012	0,00038	0	0,94889	0,934612	0,666628
289	-0,00113	0,00117	0	0,94776	0,935782	0,666628
290	9,68E-06	0,00118	0	0,94777	0,93696	0,666628
291	-0,0004	0,00099	0	0,94736	0,937949	0,666628
292	-1,99E-05	0,00109	0	0,94734	0,939035	0,666628
293	0,000222	0,00095	0	0,94757	0,939983	0,666628
294	-0,00022	0,00045	0	0,94735	0,940428	0,666628
295	0,000979	0,00074	0	0,94833	0,941169	0,666628
296	-0,00019	0,00098	0	0,94814	0,94215	0,666628
297	0,000365	0,00086	0	0,94851	0,943009	0,666628
298	0,000308	0,00093	0	0,94881	0,943937	0,666628
299	0,000201	0,00033	0	0,94901	0,944271	0,666628
300	-0,00169	0,00021	0	0,94732	0,944479	0,666628

APPENDICES 8: Gradients and Decision Variables at Experiment 3

Optimization Number (Nbr)	Gradient P1* Mu	Gradient P2 * Mu	Gradient P3* Mu	New Alfa (α)	New Beta (β)	New Gama (γ)
1	-0,08822	-0,01537	-0,00106	0,86178	0,484628	0,79894
2	0,007717	0,011351	-0,00744	0,8695	0,495979	0,791502
3	0,001283	0,009663	-0,00818	0,87078	0,505642	0,783323
4	-0,00209	0,02355	-0,00367	0,8687	0,529192	0,779649
5	-0,00973	-0,00082	-0,01342	0,85897	0,528373	0,766227
6	-0,01574	0,002089	-0,009	0,84324	0,530462	0,757225
7	0,003943	0,012937	-0,01041	0,84718	0,543399	0,746817
8	0,009786	0,001753	-0,00684	0,85696	0,545152	0,739974
9	0,008737	0,006918	-0,00733	0,8657	0,55207	0,732646
10	-0,02368	0,007081	-0,00337	0,84202	0,559151	0,729277
11	0,005589	-7,85E-05	-0,00452	0,84761	0,559072	0,724757
12	-0,00058	0,000689	-0,00159	0,84703	0,559761	0,723163
13	0,000652	0,001038	-0,00457	0,84768	0,560799	0,718596
14	0,003333	0,002629	-0,00281	0,85101	0,563428	0,715788
15	0,001657	0,005155	-0,00201	0,85267	0,568583	0,713783
16	-0,00041	0,002425	-0,0023	0,85226	0,571008	0,71148
17	-0,00539	0,000754	-0,0026	0,84687	0,571762	0,708877
18	0,002066	-0,00088	-0,00172	0,84894	0,570886	0,70716
19	-0,00277	-0,00079	-0,00369	0,84617	0,570091	0,703475
20	0,000773	0,003488	-0,00226	0,84694	0,573579	0,701214
21	0,000972	-0,00072	-0,00108	0,84792	0,572861	0,700137
22	-0,00393	0,002646	-0,00188	0,84399	0,575507	0,698256
23	-0,00276	0,002555	-0,00316	0,84122	0,578062	0,695097
24	0,001797	0,001045	-0,00195	0,84302	0,579107	0,693151
25	-0,00228	0,008156	-0,00169	0,84074	0,587263	0,691458
26	0,002857	0,000252	-0,00197	0,8436	0,587515	0,689484
27	0,000118	0,000744	-0,0009	0,84372	0,588259	0,688581
28	-0,00189	0,002249	-0,00048	0,84183	0,590508	0,688102
29	-0,00039	0,002032	-0,00077	0,84145	0,59254	0,687327
30	-0,00233	0,002379	-0,00056	0,83911	0,594919	0,686768
31	0,003918	5,10E-05	-0,00085	0,84303	0,59497	0,685921
32	-0,0014	0,000214	-0,0007	0,84163	0,595184	0,685219
33	-0,00288	0,002873	-0,00035	0,83876	0,598057	0,684865
34	1,81E-05	-0,00029	-0,00094	0,83877	0,597766	0,683929
35	0,00043	-0,00015	-0,00052	0,8392	0,59762	0,683407
36	0,001742	-8,88E-05	-0,00056	0,84095	0,597531	0,682848

37	0,000992	-0,00021	-0,00023	0,84194	0,597318	0,682613
38	0,004405	-0,00011	-0,00046	0,84634	0,597204	0,682148
39	-0,00124	0,000146	-0,00117	0,84511	0,59735	0,680982
40	-0,00062	0,000761	-0,00032	0,84449	0,598111	0,680661
41	0,003413	0,000876	-0,00054	0,8479	0,598987	0,680121
42	-0,00114	0,000291	-0,00059	0,84676	0,599278	0,679531
43	-0,00149	-0,00118	-0,00035	0,84527	0,598099	0,679182
44	1,68E-05	-0,0008	-0,0003	0,84529	0,597304	0,678882
45	-0,00091	-0,00039	-0,0004	0,84438	0,596913	0,678484
46	0,001734	-0,00028	-0,00045	0,84611	0,596637	0,678038
47	-0,00167	0,000498	-0,00024	0,84445	0,597135	0,677795
48	-0,0013	-0,00029	-0,00031	0,84314	0,596843	0,677481
49	-0,00191	0,000516	-0,00032	0,84123	0,597359	0,677164
50	0,001861	0,000234	-0,00058	0,84309	0,597593	0,676588
51	0,00155	0,000498	-0,00031	0,84464	0,598091	0,676283
52	-0,00096	-0,00044	-0,00036	0,84368	0,597656	0,675923
53	0,000109	-0,00018	-7,20E-05	0,84379	0,59748	0,675851
54	-0,00061	-9,97E-05	-0,00022	0,84318	0,59738	0,675632
55	0,0003	-0,00038	-0,00022	0,84348	0,596996	0,67541
56	-0,00255	0,000848	-0,00019	0,84093	0,597844	0,675216
57	0,001347	0,000199	-0,00022	0,84228	0,598043	0,674995
58	-0,00022	-5,41E-05	-9,97E-05	0,84206	0,597989	0,674895
59	0,001897	7,04E-06	-0,00021	0,84395	0,597996	0,674689
60	-0,00076	-0,00029	-0,00053	0,8432	0,597705	0,674162
61	-0,00074	-0,00016	-0,00019	0,84245	0,597548	0,67397
62	0,000848	0,00026	-0,0002	0,8433	0,597808	0,67377
63	0,001549	-0,0006	-0,00012	0,84485	0,597204	0,673653
64	0,001333	-0,00077	-0,00014	0,84618	0,596436	0,673515
65	-0,0005	0,000507	-0,0001	0,84569	0,596943	0,673414
66	-0,00096	-0,0002	-6,59E-05	0,84473	0,596744	0,673348
67	0,000736	0,000449	-0,00012	0,84547	0,597193	0,673225
68	7,05E-05	-0,00046	-0,00012	0,84554	0,596735	0,673106
69	-0,00066	-0,00028	-0,00012	0,84488	0,596452	0,672987
70	-0,00055	5,65E-05	-6,67E-05	0,84433	0,596508	0,67292
71	-0,0007	-0,00013	-0,00016	0,84363	0,596379	0,672762
72	0,000572	-0,00088	-0,00019	0,8442	0,595499	0,672569
73	0,000437	-0,00049	-0,0001	0,84464	0,595006	0,672465
74	-3,42E-05	0,000777	-9,26E-05	0,8446	0,595783	0,672372
75	-0,00037	-3,98E-05	-4,25E-05	0,84423	0,595743	0,67233
76	0,00077	-0,00059	-6,51E-05	0,845	0,595155	0,672265

