

# ITSS introduction & survey

*Selma M. Mulalic*  
*Helene Feveile*

**Copenhagen**  
**26. – 28. June 2019**



# Institutional arrangement

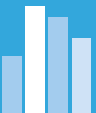
- Statistics Denmark is responsible for Balance of payments statistics
- Close cooperation with Danmarks Nationalbank
- Both institutions participate in data compilation and international cooperation in the field of Balance of payments

# International trade in services

- International trade in services is part of Balance of Payments
- Based on Balance of Payments manual
- Based on Balance of Payments principles e.g. ownership change
- No individual definitions

# International trade in services before 2005

- International trade in services based on Danmarks Nationalbank's settlements statistics (payment statistics)
- Published by Statistics Denmark, but only as part of Balance of payments with very few subcategories
- Balance of Payments Manual



# International trade in services after 2005

- International trade in services statistics is an independent statistical product
- The statistics are also included in the Balance of payments statistics
- Balance of Payments Manual and Manual on Statistics of International Trade in Services



# Direct reporting from 2005

- Danmarks Nationalbank's settlements statistics (payment statistics) was abolished at the end of 2004
- Main source - Survey on International trade in services (direct reporting) started in 2005
- Sample-based service trade statistics
- Other sources - Travel item, FISIM etc.



# Survey on International trade in services - questionnaire

- The idea behind the questionnaire on international trade in services is to cover all the service groups required in the draft regulation

Foreign Trade in Services - Service Codes

■ = Income    ■ = Expenditure

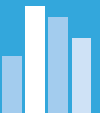
Service Code	Description
	Goods which do not cross the Danish border
300.11	Sales of merchanting goods (goods bought and sold abroad)
300.12	Acquisition values of the merchanting goods sold during the period (negative)
301	Purchases of fuels in connection with transport abroad
302	Purchases of provisions, spare parts, and accessories, etc.; also including purchases for restaurant and sales of goods
304	Purchases of goods abroad to be processed abroad
305	Sales of goods abroad after processing abroad
	Trade-related services
200.2	Commissions (from procurement of goods, etc.)
200.3	Maintenance and repair services (excl. repairs related to construction activities and repairs related to computer services)
200.4	Manufacturing services on physical inputs owned by others (processing)
200.5	Other transactions (to be used only according to agreement with Statistics Denmark)
	Transportation services
	Sea transport
201.11	Passenger sea transport (incl. rentals of ships with crew)
201.12	Freight transport by ship (incl. rentals of ships with crew)
201.14	Auxiliary sea transport services (incl. warehouse, shipping and transit services, and harbour and canal charges)
	Air transport
201.21	Passenger air transport (incl. rentals of aircraft with crew)
201.22	Freight air transport (incl. rentals of aircraft, etc. with crew)
201.24	Auxiliary air transport services (incl. warehouse, forwarding and transit services, and airport charges)
	Rail transport
201.31	Passenger rail transport (incl. rentals of trains with crew)
201.32	Freight rail transport (incl. rentals of trains with crew)
201.34	Auxiliary rail transport services (incl. warehouse, forwarding and station services, and bridge and ferry charges)
	Road transport
201.41	Passenger road transport (incl. rentals of motor vehicle with crew)
201.42	Freight road transport (incl. rentals of motor vehicles with crew)
201.44	Auxiliary road transport services (incl. warehouse, forwarding and transit services, road, bridge, and ferry charges)
	Inland waterway transport (rivers and canals)
201.51	Passenger inland waterway transport (incl. rentals of vessel with crew)
201.52	Freight inland waterway transport (incl. rentals of vessel with crew)
201.54	Auxiliary freight inland waterway transport services (incl. harbour & canal charges)



