Logistic model Denmark

A report for DTU

by Significance

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Introduction

1. Program Firm2Firm

1.1 Introduction

The Firm2Firm program disaggregates the annual zone to zone flows to annual firm to firm flows.

1.2 Control file

The Firm2Firm program is a Windows console application that is controlled by a control file that has to be passed as a parameter on the command line. The table below summarizes the settings that are passed to the program via the control file:

Item	Description
COMMODITY	Commodity
NZONES	Number of (port)zones
Rec_Send	The average number of receiving firms for a sending firm
ZONES	Input file with zonal data
BRPROD	Input file with branch production per commodity
BRCONS	Input file with branch consumption per commodity
FIRMS	Input file with production units in Denmark
PC	Input file with the annual zone to zone flows to be disaggregated
F2F	Output file with annual firm to firm flows
LOG	Log file

1.3 Input files

The table below summarizes the input files of the Firm2Firm program:

Control file item	Source[1]	Paragraph
ZONES	External	1.3.1
BRPROD	External	1.3.2
BRCONS	External	1.3.3
FIRMS	External	1.3.4
PC	External	1.3.5

[1] The source is marked as external when the file is not produced by any of the LOGISTIC Model Modules described in this report.

1.3.1 Zonal data

This file contains a list of all (port)zones used in the model. It is a tab-delimited text file containing the following columns:

- (Port)Zone number
- Region code (DK/NSF/EUC)

This file must be sorted on zone number.

1.3.2 Branch production

This file contains the production fractions for each commodity per branch. It is a comma-delimited text file (with header line) containing the following columns:

- Branch number (NACE classification)
- Production fraction commodity 1
  …
- Production fraction commodity 23

1.3.3 Branch consumption

This file contains the consumption fractions for each commodity per branch. It is a comma-delimited text file (with header line) containing the following columns:

- Branch number (NACE classification)
- Consumption fraction commodity 1
  …
- Consumption fraction commodity 23

1.3.4 Production Units

This file contains all production units within Denmark. It is a comma-delimited text file (with header line) containing the following columns:

- Production unit number
- Branch number (NACE classification)
- Number of employees
- Zone number

Although this file is unsorted, the order of the record will have an influence on the model results because of the stochastic nature of the model to select sending and receiving firms.

1.3.5 Annual zone to zone flows

This file contains all producer-consumer flows that may potentially be over Danish territory. It is a comma-delimited text file (with header line) containing the following columns:

- Origin zone number
- Destination zone number
- Rest of the World code as specified below
- Commodity
- Annual Volume (Tonnes)

This file must be sorted on origin zone number and destination zone number.

The Rest of the World code specifies the actual origin or destination region in case a port zone is involved:

Rest of the World code	Region
N/A	Not applicable
NA	North America
SA	South America
ME	Middle East
FE	Far East
RA	Rest Asia
AF	Africa
OC	Oceania
GR	Greenland, Faroe Islands and Iceland

1.4 Output files

The table below summarizes the output files of the Firm2Firm program:

Control file item	Target[2]	Paragraph
F2F	ChainChoi	1.4.1
LOG	External	1.4.2

1.4.1 Annual firm to firm flows

This file contains all PC flows, disaggregated to firm to firm flows. It is a comma-delimited text file (with header line) containing the following columns:

- Origin zone number
- Destination zone number

[2] The target is marked as external when the file is not used by any of the LOGISTIC Model Modules described in this report.

- Rest of the World code as specified in section 1.3.5
- Commodity
- Annual Volume (Tonnes)

1.4.2 Log file

The log contains information on the model application.

2. Program BuildChain

2.1 Introduction

The BuildChain program generates all possible transport chains between the logistic model zones.