77	0,000804	0,001485	-0,00018	0,8458	0,59664	0,672084
78	0,000149	0,000185	-7,97E-05	0,84595	0,596825	0,672004
79	0,00098	0,000534	-0,00023	0,84693	0,597359	0,671777
80	-0,00027	-0,00015	-0,00011	0,84666	0,597213	0,671665
81	0,000211	2,61E-05	-8,07E-05	0,84687	0,597239	0,671584
82	0,0006	0,000289	-2,93E-05	0,84747	0,597528	0,671555
83	-0,00147	0,000105	-6,66E-05	0,846	0,597633	0,671488
84	-0,00244	-9,17E-05	-3,86E-05	0,84356	0,597541	0,671449
85	-0,00032	7,20E-05	-0,0001	0,84325	0,597613	0,671348
86	0,000473	0,000165	-0,0002	0,84372	0,597778	0,67115
87	-7,30E-05	-7,01E-05	-3,00E-05	0,84365	0,597708	0,67112
88	-0,00013	0,000213	-5,48E-05	0,84352	0,597921	0,671065
89	0,001334	0,000781	-9,54E-05	0,84485	0,598702	0,67097
90	0,000905	2,18E-05	-6,31E-05	0,84576	0,598724	0,670907
91	-0,00023	0,000208	-1,31E-05	0,84553	0,598932	0,670894
92	-0,0007	0,000233	-4,97E-05	0,84482	0,599165	0,670844
93	0,00076	0,00053	-4,84E-05	0,84558	0,599695	0,670796
94	-0,00137	-4,73E-05	-4,53E-05	0,84421	0,599648	0,670751
95	0,000278	0,000246	-9,90E-05	0,84449	0,599894	0,670652
96	0,000438	0,000161	-1,64E-05	0,84493	0,600055	0,670636
97	-0,00034	-0,00039	-5,18E-05	0,84458	0,599663	0,670584
98	-0,0002	-0,00018	-1,10E-05	0,84438	0,59948	0,670573
99	0,000367	-5,06E-05	-8,14E-05	0,84475	0,599429	0,670492
100	-0,00019	-0,00043	-3,61E-05	0,84455	0,599	0,670456
101	-0,001	0,000481	-2,49E-05	0,84355	0,599481	0,670431
102	-0,00033	-8,06E-05	-2,66E-05	0,84323	0,5994	0,670404
103	0,001734	-7,80E-05	-3,84E-06	0,84496	0,599322	0,6704
104	0,00056	9,67E-05	-2,43E-05	0,84552	0,599419	0,670376
105	-0,00051	0,000176	-2,93E-05	0,84501	0,599595	0,670347
106	0,000401	0,000494	-7,22E-05	0,84541	0,600089	0,670275
107	-2,70E-06	0,000257	-3,37E-05	0,84541	0,600346	0,670241
108	0,000569	-0,00022	-7,00E-05	0,84598	0,600122	0,670171
109	0,001383	8,76E-05	-2,08E-06	0,84736	0,60021	0,670169
110	-0,00028	2,00E-06	-3,66E-05	0,84708	0,600212	0,670132
111	-4,95E-05	-3,90E-05	1,11E-06	0,84703	0,600173	0,670133
112	0,001466	-7,37E-05	-6,29E-06	0,8485	0,600099	0,670127
113	-0,0014	0,000122	-2,75E-05	0,8471	0,600221	0,670099
114	-0,00075	-0,00018	-1,37E-05	0,84635	0,600045	0,670085
115	-0,00079	-7,47E-05	-0,0001	0,84556	0,59997	0,669982

116	2,76E-06	-6,96E-05	-5,28E-05	0,84557	0,5999	0,669929
117	0,000984	0,000377	-6,90E-05	0,84655	0,600277	0,66986
118	-0,00017	-0,00011	-1,44E-05	0,84638	0,600164	0,669846
119	0,001494	0,000183	-1,56E-05	0,84787	0,600347	0,66983
120	0,00031	0,000268	-4,07E-06	0,84818	0,600615	0,669826
121	-0,00085	-5,66E-05	-3,40E-05	0,84733	0,600558	0,669792
122	0,00027	0,000152	-6,49E-05	0,8476	0,60071	0,669727
123	0,000509	-8,60E-05	-3,56E-05	0,84811	0,600624	0,669691
124	0,000659	0,000246	-1,45E-05	0,84877	0,60087	0,669677
125	-0,00137	-7,17E-05	-5,73E-06	0,84739	0,600798	0,669671
126	0,000708	-0,00027	-2,23E-05	0,8481	0,600529	0,669649
127	-0,00142	0,00012	-5,66E-05	0,84668	0,600649	0,669592
128	0,00027	-4,96E-06	-2,54E-05	0,84695	0,600644	0,669567
129	-0,00086	-0,00036	-7,34E-05	0,84609	0,600284	0,669494
130	-0,00113	0,000512	-1,32E-05	0,84496	0,600796	0,669481
131	-0,00054	-0,00019	-2,48E-05	0,84442	0,60061	0,669456
132	0,000938	-9,26E-05	-8,97E-05	0,84536	0,600517	0,669366
133	-0,00027	-5,36E-05	-2,26E-05	0,84509	0,600463	0,669343
134	0,000487	-0,00048	-3,98E-05	0,84558	0,599979	0,669303
135	-0,00078	-1,98E-05	-3,81E-05	0,8448	0,599959	0,669265
136	-0,0007	0,000139	-7,11E-05	0,8441	0,600098	0,669194
137	0,000329	1,62E-05	-8,71E-05	0,84443	0,600114	0,669107
138	0,000981	-0,00021	-2,53E-05	0,84541	0,599905	0,669082
139	0,001164	-0,00025	-8,85E-06	0,84658	0,599651	0,669073
140	0,000768	-2,46E-05	-2,16E-06	0,84735	0,599626	0,669071
141	-5,09E-05	-0,00013	-0,00012	0,84729	0,599491	0,66895
142	-0,0002	-5,07E-05	-1,29E-05	0,8471	0,59944	0,668937
143	-0,00059	-1,90E-05	-3,86E-06	0,84651	0,599421	0,668933
144	-6,04E-06	-4,07E-05	-3,47E-05	0,84651	0,59938	0,668898
145	-0,00049	-5,08E-06	-2,65E-05	0,84602	0,599375	0,668871
146	-0,00038	-5,08E-05	-9,57E-07	0,84564	0,599324	0,66887
147	-7,63E-05	8,36E-05	-2,15E-05	0,84556	0,599408	0,668848
148	-0,00041	-3,55E-05	-1,84E-05	0,84515	0,599372	0,66883
149	-0,00032	-0,00015	0	0,84483	0,599218	0,66883
150	-0,0005	0,000323	0	0,84434	0,599541	0,66883
151	0,000223	-6,22E-05	-2,86E-05	0,84456	0,599479	0,668801
152	0,00077	0,000311	-5,59E-05	0,84533	0,59979	0,668745
153	-0,00056	0,00016	-7,69E-06	0,84477	0,59995	0,668737