Country	Code	Dominican Republic	EC	Madagascar	MG
European Union institutions, and Organisms (excluding ECB)	4A	Ecuador	EC	Malawi	MW
International Organisations excluding European Union institutions		Egypt	EG	Malaysia	MY
		El Salvador	SV	Maldives	MV
		Equatorial Guinea	GQ	Mali	ML
		Eritrea	ER	Malta	MT
		Estonia	EE	Marshall Islands	MH
		Ethiopia	ET	Mauritania	MR
		Falkland Islands	FK	Mauritius	MU
		Faroe Islands	FO	Mexico	MX
		Fiji	FJ	Micronesia, Federated States of	FM
		Finland	FI	Moldova	MD
		France	FR	Monaco (use code for France)	
		French Polynesia	PF	Mongolia	MN
		French Southern and Antarctic Lands	TF	Montenegro	ME
		Gabon	GA	Montserrat	MS
		Gambia	GM	Morocco	MA
		Georgia	GE	Mozambique	MZ
		Germany	DE	Myanmar	MM
		Gibraltar	GI	Namibia	NA
		Ghana	GH	Nauru	NR
		Greece	GR	Nepal	NP
		Greenland	GL	Netherlands	NL
		Grenada	GD	New Caledonia	NC
		Guam	GU	New Zealand	NZ
		Guadeloupe (use code for France)		Nicaragua	NI
		Guatemala	GT	Niger	NE
		Guernsey	GG	Nigeria	NG
		Guinea	GN	Niue	NU
		Guinea-Bissau	GW	Norfolk Island	NF
		Guyana	GY	North Korea	KP
		Haiti	HT	Northern Mariana Islands	MP
		Heard Island and McDonald Islands	HM	Norway	NO
		Holy See (Vatican City State)	VA	Oman	OM
		Honduras	HN	Occidental Sahara (use code for Morocco)	
		Hong Kong	HK	Pakistan	PK
		Hungary	HU	Palau	PW
		Iceland	IS	Palestinian Territory	PS
		India	IN	Panama	PA
		Indonesia	ID	Papua New Guinea	PG
		Iran	IR	Paraguay	PY
		Iraq	IQ	Peru	PE
		Ireland	IE	Philippines	PH
		Isle of Man	IM	Pitcairn	PN
		Israel	IL	Poland	PL
		Italy	IT	Portugal	PT
		Jamaica	JM	Puerto Rico (use code for United States)	
		Japan	JP	Qatar	QA
		Jersey	JE	Ribunon (use code for France)	
		Jordan	JO	Romania	RO
		Kazakhstan	KZ	Russian Federation	RU
		Kenya	KE	Rwanda	RW
		Kiribati	KI	Saint Lucia	LC
		Kosovo (use code for Serbia)		Samoa	WS
		Kuwait	KW	San Marino	SM
		Kyrgyzstan	KG	Sao Tome and Principe	ST
		Laos	LA	Saudi Arabia	SA
		Latvia	LV	Senegal	SN
		Lebanon	LB	Serbia	RS
		Lesotho	LS	Seychelles	SC
		Liberia	LR	Sierra Leone	SL
		Libya	LY	Singapore	SG
		Liechtenstein	LI	Sint Maarten	SX
		Lithuania	LT	Slovakia	SK
		Luxembourg	LU	Slovenia	SI
		Macao	MO	Solomon Islands	SB
		Macedonia, the Former Yugoslav Republic	MK	Somalia	SO
				South Africa	ZA

# Two types questionnaire

- Two groups of companies:
  - Insurance companies and pension funds
  - All the other companies



# Services covered

- Trade related services
- Transportation
- Travel
- Communication
- Construction
- Insurance
- Financial services
- Franchises and registered trademarks
- Other business services
- Computer and information services
- Personal, cultural, and recreational services
- Research and development services
- Audiovisual services

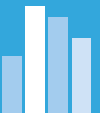


# Other items

- (Insurance)
- Merchanting
- Processing goods
- Currant transfers (e.g. development aid through NGO's)