2.2 Control file

The BuildChain program is a Windows console application that is controlled by a control file that has to be passed as a parameter on the command line. The table below summarizes the settings that are passed to the program via the control file:

Item	Description
GROUP	Cargo group: 1: Dry bulk 2: Wet bulk 3: General Cargo 4: Container transport
NODES	Input file with node locations
CONSOL	Input file with the vehicle type mix for consolidated transport
ROADCST	Input file with cost parameters per vehicle type for road transport
ROADAVAIL	Comma separated list of road vehicle type availability
ROADLOS	Input file with road LOS
RAILCST	Input file with cost parameters per vehicle type for rail transport
RAILAVAIL	Comma separated list of rail vehicle type availability
RAILLOS	Input file with rail LOS
SEACST	Input file with cost parameters per vessel type for sea transport
SEAAVAIL	Comma separated list of vessel type availability
SEALOS	Input file with sea LOS
CHAINS	Output file with all transport chains between the logistic model zones

2.3 Input files

The table below summarizes the input files of the BuildChain program:

Control file item	Source[3]	Paragraph
NODES	External	2.3.1
CONSOL	External	2.3.2
ROADCST	External	2.3.3
ROADLOS	External	2.3.4
RAILCST	External	2.3.5
RAILLOS	External	2.3.6
SEACST	External	2.3.7
SEALOS	External	2.3.8

2.3.1 Node location data

This file contains the coordinates and region (DK/NSF/EUC) of the model nodes. It is a comma-delimited text file (with header line) containing the following columns:

- Node number
- Latitude (decimal degrees)
- Longitude (decimal degrees)
- Region (DK/NSF/EUC)

Nodes 1-295 are the model zones, these should not be changed. Nodes 296-302 are the port zones (Aarhus, Gothenburg,Bergen,Hamburg,Bremerhaven,Rotterdam,Antwerp), these are fixed too.

This file must be sorted on node number.

2.3.2 Vehicle type mix consolidated transport

This file contains the vehicle type mix for consolidated transports, per mode and per relation type (Zone-Terminal or Terminal-Terminal). It is a comma-delimited text file (with header line) containing the following columns:

- Mode classification as specified in the table below
- TerminalTerminal (0= Zone-Terminal, 1=Terminal-Terminal)
- Vehicle type number[4]
- Fraction
- Consolidation factor

[3] The source is marked as external when the file is not produced by any of the LOGISTIC Model Modules described in this report.
[4] This number corresponds to the vehicle type numbers in section 2.3.3, 2.3.5 or 2.3.7 depending on the mode.

Mode	Relation	Baltic Sea crossing	Classification character
Road	DK-DK or DK-NSF	No crossing	1
	DK – EUC	Green border	2
		Ferry	3
		Fixed link	4
	NSF – EUC	Transit Denmark	5
		Direct ferry	6
Rail			7
Sea			8
RoRo			9

2.3.3 Road cost parameters

This file contains the parameters used in the road transport cost calculation for all road vehicle types. It is a comma-delimited text file (with header line) containing the following columns:

- Vehicle type number
- Vehicle class as specified below
- Capacity (Tonnes)
- Loading costs (DKK/Tonnes)
- Distance cost (DKK/Km)
- Time costs (DKK/Hour)
- Time costs on board of a ferry (DKK/Hour)

The vehicle classification specified below is introduced because the road LOS is provided for limited set of vehicle classes:

Vehicle Class	Description
1	Light goods vehicle
2	Truck below 12 ton
3	Truck above 12 ton
4	Truck with trailer
5	Articulated truck
6	Gigaliner

2.3.4 Road Level-of-Service

This file contains the road level-of-service. It is a comma-delimited text file (with header line) containing the following columns:

- Origin zone number
- Destination zone number
- Crossing classification as specified below
- Vehicle class as specified in 2.3.1
- Road distance (Km)
- Driving time (Minutes)
- Time on Baltic Sea ferry (Minutes)
- Waiting time for Baltic Sea ferry (Minutes)
- Time on other ferry (Minutes)
- Waiting time for other ferry (Minutes)
- Toll and ferry costs (DKK)

The crossing classification specifies how the Baltic Sea screen line is crossed:

Relation	Baltic Sea crossing	Classification code
DK-DK or DK-NSF	No crossing	-1
DK – EUC	Green border	1
	Ferry	2
	Fixed link	5
NSF – EUC	Direct ferry	3
	Transit Denmark	4

This file must be sorted on origin zone number and destination zone number.