154	-5,22E-05	0,000104	-3,05E-05	0,84472	0,600054	0,668707
155	0,000256	-2,62E-05	-0,00012	0,84497	0,600028	0,668587
156	0,000753	0,000316	-7,68E-06	0,84573	0,600344	0,668579
157	7,49E-05	0,000185	-3,55E-05	0,8458	0,600529	0,668543
158	0,000113	-0,00017	-8,49E-06	0,84591	0,600357	0,668535
159	0,000847	0,000453	-2,26E-05	0,84676	0,60081	0,668512
160	-0,00071	-0,0002	-3,33E-05	0,84605	0,600613	0,668479
161	0,000505	-0,00012	-2,79E-05	0,84656	0,600494	0,668451
162	-0,00027	-0,00017	-1,75E-06	0,84629	0,600327	0,668449
163	0,000181	0,000559	-3,60E-05	0,84647	0,600886	0,668413
164	5,48E-05	-0,00023	0	0,84652	0,600651	0,668413
165	-0,00042	-7,92E-05	-1,83E-05	0,8461	0,600572	0,668395
166	0,000607	-3,46E-05	-1,59E-05	0,8467	0,600537	0,668379
167	-0,00053	0,000594	-5,88E-06	0,84618	0,601131	0,668373
168	-0,00037	4,04E-05	-1,87E-05	0,84581	0,601171	0,668354
169	0,000256	9,33E-05	-2,76E-05	0,84606	0,601264	0,668326
170	0,001153	-6,38E-05	-2,38E-05	0,84721	0,6012	0,668302
171	5,88E-05	-5,43E-05	-8,32E-06	0,84727	0,601146	0,668294
172	-0,00013	-9,98E-05	-2,90E-05	0,84714	0,601046	0,668265
173	0,000421	-0,00021	-2,44E-05	0,84756	0,600832	0,668241
174	-0,00035	-4,31E-05	-1,31E-05	0,84721	0,600789	0,668228
175	-0,00073	-0,00013	-4,70E-05	0,84648	0,600654	0,668181
176	0,000253	-0,00011	-4,53E-06	0,84673	0,600548	0,668176
177	-0,00069	5,15E-05	2,67E-06	0,84604	0,600599	0,668179
178	0,00047	9,05E-05	-3,07E-05	0,84651	0,60069	0,668148
179	6,76E-05	0,000227	-2,20E-06	0,84658	0,600917	0,668146
180	0,000371	-2,48E-05	-7,38E-06	0,84695	0,600892	0,668139
181	0,000389	-6,70E-05	-6,57E-06	0,84734	0,600825	0,668132
182	0,000611	-0,00011	-1,89E-06	0,84795	0,600713	0,66813
183	0,000433	-5,72E-05	-3,47E-06	0,84838	0,600656	0,668127
184	-0,00098	8,91E-05	-3,62E-05	0,8474	0,600745	0,668091
185	0,000283	2,12E-05	-2,21E-06	0,84768	0,600766	0,668089
186	0,000233	-0,00011	-2,49E-05	0,84791	0,600658	0,668064
187	-0,00074	-5,14E-05	-1,08E-05	0,84718	0,600607	0,668053
188	-0,00032	5,80E-05	0	0,84686	0,600665	0,668053
189	0,000738	-0,00024	-5,09E-06	0,84759	0,600425	0,668048
190	-0,00026	-0,00012	-5,55E-06	0,84733	0,600309	0,668042
191	-0,00012	0,000138	-3,55E-06	0,84722	0,600447	0,668038
192	-0,00039	-8,35E-05	-2,58E-05	0,84683	0,600364	0,668012
193	0,000452	0,000139	0	0,84728	0,600503	0,668012

194	-0,00025	0,000299	-3,69E-05	0,84704	0,600802	0,667975
195	-5,01E-06	1,07E-05	-1,13E-05	0,84703	0,600813	0,667964
196	-0,00037	0,000249	-1,13E-05	0,84666	0,601062	0,667953
197	-0,0004	-0,00029	0	0,84626	0,600768	0,667953
198	-0,0005	0,000482	-1,25E-05	0,84577	0,60125	0,667941
199	-0,00019	-6,12E-05	-2,44E-05	0,84557	0,601189	0,667917
200	0,000404	2,04E-05	-9,16E-05	0,84598	0,601209	0,667825
201	-0,0004	8,94E-06	-1,18E-05	0,84558	0,601218	0,667813
202	-0,00056	-0,00018	2,02E-07	0,84502	0,60104	0,667813
203	0,000388	-3,37E-06	-2,11E-06	0,8454	0,601037	0,667811
204	0,000101	-9,29E-06	-3,20E-05	0,8455	0,601028	0,667779
205	-0,00048	9,68E-05	-1,30E-05	0,84502	0,601125	0,667766
206	0,000229	0,00032	-0,0001	0,84525	0,601445	0,667666
207	0,000476	-0,00031	-7,21E-06	0,84573	0,60113	0,667659
208	0,000407	-7,71E-05	6,39E-06	0,84613	0,601053	0,667665
209	-0,00029	-9,64E-05	-1,13E-06	0,84585	0,600957	0,667664
210	0,000197	-2,58E-05	-1,11E-05	0,84604	0,600931	0,667653
211	-0,00113	6,94E-05	-4,18E-06	0,84491	0,601	0,667649
212	0,000474	0,000123	-2,76E-06	0,84539	0,601123	0,667646
213	-0,00042	7,40E-05	-2,73E-05	0,84497	0,601197	0,667619
214	0,000437	-6,43E-05	4,99E-07	0,84541	0,601133	0,667619
215	-0,00014	-4,07E-05	-1,79E-05	0,84527	0,601092	0,667601
216	0,000216	1,01E-05	-1,30E-05	0,84549	0,601102	0,667588
217	0,000145	-0,00021	-7,95E-06	0,84563	0,600894	0,66758
218	-0,00045	1,22E-05	-1,02E-05	0,84519	0,600906	0,66757
219	0,000636	0,00011	0	0,84582	0,601016	0,66757
220	0,000167	-0,00021	-4,64E-06	0,84599	0,600808	0,667565
221	-0,00039	-5,72E-05	-2,84E-06	0,8456	0,600751	0,667562
222	4,49E-05	-4,91E-06	-7,91E-06	0,84564	0,600746	0,667554
223	9,87E-05	-3,50E-05	6,53E-07	0,84574	0,600711	0,667555
224	-0,00038	-1,53E-05	-2,46E-05	0,84536	0,600696	0,66753
225	0,000433	-7,15E-05	0	0,84579	0,600624	0,66753
226	0,000286	-2,68E-05	-6,03E-06	0,84608	0,600597	0,667524
227	0,00069	5,96E-05	-2,80E-06	0,84677	0,600657	0,667521
228	0,000547	4,87E-05	-1,20E-05	0,84731	0,600706	0,667509
229	-0,0005	-0,00026	-3,82E-06	0,84681	0,600442	0,667505
230	-0,00026	-0,0001	-2,22E-06	0,84655	0,600338	0,667503
231	-0,00038	6,26E-05	-1,03E-05	0,84617	0,600401	0,667493
232	-0,0002	0,000132	-7,07E-06	0,84598	0,600533	0,667486
233	0,000431	-0,00023	-7,89E-07	0,84641	0,600307	0,667485