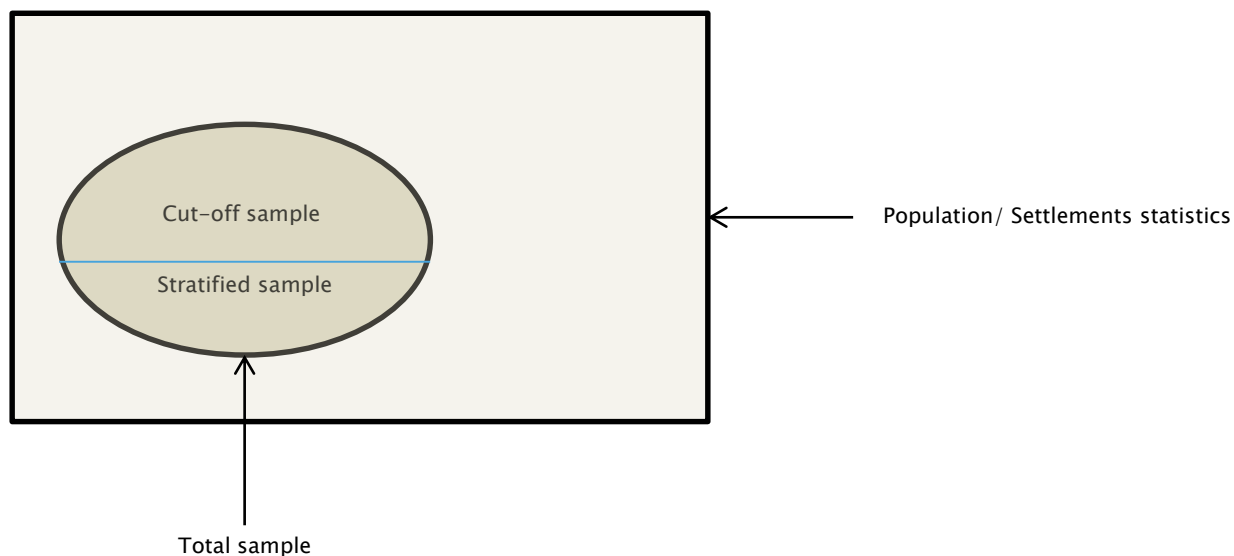
# Modes of reporting

- Online reporting
- Other solutions like Excel and Paper are abandoned several years ago



# First sample (in 2005) – based on settlements statistics

- Sample: App. 1.600 respondents (CVR-units)
- One part found by using a cut-off method
- After the cut-off sample was found – a stratified sample was drawn from the remaining part of the population



# Cut off in the first sample (in 2005)

- For each purpose of payments – the largest enterprises covering 70 % of the trade
- More enterprises drawn till the monthly development in trade in services could be described
- Monthly reporters, app. 400



# Random sample in the first sample (in 2005)

- The rest of the population was stratified on the basis of the trade and of industry
- In the strata with the largest trade, all enterprises were chosen
- In the strata with less trade, a smaller part of the enterprises was chosen
- Quarterly reporters ensure the geographical dimension
- Quarterly reporters, app. 1.200



# Update methods?

- 2005-2008: The sample based on 2003/2004 information from the settlements statistics
- The information from the settlements statistics was gradually obsolete
- Other sources could not be used



# Samples from 2005

- Before 2005 - all transactions were reported via banks
- 2005-2008 - first sample based on information from the settlements statistics
- 2008-2009 - 1. update of the sample
- 2013-2014 - 2. update of the sample
- 2018-2019 - 3. update of the sample



# Screening surveys

- From 2009, the sample is based on information from the so-called screening surveys
- Before a new sample is established, we start with conducting a screening survey, which is also a sample, where information about total trade in services is obtained and subsequently used for the final sample.
- The screening surveys have been conducted approx. every fifth year, last time in 2018 where approx. 5.000 companies were screened.

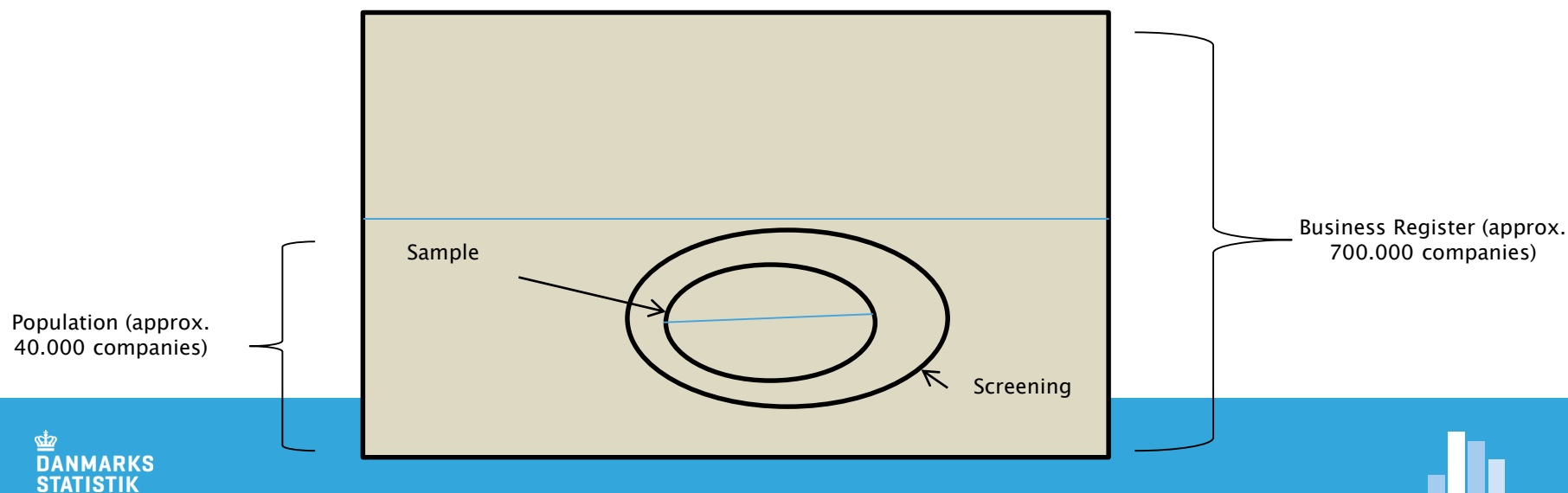


# Screening survey – a base for the sample updates

- The population (about 40.000 companies) is defined on the basis of the Business Register and supplementary sources.
- All companies with number of employees  $< 3$  and turnover  $< 10$  mill. DKK or turnover  $< 5$  mill. DKK and number of employees  $< 50$  are deleted from the population.