2.3.5 Rail cost parameters

This file contains the parameters used in the rail cost calculation for all rail vehicle types. It is a comma-delimited text file (with header line) containing the following columns:

- Vehicle type number
- Capacity (Tonnes)
- Loading costs (DKK/Tonnes)

- Distance cost (DKK/Km)
- Time costs (DKK/Hour)

2.3.6 Rail Level-of-Service

This file contains the rail level-of-service. It is a comma-delimited text file (with header line) containing the following columns:

- Origin zone number
- Destination zone number
- Rail track distance (Km)
- Driving time (Minutes)
- Time on ferry (Minutes)

This file must be sorted on origin zone number and destination zone number.

2.3.7 Sea cost parameters

This file contains the parameters used in the sea cost calculation for all vessel types. It is a comma-delimited text file (with header line) containing the following columns:

- Vessel type number
- Capacity (Tonnes)
- Loading costs (DKK/Tonnes)
- Distance cost (DKK/Km)
- Time costs (DKK/Hour)

2.3.8 Sea Level-of-Service

This file contains the sea level-of-service. It is a comma-delimited text file (with header line) containing the following columns:

- Origin zone number
- Destination zone number
- Distance (Km)
- Time (Minutes)

This file must be sorted on origin zone number and destination zone number.

2.4 Output files

The BuildChain program generates a single output file:

Control file item	Target[5]	Paragraph
CHAINS	ChainChoi	2.4.1

[5] The target is marked as external when the file is not used by any of the LOGISTIC Model Modules described in this report.

2.4.1 Transport chains

This file contains all available transport chains between the (port)zones of the logistic model. This ASCII file contains records (for every origin-destination pair) with the following structure:

Origin Destination NumberOfChains
  ChainType_1
    Leg_1_1: Orig,Dest,Distance,CostVhcl1,CostVhcl2,..,TimeVhcl1,TimeVhcl2,..
    …
    Leg_1_n: Orig,Dest,Distance,CostVhcl1,CostVhcl2,..,TimeVhcl1,TimeVhcl2,..
  …
  ChainType_m
    Leg_m_1: Orig,Dest,Distance,CostVhcl1,CostVhcl2,..,TimeVhcl1,TimeVhcl2,..
    …
    Leg_m_k: Orig,Dest,Distance,CostVhcl1,CostVhcl2,..,TimeVhcl1,TimeVhcl2,..

Chain types are specified by a character string, where the characters specify the modes of the subsequent chain legs as specified in the table in section 2.3.2.

3. Program ChainChoi

3.1 Introduction

The ChainChoi program determines the optimal shipment frequency, chain type (from all chain types generated by the BuildChain program) and vehicle types for all firm to firm flows generated by the Firm2Firm program.

3.2 Control file

The ChainChoi program is a Windows console application that is controlled by a control file that has to be passed as a parameter on the command line. The table below summarizes the settings that are passed to the program via the control file:

Item	Description
GROUP	Cargo group: 1: Dry bulk 2: Wet bulk 3: General Cargo 4: Container transport
COMMODITY	Commodity
STUF	Stuffing and stripping costs for container transport
INTEREST	Interest percentage used to calculate the capital costs
PC	Input file with annual firm to firm flows
CARGO	Input file with cost parameters for order and storage costs per commodity
ROADCST	Input file with cost parameters per vehicle type for road transport
RAILCST	Input file with cost parameters per vehicle type for rail transport
SEACST	Input file with cost parameters per vessel type for sea transport
ROROCST	Input file with cost parameters per vessel type for RoRo transport
NODES	Input file with node locations
CHAINS0	Input file with non-container chains
CONSOL0	Input file with the vehicle type mix for consolidated non-container transport
CHAINS1	Input file with container chains
CONSOL1	Input file with the vehicle type mix for consolidated container transport
OUT	Output file with optimized frequencies, chain types and

	vehicle types
LOG	Log file

3.3 Input files

The table below summarizes the input files of the ChainChoi program:

Control file item	Source[6]	Paragraph
PC	Firm2Firm	1.4.1
CARGO	External	3.3.1
ROADCST	External	2.3.3
RAILCST	External	2.3.5
SEACST	External	2.3.7
ROROCST	External	2.3.7
NODES	External	2.3.1
CHAINS0	BuildChain	2.4.1
CONSOL0	External	2.3.2
CHAINS1	BuildChain	2.4.1
CONSOL1	External	2.3.2

3.3.1 Order and storage cost parameters

This file contains the parameters for the calculation of order and holding costs for all commodities. It is a comma-delimited text file (with header line) containing the following columns:

- Commodity
- Order costs (DKK/shipment)
- Storage costs (DKK/Tonnes/Year)
- Value (DKK/Tonnes)

3.4 Output files

The table below summarizes the output files of the ChainChoi program:

Control file item	Target[7]	Paragraph
OUT	External,Crossing	3.4.1
LOG	External	3.4.2

[6] The source is marked as external when the file is not produced by any of the LOGISTIC Model Modules described in this report.
[7] The target is marked as external when the file is not used by any of the LOGISTIC Model Modules described in this report.

3.4.1 Optimized tranport chains

This file contains the optimized frequencies, chain types and vehicle types for all firm to firm flows generated by the Firm2Firm program. It is a comma-delimited text file (with header line) containing the following columns:

- Origin zone number
- Destination zone number
- Rest of the World code as specified in section 1.3.5
- Annual firm to firm volume (Tonnes)
- Index that indexes all chains corresponding to the same transport
- Chain probability
- Shipment frequency
- Optimal chain type
- Containerized transport indicator (0/1)
- Transport costs (DKK/shipment)
- Non-transport costs (DKK)
- Total costs (DKK)
- Origin node number of first leg
- Destination node number of first leg
- Consolidated transport indicator (0/1) first leg
- Optimal vehicle type first leg
- Number of vehicles on first leg
- Last 5 items are repeated for subsequent legs

3.4.2 Log file

The log file is used to save information on the model application.

4. Program Crossing

4.1 Introduction

The CROSSING program applies the crossing model for all firm to firm flows generated by the Firm2Firm program, using the shipment frequency determined by the CHAINCHOI program.

4.2 Control file

The BuildChain program is a Windows console application that is controlled by a control file that has to be passed as a parameter on the command line. The table below summarizes the settings that are passed to the program via the control file:

Item	Description
LSTALL	0/1 Switch that determines whether or not flows that do not cross the Baltic see screen line are included in the output file (with probability 1)
GROUP	Cargo group: 1: Dry bulk 2: Wet bulk 3: General Cargo 4: Container transport
COMMODITY	Commodity
STUF	Stuffing and stripping costs for container transport
INTEREST	Interest percentage used to calculate the capital costs
PC	Input file with annual firm to firm flows and shipment frequencies
COEFS	Input file with model coëfficients of the crossing model
ROADCST	Input file with cost parameters per vehicle type for road transport
RAILCST	Input file with cost parameters per vehicle type for rail transport
SEACST	Input file with cost parameters per vessel type for sea transport
ROROCST	Input file with cost parameters per vessel type for RoRo transport
NODES	Input file with node locations
CHAINS0	Input file with non-container chains
CONSOL0	Input file with the vehicle type mix for consolidated non-container transport

CHAINS1	Input file with container chains
CONSOL1	Input file with the vehicle type mix for consolidated container transport
OUT	Output file with tranport chain probabilities
LOG	Log file

4.3 Input files

The table below summarizes the input files of the CROSSING program:

Control file item	Source[8]	Paragraph
PC	ChainChoi	3.4.1
COEFS	External	4.3.1
ROADCST	External	2.3.3
RAILCST	External	2.3.5
SEACST	External	2.3.7
ROROCST	External	2.3.7
NODES	External	2.3.1
CHAINS0	BuildChain	2.4.1
CONSOL0	External	2.3.2
CHAINS1	BuildChain	‼ REF
CONSOL1	External	2.3.2

4.3.1 Coeëfficients crossing model

This file is an ALOGIT coefficient summary containing the model coefficients of the crossing model.