234	-5,09E-05	-0,00015	-7,70E-07	0,84636	0,600154	0,667484
235	-6,72E-06	-4,16E-05	-4,35E-07	0,84635	0,600112	0,667484
236	0,000578	-1,62E-05	-9,18E-06	0,84693	0,600096	0,667475
237	0,000323	0,000246	-7,50E-07	0,84725	0,600342	0,667474
238	-0,00036	-0,00011	0	0,84689	0,600234	0,667474
239	-0,00049	-9,47E-05	-5,14E-06	0,84641	0,600139	0,667469
240	2,42E-05	7,77E-05	0	0,84643	0,600217	0,667469
241	8,95E-07	-2,57E-05	-5,62E-06	0,84643	0,600191	0,667463
242	0,000225	8,90E-05	-2,07E-06	0,84666	0,60028	0,667461
243	-0,00024	9,08E-05	6,91E-06	0,84642	0,600371	0,667468
244	-0,00048	-0,00014	0	0,84594	0,600235	0,667468
245	-0,00024	0,000386	0	0,8457	0,600621	0,667468
246	0,000553	-7,19E-05	-4,90E-06	0,84626	0,600549	0,667463
247	0,000219	0,00017	-1,35E-07	0,84648	0,600719	0,667463
248	-1,87E-05	-0,00021	-5,07E-06	0,84646	0,600513	0,667458
249	-0,00023	-7,23E-05	2,52E-06	0,84622	0,600441	0,667461
250	0,000547	3,43E-05	-1,15E-05	0,84677	0,600475	0,66745
251	0,000138	-0,0001	-1,25E-05	0,84691	0,600375	0,667438
252	2,48E-05	-0,00015	-1,81E-06	0,84693	0,600226	0,667436
253	0,000189	0,000199	0	0,84712	0,600425	0,667436
254	-0,00079	-0,00027	-3,79E-05	0,84634	0,600159	0,667398
255	0,000332	8,67E-06	0	0,84667	0,600168	0,667398
256	8,20E-05	-0,00013	0	0,84675	0,600039	0,667398
257	-1,66E-05	0,000107	-1,70E-06	0,84673	0,600146	0,667396
258	0,00056	0,000141	-3,58E-06	0,84729	0,600287	0,667392
259	-0,00015	7,33E-05	-1,03E-05	0,84714	0,60036	0,667382
260	0,000129	-6,72E-05	-2,11E-06	0,84727	0,600293	0,66738
261	0,000338	2,67E-05	-9,77E-07	0,84761	0,60032	0,667379
262	-1,64E-05	-0,00015	-1,11E-05	0,84759	0,600167	0,667368
263	0,000554	-5,17E-05	-4,61E-05	0,84814	0,600115	0,667322
264	-0,00037	-0,00011	-2,52E-05	0,84778	0,600009	0,667297
265	-0,00015	-1,94E-05	0	0,84762	0,59999	0,667297
266	2,58E-05	-0,00016	-2,26E-05	0,84765	0,599828	0,667274
267	-0,00011	-6,11E-05	0	0,84754	0,599767	0,667274
268	-0,00012	2,50E-05	-8,55E-06	0,84742	0,599792	0,667265
269	-0,00015	0,000158	-1,21E-06	0,84727	0,59995	0,667264
270	-0,00011	-6,82E-05	0	0,84716	0,599882	0,667264

271	-3,25E-06	-0,00013	0	0,84715	0,599755	0,667264
272	-4,69E-06	2,77E-05	-3,88E-06	0,84715	0,599783	0,66726
273	-0,00014	4,65E-05	-1,03E-05	0,84701	0,59983	0,66725
274	0,000101	4,95E-05	5,15E-06	0,84711	0,599879	0,667255
275	-0,00032	9,53E-05	-2,13E-05	0,84678	0,599974	0,667234
276	-0,00035	-0,00013	-8,84E-06	0,84643	0,599849	0,667225
277	1,54E-05	-0,00018	-2,21E-06	0,84645	0,599666	0,667223
278	-0,00028	-0,00013	-3,31E-06	0,84617	0,599533	0,66722
279	-0,00011	-6,22E-05	-1,51E-06	0,84606	0,599471	0,667218
280	-0,00018	5,90E-05	-5,75E-06	0,84588	0,59953	0,667212
281	-0,00047	-8,08E-05	-3,38E-06	0,8454	0,599449	0,667209
282	0,000234	-8,44E-05	0	0,84564	0,599365	0,667209
283	-0,00033	3,67E-05	0	0,84531	0,599402	0,667209
284	0,000152	-0,0001	2,11E-06	0,84546	0,599299	0,667211
285	-0,00011	6,21E-05	-7,45E-06	0,84535	0,599361	0,667204
286	-0,00042	7,02E-05	2,38E-07	0,84493	0,599431	0,667204
287	0,000407	-1,44E-05	-5,50E-07	0,84534	0,599417	0,667203
288	9,09E-05	0,000207	0	0,84543	0,599624	0,667203
289	0,000281	-7,21E-05	-5,28E-06	0,84571	0,599552	0,667198
290	-0,0003	6,49E-05	-7,11E-06	0,84541	0,599617	0,667191
291	6,88E-05	-3,88E-05	-9,25E-06	0,84548	0,599578	0,667182
292	-0,00018	-9,41E-05	0	0,8453	0,599484	0,667182
293	-0,00019	7,60E-05	-2,39E-06	0,84511	0,59956	0,66718
294	-0,00025	2,79E-05	0	0,84486	0,599588	0,66718
295	0,00048	-5,96E-05	-7,89E-07	0,84534	0,599528	0,667179
296	-4,99E-05	-0,0001	-1,16E-05	0,84529	0,599425	0,667167
297	-0,00025	3,62E-06	0	0,84504	0,599429	0,667167
298	-0,00018	3,64E-05	-3,69E-06	0,84486	0,599465	0,667163
299	8,20E-05	3,49E-05	-7,80E-07	0,84494	0,5995	0,667162
300	9,32E-05	-0,00013	-3,87E-06	0,84503	0,599373	0,667158