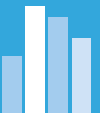
# Current sample (2019)

- The current sample is updated in 2019 on the basis of the screening survey in 2018 among approx. 5.000 companies
- Representative sample with approx. 1.700 reporters (CVR units) ca. 400 monthly reporters ca. 1.300 yearly reporters (out of which 200 companies will report quarterly the first year)



# Challenges with screening surveys

- Periodic screening surveys - a good strategy to ensure a quality of international trade in services statistics
- But it is a long and resource-consuming process
- New routine?



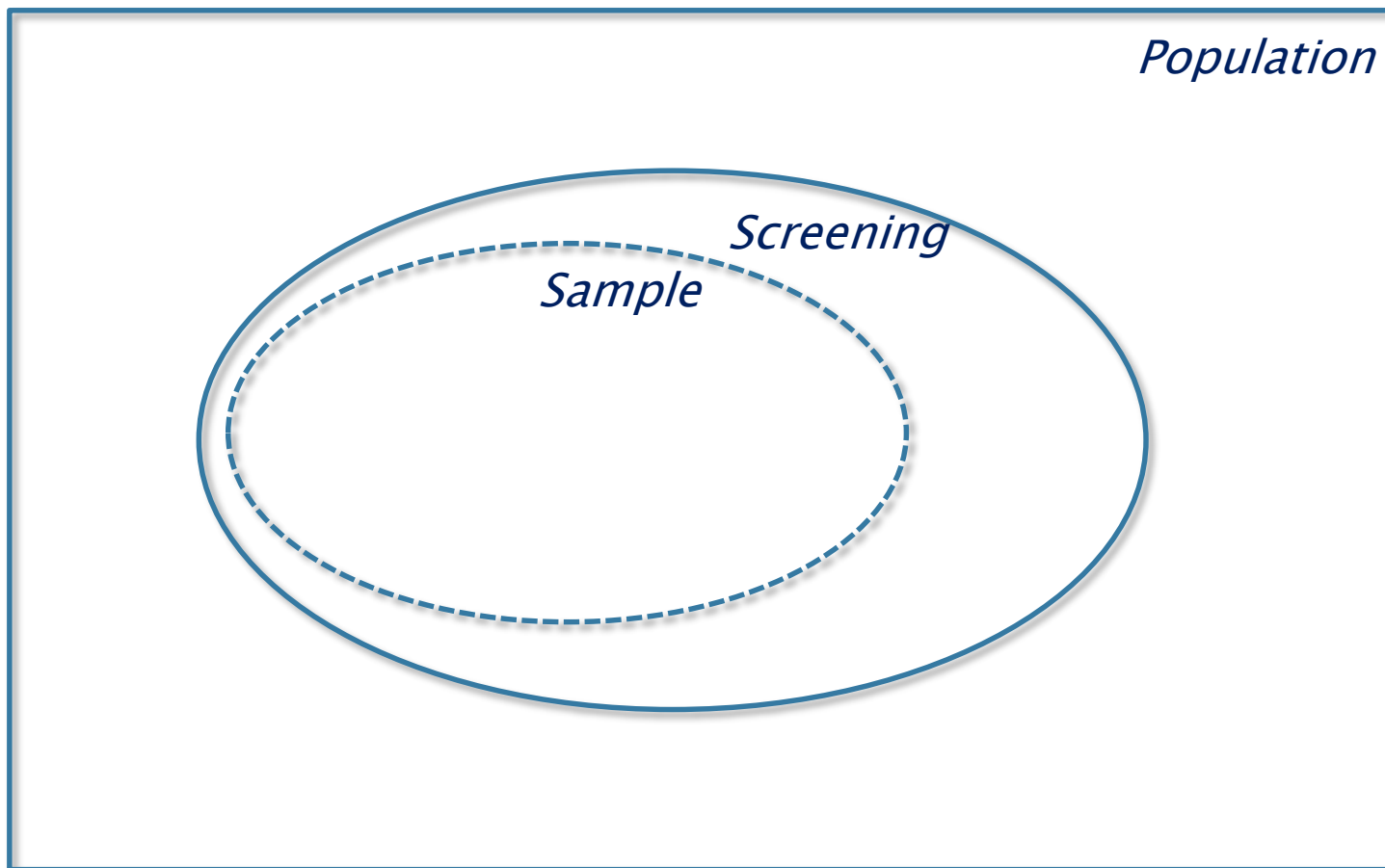
# Setting

- No payment statistics in Denmark – anymore
- No other data sources with this kind of information