4.4 Output file

The table below summarizes the output files of the ChainChoi program:

Control file item	Target[9]	Paragraph
OUT	External	4.4.1
LOG	External	4.4.2

[8] The source is marked as external when the file is not produced by any of the LOGISTIC Model Modules described in this report.
[9] The target is marked as external when the file is not used by any of the LOGISTIC Model Modules described in this report.

4.4.1 Tranport chain probabilities

This file contains the chain type probabilities for all firm to firm flows crossing the Baltic sea screen line. If the LSTALL switch is set, shipments not crossing this screen line are adopted from the CHAINCHOI output file with probability 1. This file is a comma-delimited text file (with header line) containing the following columns:

- Origin zone number
- Destination zone number
- Rest of the World code as specified in section 1.3.5
- Annual firm to firm volume (Tonnes)
- Index that indexes all chains corresponding to the same transport
- Chain probability
- Shipment frequency
- Optimal chain type
- Containerized transport indicator (0/1)
- Transport costs (DKK/shipment)
- Non-transport costs (DKK)
- Total costs (DKK)
- Origin node number of first leg
- Destination node number of first leg
- Consolidated transport indicator (0/1) first leg
- Optimal vehicle type first leg
- Number of vehicles on first leg
- Last 5 items are repeated for subsequent legs

4.4.2 Log file

The log file is used to save information on the model application.

5. Program Extract

5.1 Introduction

The EXTRACT program extracts vehicles and tonnes origin-destination matrices from the loaded chains output files generated by the CROSSING program. For road transport the EXTRACT program calculates empty vehicles matrices.

5.2 Control file

The EXTRACT program is a Windows console application that is controlled by a control file that has to be passed as a parameter on the command line. The table below summarizes the settings that are passed to the program via the control file:

Item	Description
MODES	A comma separated list of selected modes
VTYP	Selected vehicle type
EMPTY	0/1 Switch that determines whether or not an empty vehicle matrix will be calculated
NNODES	Number of nodes. If this setting is omitted in the control file, the program will read the number of nodes from the nodes file.
NODES	Input file with node locations. This file will only be used when the NNODES setting is omitted in the control file.
COST	Input file with cost parameters per vehicle type for road transport. This file contains the applicable vehicle class (see 2.3.2)
DIST	Input file with road distances.
CHAINFLS	Number of loaded chains files
CHAINFL1	First loaded chains file
CHAINFL2	Second loaded chains file
…	
ODTOT	Matrices with aggregated number of vehicles and tonnes
LOG	LOG file

5.3 Input files

The table below summarizes the input files of the EXTRACT program:

Control file item	Source[10]	Paragraph
NODES	External	2.3.1
COST	External	2.3.2
DIST	External	2.3.4
CHAINFL*	CROSSING	4.4.1

5.4 Output file

The table below summarizes the output files of the ChainChoi program:

Control file item	Target[11]	Paragraph
ODTOT	External	5.4.1
LOG	External	5.4.2

5.4.1 Aggregated od-matrices

This file contains the aggregated number of vehicles and tonnes on all origin-destination relations.

- From node number
- To node number
- Number of loaded vehicles
- Number of empty vehicles
- Transport volume (tonnes)

5.4.2 Log file

The log file is used to save information on the model application.

[10] The source is marked as external when the file is not produced by any of the LOGISTIC Model Modules described in this report.
[11] The target is marked as external when the file is not used by any of the LOGISTIC Model Modules described in this report.