APPENDICES 9: Gradients and Decision Variables at Experiment 4

Optimization Number (Nbr)	Gradient P1* Mu	GradientP2 * Mu	Gradient P3* Mu	New Alfa (α)	New Beta (β)	New Gama (γ)
1	-0,09128	0,01291458	0,000294	0,85872	0,512915	0,800294
2	0,001075	0,00254386	-0,00931	0,85979	0,515459	0,790983
3	0,017009	0,00806094	-0,01093	0,8768	0,52352	0,780053
4	-0,01162	0,00066209	-0,00851	0,86518	0,524182	0,771546
5	0,001067	0,03965585	-0,01125	0,86625	0,563838	0,7603
6	-0,0236	0,01566948	-0,0118	0,84265	0,579507	0,748498
7	-0,00099	0,00185138	-0,00358	0,84167	0,581358	0,744921
8	-0,00224	0,00746328	-0,00344	0,83942	0,588821	0,741482
9	0,005172	0,00466686	-0,00392	0,8446	0,593488	0,73756
10	0,001419	0,00233903	-0,00751	0,84602	0,595827	0,730046
11	0,003686	-0,001001	-0,00649	0,8497	0,594826	0,723552
12	-0,00161	-5,89E-05	-0,00448	0,84809	0,594767	0,71907
13	-0,00125	0,00323997	-0,00454	0,84684	0,598007	0,714529
14	-0,00492	-0,0008423	-0,00565	0,84192	0,597165	0,708883
15	-0,00346	-0,0002753	-0,00244	0,83846	0,59689	0,706447
16	0,005448	-0,0010027	-0,00241	0,84391	0,595887	0,704035
17	-0,00341	-0,0006076	-0,00255	0,84051	0,595279	0,701484
18	0,000504	0,001201	-0,00179	0,84101	0,59648	0,69969
19	1,57E-05	0,00106427	-0,00272	0,84103	0,597544	0,696969
20	0,004389	0,00096833	-0,00276	0,84541	0,598512	0,694209
21	-0,00048	0,00133687	-0,00173	0,84493	0,599849	0,692475
22	0,000657	-0,0008089	-0,00064	0,84559	0,59904	0,69184
23	-0,00319	0,00065754	-0,00153	0,8424	0,599698	0,690305
24	0,002808	-0,0001522	-0,00183	0,84521	0,599546	0,688473
25	-0,00027	0,00069253	-0,00165	0,84494	0,600239	0,686823
26	0,002705	-0,000353	-0,00055	0,84765	0,599886	0,686268
27	-0,00154	-0,0006729	-0,00128	0,84611	0,599213	0,684989
28	-0,0019	-0,0013774	-0,0016	0,84421	0,597836	0,683389
29	-0,0008	-0,0002222	-0,00062	0,84341	0,597614	0,682765
30	0,00165	-0,0001876	-0,00088	0,84506	0,597426	0,681885
31	-0,00065	-0,0001135	-0,00104	0,84441	0,597313	0,680846
32	0,000733	-0,0006728	-0,00037	0,84514	0,59664	0,680476
33	-0,00254	-0,0002666	-0,00034	0,8426	0,596373	0,680138
34	-0,00032	0,00155983	-0,00082	0,84229	0,597933	0,679322
35	-0,00342	-0,0002923	-0,00014	0,83886	0,597641	0,679179
36	0,000807	0,0004963	-0,0006	0,83967	0,598137	0,678576

37	-0,00021	-0,0007912	-0,00046	0,83946	0,597346	0,678117
38	0,001506	-0,0001951	-0,00053	0,84097	0,597151	0,677586
39	-0,00011	-0,0001072	-0,00087	0,84086	0,597044	0,676717
40	0,00107	-0,0003389	-0,00082	0,84193	0,596705	0,675894
41	0,00231	-0,0002558	-0,00051	0,84424	0,596449	0,67538
42	-0,00013	-0,0002908	-9,21E-05	0,84411	0,596158	0,675288
43	0,001486	-0,0001079	-0,00061	0,84559	0,59605	0,674674
44	0,000701	-0,000246	-7,17E-05	0,84629	0,595804	0,674602
45	0,000152	-0,0003636	-0,00022	0,84645	0,59544	0,674381
46	-0,00065	-3,93E-05	-0,00024	0,84579	0,595401	0,674144
47	-0,00075	-0,0002179	-0,00014	0,84504	0,595183	0,674009
48	-0,00012	0,00357476	-0,00038	0,84493	0,598758	0,673627
49	0,001265	-0,0007591	-0,0003	0,84619	0,597999	0,673326
50	0,002064	-0,000303	-0,0001	0,84826	0,597696	0,673225
51	-0,00099	-0,0007217	-0,00018	0,84727	0,596974	0,673048
52	-0,00094	-0,0003803	-0,00022	0,84632	0,596594	0,67283
53	-0,0003	7,60E-05	-0,00013	0,84602	0,59667	0,672699
54	0,001691	-0,0003003	-8,40E-05	0,84771	0,59637	0,672615
55	-0,00094	0,0015282	-5,56E-05	0,84677	0,597898	0,672559
56	0,001854	-0,0002264	-0,00043	0,84863	0,597672	0,672129
57	5,96E-06	-0,0002059	-7,35E-05	0,84863	0,597466	0,672056
58	0,000819	-0,0001674	-0,00029	0,84945	0,597299	0,671767
59	0,000261	0,00016614	-8,44E-05	0,84971	0,597465	0,671683
60	-0,00016	5,76E-05	-0,0002	0,84956	0,597523	0,671483
61	-0,00082	3,05E-05	-0,00025	0,84873	0,597553	0,671233
62	0,000739	-0,0002607	-8,90E-05	0,84947	0,597292	0,671144
63	-0,0016	-0,0003848	-0,0001	0,84787	0,596907	0,671043
64	-0,00171	0,00070299	-8,02E-05	0,84616	0,59761	0,670963
65	-0,0003	0,00071998	-5,13E-05	0,84586	0,59833	0,670912
66	-0,00124	0,00069543	-3,74E-05	0,84462	0,599025	0,670875
67	0,000713	-3,98E-05	-8,63E-05	0,84533	0,598985	0,670789
68	-0,00116	-0,0003364	-4,89E-05	0,84418	0,598649	0,67074
69	6,52E-05	0,00022285	-0,00014	0,84424	0,598872	0,670595
70	0,001387	-0,000313	-2,60E-05	0,84563	0,598559	0,670569
71	-8,91E-06	0,00044159	-0,00037	0,84562	0,599001	0,670203
72	0,000154	-0,0001426	0	0,84577	0,598858	0,670203
73	-0,00022	-1,02E-05	-8,30E-05	0,84556	0,598848	0,67012
74	-0,00159	-0,000547	-5,46E-05	0,84397	0,598301	0,670065
75	-0,00184	0,00025805	-3,81E-05	0,84213	0,598559	0,670027