# Challenge

- Not ending up having a sample with only companies with no (i.e. 0 DKK) international trade with services
- Discovering “shooting stars” / “newcomers”
- Association between register information and actual import/export of services vary a lot between industries

# Outline of sampling design



# Stratification

Stratification: combination of industry and size  
(i.e. industry \* size)

- Industries (collapsed into 13 groups)
- How do we quantify size (in a relevant way)?

Predicted ITS

# Regression models –per industry

Response from  
existing sample:

Auxiliary variables from Statistical  
Business Register and TAX / VAT:

Import



turnover  
employment  
import of goods  
EU-import of services  
Trade goods and services outside EU

Export



turnover  
employment  
export of goods  
EU-export of services  
Trade goods and services outside EU

# Estimate international trade with services for the entire population

Using the crude regression models og auxiliary information (register and other surveys) import and export are estimated for the entire population.

Size is defined from this estimated ITS:

Above 20 m. DKK

10-20 m. DKK

5-10 m. DKK

2½ - 5 m. DKK

1 - 2½ m. DKK

<1 m. DKK (cut-off)

# Allocation (screening)

1. Proportional allocation  $n_h = n \cdot N_h / N$
2. Neyman allocation according to estimated ITS

$$n_{\tilde{h}} = n \cdot \frac{N_{\tilde{h}} S_{y\tilde{h}}}{\sum_{h=1}^H N_h S_{yh}}$$

3. Proportional allocation according to  $R^2$

$$n_{\tilde{h}} = n \cdot \frac{1 - \min(R^2_{imp,\tilde{h}}, R^2_{exp,\tilde{h}})}{\sum_{h=1}^H (1 - \min(R^2_{imp,h}, R^2_{exp,h}))}$$

4. The final allocation is the mean of the three allocations above

# Screening sample

	Size														Total	
	Special		Above 20 m.		10-20 m.		5-10 m.		2.5-5 m.		1-2.5 m.		Below 1 m.			
	pop	scr	pop	scr	pop	scr	pop	scr	pop	scr	pop	scr	pop	scr	pop	scr
Sector of industry																
Industry	8	8	193	188	190	183	336	223	596	113	1155	116	2458	0	4936	831
Agriculture etc.	5	5	114	110	103	99	209	199	455	127	1476	148	5790	0	8152	688
Trade etc.	26	26	202	200	161	157	270	208	506	131	1332	134	11425	0	13922	856
Transportation by sea or land	16	16	158	139	55	53	17	16	.	.	3	3	3	3	252	230
Transportation – other	10	10	227	225	92	90	95	67	142	32	265	27	992	0	1823	451
Information etc.	13	13	198	194	98	93	127	81	160	29	290	29	737	0	1623	439
Insurance	4	4	58	57	18	16	18	17	11	9	11	10	14	14	134	127
Banks, real estate trading etc.	12	12	184	178	107	103	151	144	264	97	474	58	290	0	1482	592
Service/knowledge/research	10	10	165	164	125	119	175	108	204	39	445	45	1518	0	2642	485
Travel organizer etc.	6	6	676	636	366	334	351	252	120	24	21	3	44	0	1584	1255
Public administration etc.	6	6	19	19	15	14	22	20	43	13	61	7	670	0	836	79
Culture, unknown activity etc.	7	7	48	47	11	10	14	13	26	7	72	8	603	0	781	92
No code	.	.	5	5	.	.	1	1	1	1	.	.	4	4	11	11
Total	123	123	2247	2162	1341	1271	1786	1349	2528	622	5605	588	24548	21	38178	6136

# Post-screening status

- Population: 38178
- Sampling frame for screening (above cut-off): 13651
- Sample for screening: 6136
- Respondents (screening): 5866
- Cut-off based on screening - 2½ m. DKK (96% of the reported screening ITS)
- Selma "hand-picks" (548 + weight=1)
- Sampling frame for actual random sample: 1987