76	-6,05E-05	0,0002043	-9,74E-05	0,84207	0,598763	0,66993
77	-0,00108	-9,98E-05	-6,86E-05	0,84099	0,598663	0,669861
78	0,000772	-0,0001569	-9,85E-05	0,84176	0,598506	0,669762
79	-0,00038	-0,0004164	-0,00012	0,84139	0,59809	0,669646
80	0,000775	-0,0002188	-1,53E-05	0,84216	0,597871	0,669631
81	0,001113	-0,000206	-3,54E-05	0,84328	0,597665	0,669596
82	0,001417	-8,24E-05	-3,73E-05	0,84469	0,597583	0,669559
83	0,001959	0,00048864	-3,32E-05	0,84665	0,598072	0,669526
84	-0,00139	-0,0003389	-0,00012	0,84526	0,597733	0,669411
85	0,001238	0,00054827	-0,00013	0,8465	0,598281	0,669286
86	4,80E-05	0,00021671	-0,00015	0,84654	0,598498	0,669137
87	0,001256	0,00023144	-3,77E-05	0,8478	0,598729	0,669099
88	-0,00087	6,66E-05	1,99E-07	0,84693	0,598796	0,669099
89	0,000278	6,19E-05	-8,26E-06	0,84721	0,598858	0,669091
90	0,000269	3,84E-05	-5,44E-06	0,84748	0,598896	0,669086
91	0,000506	0,00033208	1,67E-06	0,84799	0,599228	0,669088
92	0,000362	-0,0004329	-1,44E-05	0,84835	0,598795	0,669074
93	-0,00024	-0,0001952	-3,66E-05	0,84811	0,5986	0,669037
94	0,00023	-5,17E-05	-9,78E-06	0,84834	0,598548	0,669027
95	0,001022	0,00036577	-7,72E-05	0,84936	0,598914	0,66895
96	-0,00223	-0,0002665	-2,87E-06	0,84713	0,598648	0,668947
97	0,001389	1,86E-05	7,92E-06	0,84852	0,598667	0,668955
98	-0,00071	-1,09E-05	-2,78E-06	0,84781	0,598656	0,668952
99	0,000762	2,85E-05	-4,64E-05	0,84857	0,598685	0,668906
100	-0,00055	-0,0002261	3,64E-08	0,84802	0,598459	0,668906
101	-0,0006	4,78E-05	-2,25E-05	0,84742	0,598507	0,668883
102	0,000126	-1,92E-05	-1,25E-05	0,84755	0,598488	0,66887
103	-0,00127	-5,76E-05	-8,03E-05	0,84628	0,59843	0,66879
104	-0,00139	0,00023156	-1,95E-05	0,84489	0,598662	0,668771
105	0,000396	0,00033271	1,35E-07	0,84529	0,598995	0,668771
106	-0,00039	0,00018293	-1,50E-05	0,84489	0,599178	0,668756
107	0,001441	-0,0001173	-3,99E-05	0,84633	0,599061	0,668716
108	0,000373	0,00015497	-1,45E-05	0,84671	0,599216	0,668701
109	0,000527	-0,000253	-1,69E-05	0,84723	0,598963	0,668684
110	-0,00023	-9,36E-05	-4,14E-05	0,84701	0,598869	0,668643
111	-1,71E-07	0,0002724	-4,51E-05	0,84701	0,599141	0,668598
112	0,000251	-0,0001141	2,91E-07	0,84726	0,599027	0,668598
113	0,000332	0,00012959	-6,41E-05	0,84759	0,599157	0,668534
114	0,000539	-2,19E-05	-4,11E-05	0,84813	0,599135	0,668493

115	0,001129	0,00021899	-4,50E-05	0,84926	0,599354	0,668448
116	-0,00086	0,00035688	-1,62E-05	0,8484	0,599711	0,668432
117	0,001104	3,21E-06	0	0,8495	0,599714	0,668432
118	0,000395	0,00039661	-2,48E-05	0,8499	0,600111	0,668407
119	0,000208	-0,0001746	-1,25E-05	0,85011	0,599936	0,668394
120	-0,00057	-3,17E-05	-5,14E-05	0,84954	0,599904	0,668343
121	-0,00092	-0,0001244	-3,25E-05	0,84862	0,59978	0,668311
122	-0,00014	-0,0001771	-2,50E-05	0,84848	0,599603	0,668286
123	0,000564	-7,93E-05	-5,44E-05	0,84904	0,599524	0,668232
124	-0,00013	-0,0003617	-0,00011	0,84891	0,599162	0,668123
125	-0,00115	-0,000175	-4,15E-05	0,84776	0,598987	0,668082
126	0,000425	-0,0001453	-1,53E-05	0,84818	0,598842	0,668067
127	6,83E-05	-0,0002341	-7,39E-06	0,84825	0,598608	0,66806
128	-0,0003	-4,75E-05	-1,18E-07	0,84795	0,598561	0,66806
129	0,000165	-4,31E-05	-3,29E-05	0,84811	0,598518	0,668027
130	0,000181	3,47E-05	-1,19E-05	0,8483	0,598553	0,668015
131	-0,00113	-0,0002848	-6,17E-06	0,84717	0,598268	0,668009
132	-0,00078	-0,0001189	-3,11E-07	0,84639	0,598149	0,668009
133	0,000612	-5,09E-06	-6,46E-06	0,847	0,598144	0,668003
134	-0,00016	-0,0001395	-8,15E-06	0,84684	0,598004	0,667995
135	-0,0012	0,0003638	-4,79E-06	0,84564	0,598368	0,66799
136	-0,00025	0,00025344	-4,77E-05	0,8454	0,598621	0,667942
137	-0,00013	0,00023173	-4,76E-05	0,84527	0,598853	0,667894
138	-0,00061	0,00019435	-4,52E-05	0,84466	0,599047	0,667849
139	-0,00038	-0,0001275	0	0,84427	0,59892	0,667849
140	-7,67E-05	-7,27E-05	-1,50E-05	0,8442	0,598847	0,667834
141	0,000677	-7,99E-05	-5,71E-05	0,84487	0,598767	0,667777
142	-0,00057	0,00012983	-1,33E-05	0,8443	0,598897	0,667764
143	-0,00047	-0,0002456	-5,73E-05	0,84383	0,598651	0,667707
144	-0,00033	-8,37E-05	-3,98E-06	0,84349	0,598567	0,667703
145	0,000312	-3,06E-05	-8,20E-06	0,84381	0,598536	0,667695
146	0,000441	0,00011943	0	0,84425	0,598655	0,667695
147	-0,00032	-5,79E-05	-5,79E-06	0,84393	0,598597	0,667689
148	-0,00024	1,35E-05	3,93E-06	0,84369	0,59861	0,667693
149	0,001001	-0,0001259	-9,90E-06	0,84469	0,598484	0,667683
150	-0,00107	4,07E-05	-1,69E-06	0,84362	0,598525	0,667681
151	0,000522	-6,52E-05	-4,87E-06	0,84414	0,59846	0,667676
152	-0,00118	-6,52E-05	-6,93E-07	0,84296	0,598395	0,667675
153	0,000187	4,54E-05	0	0,84315	0,59844	0,667675
154	-0,00022	0,00017668	-2,84E-05	0,84293	0,598617	0,667647