# Actual sample

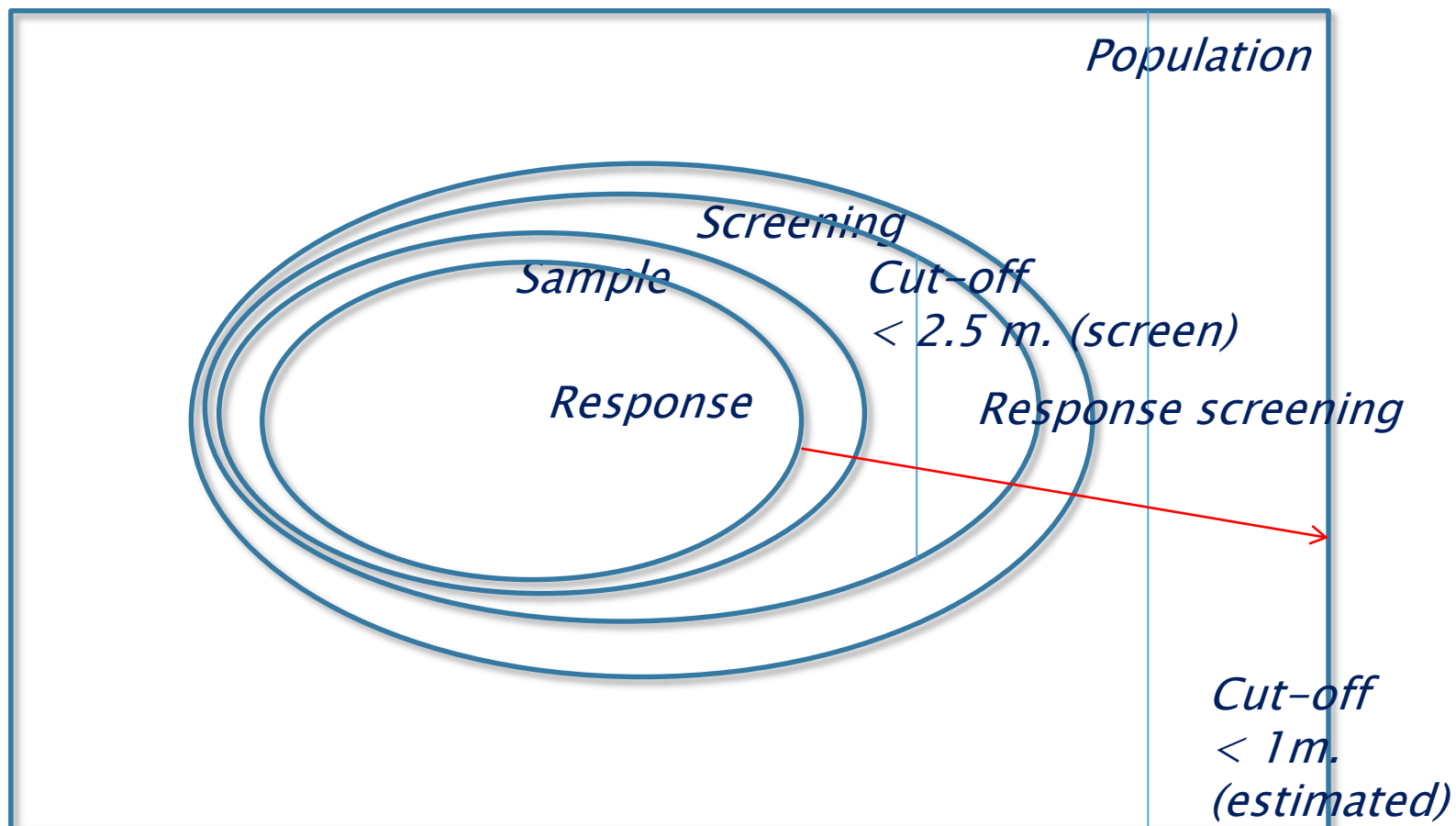
- Sample size (not counting the "hand-picked")  $\approx 1100$
- Splitting of strata:           Above 30 m. DKK  
  20-30 m. DKK
- Neyman allocation according to estimated standard deviations of trade of import / export (from screening)