155	0,000385	6,50E-05	-2,52E-05	0,84331	0,598682	0,667622
156	-0,00015	-0,0002779	-6,25E-06	0,84316	0,598404	0,667616
157	-0,00022	7,34E-05	-9,80E-06	0,84294	0,598477	0,667606
158	0,000183	0,00031921	0	0,84312	0,598796	0,667606
159	-0,00031	0,00011892	-9,25E-06	0,84282	0,598915	0,667597
160	-3,09E-06	-3,07E-05	-5,00E-06	0,84281	0,598884	0,667592
161	-5,58E-05	-6,49E-05	-8,94E-06	0,84276	0,598819	0,667583
162	-0,00028	-8,68E-05	-1,11E-05	0,84247	0,598732	0,667572
163	0,000873	0,00019224	0	0,84335	0,598924	0,667572
164	-0,00038	-0,00013	-2,80E-06	0,84297	0,598794	0,667569
165	0,000139	0,00044888	-6,55E-06	0,84311	0,599243	0,667562
166	-0,00076	-0,0002125	-3,57E-06	0,84234	0,59903	0,667558
167	0,000136	-1,55E-05	-3,25E-06	0,84248	0,599014	0,667555
168	-5,77E-05	5,48E-05	-9,02E-06	0,84242	0,599069	0,667546
169	6,67E-05	1,27E-05	-5,69E-06	0,84249	0,599082	0,66754
170	0,000248	2,79E-05	-1,05E-05	0,84274	0,59911	0,66753
171	-0,0006	-4,44E-05	-6,48E-06	0,84213	0,599066	0,667524
172	-0,00051	0,00010294	-1,78E-06	0,84163	0,599169	0,667522
173	0,001352	-0,0001578	-9,79E-06	0,84298	0,599011	0,667512
174	-0,00052	-1,57E-05	0	0,84246	0,598995	0,667512
175	-0,00042	-4,89E-05	-1,58E-05	0,84204	0,598946	0,667496
176	-0,00034	1,58E-05	-3,26E-06	0,8417	0,598962	0,667493
177	0,000196	-0,0001928	-3,79E-06	0,8419	0,598769	0,667489
178	0,000284	-1,60E-05	0	0,84218	0,598753	0,667489
179	0,000642	0,0002316	-3,08E-06	0,84282	0,598985	0,667486
180	9,95E-05	9,01E-05	-1,13E-05	0,84292	0,599075	0,667475
181	0,000181	-3,12E-05	0	0,8431	0,599044	0,667475
182	-5,13E-05	-0,0001871	-6,75E-06	0,84305	0,598857	0,667468
183	-3,33E-05	-2,14E-05	-2,25E-05	0,84302	0,598836	0,667445
184	0,000262	-3,46E-05	-2,20E-05	0,84328	0,598801	0,667423
185	0,000857	7,54E-05	0	0,84414	0,598876	0,667423
186	2,24E-05	-0,0001544	-3,82E-05	0,84416	0,598722	0,667385
187	0,000478	0,0004338	-8,99E-06	0,84464	0,599156	0,667376
188	0,000384	-2,32E-05	0	0,84502	0,599133	0,667376
189	-0,00013	0,00010361	-1,97E-05	0,84489	0,599237	0,667356
190	-1,14E-05	-5,51E-05	0	0,84488	0,599182	0,667356

191	-0,00053	-0,0001776	-5,96E-06	0,84435	0,599004	0,66735
192	0,000384	0,00011378	0	0,84473	0,599118	0,66735
193	0,000407	-1,97E-05	-5,50E-06	0,84514	0,599098	0,667345
194	0,000388	-3,36E-05	-1,27E-05	0,84553	0,599064	0,667332
195	0,000113	-0,0001034	0	0,84564	0,598961	0,667332
196	-0,00021	-3,96E-05	-4,18E-06	0,84543	0,598921	0,667328
197	-1,24E-05	0,00012829	-2,18E-06	0,84542	0,599049	0,667326
198	0,000628	0,00034372	-2,68E-06	0,84604	0,599393	0,667323
199	-0,00029	-4,06E-05	-3,67E-06	0,84576	0,599352	0,667319
200	-0,0005	0,00016777	-1,83E-06	0,84526	0,59952	0,667317
201	-0,00049	-0,0001181	0	0,84476	0,599402	0,667317
202	0,001129	-5,28E-05	-4,06E-06	0,84589	0,599349	0,667313
203	-0,00047	7,16E-05	-4,09E-05	0,84542	0,599421	0,667272
204	-2,41E-05	4,29E-05	0	0,8454	0,599464	0,667272
205	0,000701	-0,0001635	0	0,8461	0,599301	0,667272
206	-9,70E-06	-0,0001319	-2,08E-05	0,84609	0,599169	0,667251
207	0,000261	-7,47E-05	0	0,84635	0,599094	0,667251
208	0,000139	-0,0001597	-1,48E-06	0,84649	0,598934	0,66725
209	-0,00011	-0,0001265	-3,62E-06	0,84638	0,598808	0,667246
210	0,00045	-4,55E-05	-4,58E-06	0,84683	0,598762	0,667241
211	-0,00138	0,00016364	0	0,84546	0,598926	0,667241
212	0,000184	0,0001196	-1,55E-06	0,84564	0,599046	0,667239
213	-0,00027	-7,40E-06	-5,28E-06	0,84538	0,599039	0,667234
214	-0,0004	2,26E-05	0	0,84498	0,599062	0,667234
215	0,000104	-0,0001158	0	0,84508	0,598946	0,667234
216	-0,00064	-0,0001708	-4,04E-05	0,84445	0,598775	0,667194
217	-0,00037	-8,75E-05	-9,36E-06	0,84407	0,598688	0,667185
218	0,00025	-7,39E-05	0	0,84432	0,598614	0,667185
219	7,73E-05	-6,29E-05	9,42E-07	0,8444	0,598551	0,667186
220	-0,00014	-0,0003246	-2,28E-06	0,84426	0,598226	0,667184
221	-0,00028	-0,0001111	0	0,84398	0,598115	0,667184
222	-6,38E-05	0,00011758	-1,07E-05	0,84392	0,598233	0,667173
223	2,81E-05	-0,0001313	-7,43E-07	0,84394	0,598102	0,667172
224	0,000328	0,00012171	0	0,84427	0,598224	0,667172
225	0,000655	-2,33E-05	-1,47E-05	0,84493	0,598201	0,667157
226	0,00032	-0,0001394	0	0,84525	0,598062	0,667157
227	-8,94E-05	3,04E-05	-2,28E-06	0,84516	0,598092	0,667155

228	-0,00029	0,00012537	-2,53E-06	0,84486	0,598217	0,667152
229	-0,00074	-6,19E-05	0	0,84413	0,598155	0,667152
230	2,37E-06	0,00034747	0	0,84413	0,598502	0,667152
231	-7,81E-05	-1,40E-05	-6,11E-06	0,84405	0,598488	0,667146
232	0,000232	8,97E-05	-9,11E-06	0,84428	0,598578	0,667137
233	-0,00025	-2,06E-05	-3,10E-05	0,84403	0,598557	0,667106
234	0,000646	-6,95E-05	0	0,84468	0,598488	0,667106
235	0,000304	6,20E-05	0	0,84498	0,59855	0,667106
236	-0,0005	9,40E-05	-4,58E-06	0,84448	0,598644	0,667101
237	-0,00069	-5,10E-06	-5,70E-06	0,8438	0,598639	0,667095
238	0,000459	-9,19E-05	0	0,84425	0,598547	0,667095
239	-0,00029	-9,64E-05	0	0,84396	0,598451	0,667095
240	-0,00014	-8,97E-05	0	0,84382	0,598361	0,667095
241	-0,00053	4,02E-05	0	0,8433	0,598401	0,667095
242	-0,00084	-9,34E-05	0	0,84246	0,598308	0,667095
243	0,000226	-3,54E-05	-1,20E-06	0,84269	0,598273	0,667094
244	1,62E-05	-3,33E-05	0	0,8427	0,59824	0,667094
245	0,000358	-1,76E-05	-9,18E-06	0,84306	0,598222	0,667085
246	-3,51E-06	0,00010168	0	0,84306	0,598324	0,667085
247	0,00022	-1,49E-05	-2,33E-07	0,84328	0,598309	0,667085
248	0,001011	1,99E-05	-1,49E-05	0,84429	0,598329	0,66707
249	0,000237	-2,26E-05	3,19E-07	0,84452	0,598306	0,66707
250	0,000378	-7,35E-05	0	0,8449	0,598233	0,66707
251	-0,00053	-1,89E-05	0	0,84437	0,598214	0,66707
252	0,000287	-2,70E-05	0	0,84465	0,598187	0,66707
253	0,000469	-1,42E-05	0	0,84512	0,598173	0,66707
254	-0,00013	0,00018849	3,45E-07	0,84499	0,598361	0,66707
255	-0,00041	-5,15E-05	0	0,84458	0,59831	0,66707
256	0,000274	0,00032931	0	0,84486	0,598639	0,66707
257	0,000272	-2,49E-05	-1,60E-05	0,84513	0,598614	0,667054
258	-4,40E-05	0,00025273	0	0,84508	0,598867	0,667054
259	-0,00053	0,00016023	0	0,84455	0,599027	0,667054
260	0,000189	-5,15E-05	-6,39E-06	0,84474	0,598976	0,667048
261	0,000292	-2,73E-05	-1,74E-06	0,84503	0,598949	0,667046
262	0,000181	-9,37E-05	0	0,84521	0,598855	0,667046
263	-0,0005	4,90E-05	0	0,84472	0,598904	0,667046
264	5,50E-05	-2,01E-05	0	0,84477	0,598884	0,667046
265	-0,00012	-3,72E-05	-1,27E-05	0,84465	0,598847	0,667033
266	-0,00037	-0,0001041	-6,44E-06	0,84428	0,598743	0,667027

267	-4,98E-05	-6,94E-05	0	0,84423	0,598674	0,667027
268	-0,00014	0,00016404	0	0,84409	0,598838	0,667027
269	0,000478	2,80E-05	0	0,84457	0,598866	0,667027
270	-0,00043	-0,0002294	0	0,84414	0,598637	0,667027
271	-0,00018	-9,28E-05	0	0,84396	0,598544	0,667027
272	-0,00017	7,35E-05	-9,59E-08	0,84379	0,598617	0,667027
273	0,000347	7,04E-05	-7,07E-07	0,84414	0,598687	0,667026
274	-4,69E-05	7,48E-05	0	0,84409	0,598762	0,667026
275	0,000234	-7,20E-07	0	0,84433	0,598761	0,667026
276	-5,47E-05	-4,26E-05	-3,26E-06	0,84427	0,598718	0,667023
277	0,000274	3,95E-05	0	0,84455	0,598757	0,667023
278	-0,00026	-5,65E-05	-9,83E-07	0,84428	0,598701	0,667022
279	3,17E-05	-8,04E-07	-1,06E-08	0,84431	0,5987	0,667022
280	-2,90E-05	0,00011961	-1,65E-05	0,84428	0,59882	0,667006
281	1,98E-06	-1,93E-05	-2,04E-05	0,84429	0,598801	0,666986
282	-0,0004	-0,0001391	0	0,84388	0,598662	0,666986
283	0,000306	0,00014147	-3,82E-06	0,84419	0,598803	0,666982
284	-4,62E-05	-1,48E-05	0	0,84414	0,598788	0,666982
285	0,00051	0,00016238	0	0,84465	0,59895	0,666982
286	-0,00011	-2,70E-06	0	0,84454	0,598947	0,666982
287	-0,00058	1,40E-05	-2,29E-06	0,84395	0,598961	0,66698
288	0,000296	7,47E-05	-2,08E-05	0,84425	0,599036	0,666959
289	0,000203	-8,90E-05	0	0,84445	0,598947	0,666959
290	0,000366	-0,0001243	0	0,84482	0,598823	0,666959
291	2,53E-05	0,00015662	0	0,84484	0,59898	0,666959
292	-4,37E-05	-1,30E-05	0	0,8448	0,598967	0,666959
293	2,88E-05	-8,29E-05	0	0,84483	0,598884	0,666959
294	-0,00011	-1,21E-05	0	0,84472	0,598872	0,666959
295	0,00053	0,00017599	0	0,84525	0,599048	0,666959
296	0,000693	3,18E-05	0	0,84594	0,59908	0,666959
297	8,58E-05	0,0002123	0	0,84603	0,599292	0,666959
298	0,000391	-7,35E-05	-1,11E-06	0,84642	0,599218	0,666958
299	-3,63E-05	-3,36E-05	-8,23E-06	0,84639	0,599184	0,66695
300	0,000141	-6,75E-05	-6,83E-06	0,84653	0,599116	0,666943