# Actual sample

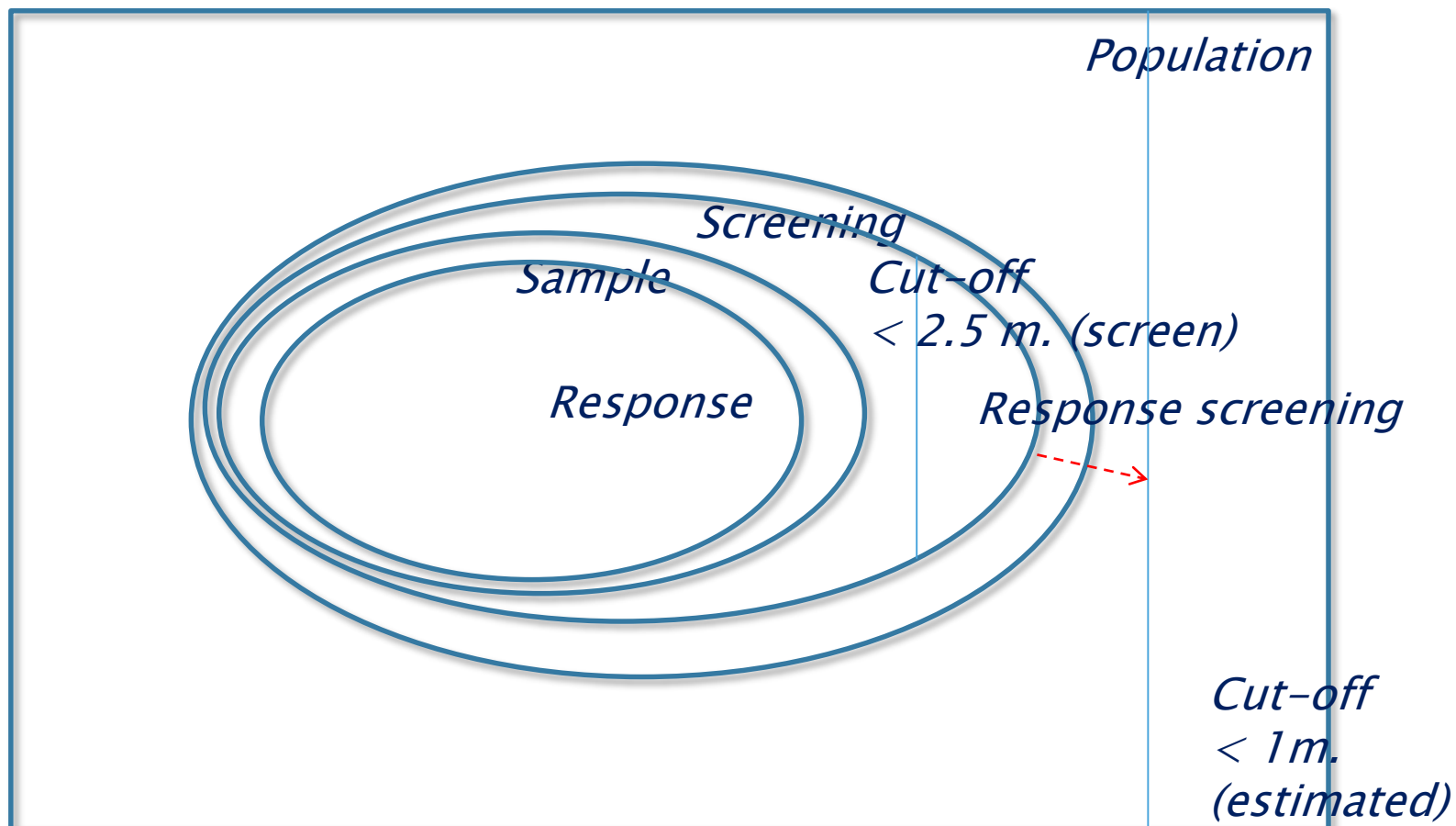
	Size														Total	
	Above 30 m.		20-30 m.		10-20 m.		5-10.		2.5-5 m.		1-2.5 m.		Below 1 m.			
	Pop	Stik	Pop	Stik	Pop	Stik	Pop	Stik	Pop	Stik	Pop	Stik	Pop	Stik	Pop	Stik
Sector of industry																
Industry	53	53	46	20	94	28	68	11	21	10	8	8	.	.	290	130
Agriculture etc.	22	22	9	9	29	12	25	9	11	11	5	5	.	.	101	68
Trade etc.	55	55	55	25	97	30	94	18	29	10	11	11	.	.	341	149
Transportation by sea or land	45	43	20	6	27	10	10	10	.	.	1	1	1	1	104	71
Transportation – other	86	83	27	14	64	26	46	14	17	17	5	5	.	.	245	159
Information etc.	61	59	43	19	66	20	57	11	15	15	8	8	.	.	250	132
Insurance	14	13	3	3	5	5	6	6	1	1	.	.	2	2	31	30
Banks, real estate trading etc.	31	29	12	12	37	11	22	10	6	6	1	1	.	.	109	69
Service/knowledge/research	56	56	30	13	77	23	65	11	13	13	5	5	.	.	246	121
Travel organizer etc.	84	82	30	12	61	14	38	10	4	4	.	.	.	.	217	122
Public administration etc.	5	4	3	3	6	6	5	5	.	.	1	1	.	.	20	19
Culture, unknown activity etc.	15	15	4	4	3	3	7	7	2	2	2	2	.	.	33	33
No code	527	514	282	140	566	188	443	122	119	89	47	47	3	3	1987	1103



# Sampling design – comprehensive



# Weighting: Step 1



# Step 1 – from screening to population

For every screening respondent,  $k$ , the design weights are calculated:

$$\pi_k = \frac{N_{h(k)}}{m_{h(k)}},$$

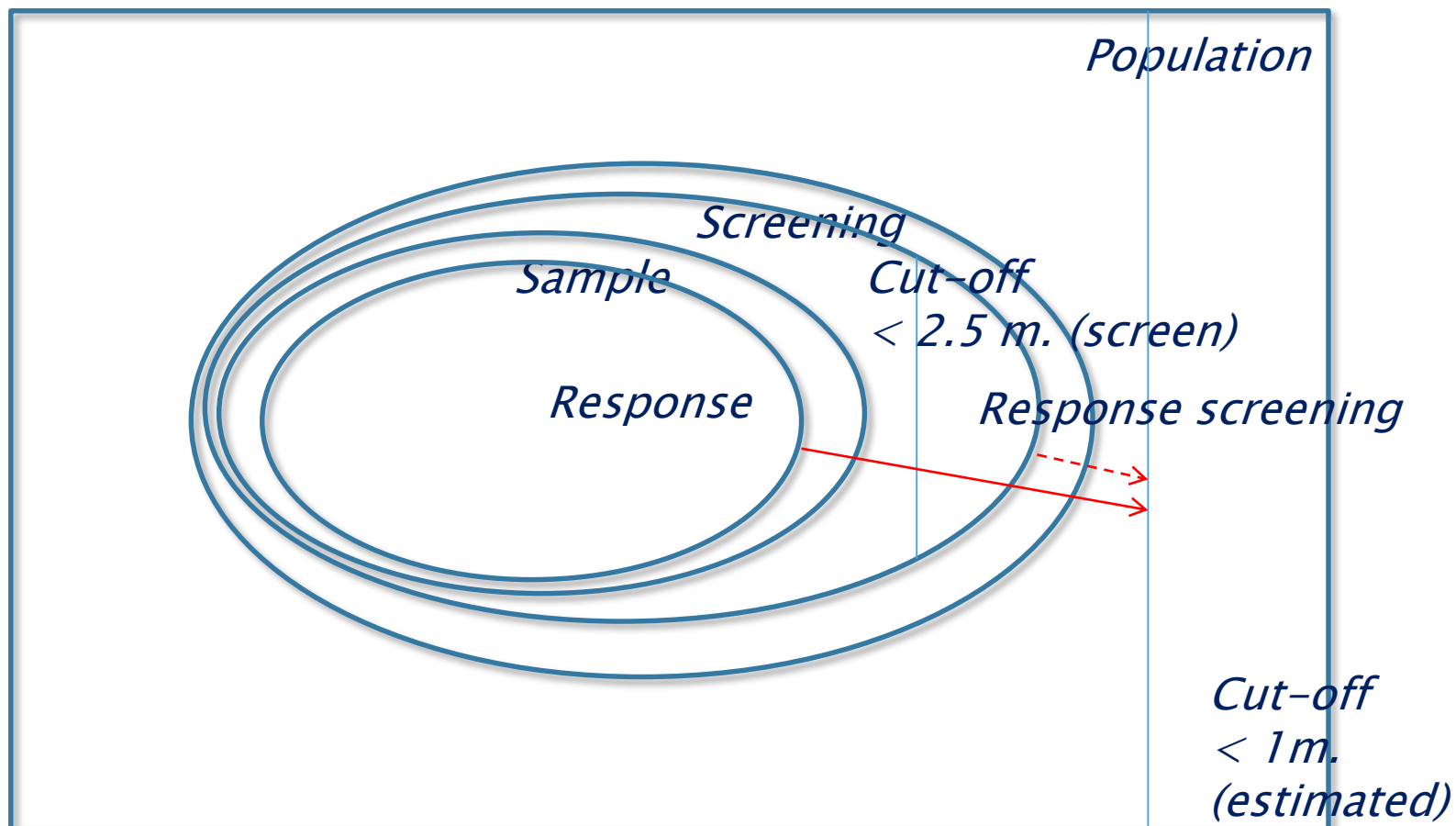
$N_{h(k)}$  is the population count in the stratum comprising  $k$ :  $h(k)$

$m_{h(k)}$  is the number of screening respondents in  $h(k)$

For each domain,  $d$  (domain  $\approx$  strata)

$$\hat{t}_d^{export} \stackrel{\text{def}}{=} \sum_{k \in \text{screen} \cap d} \pi_k \text{export}_{\text{screen},k}$$

# Weighting: Step 2



## Step 2 – from sample to population

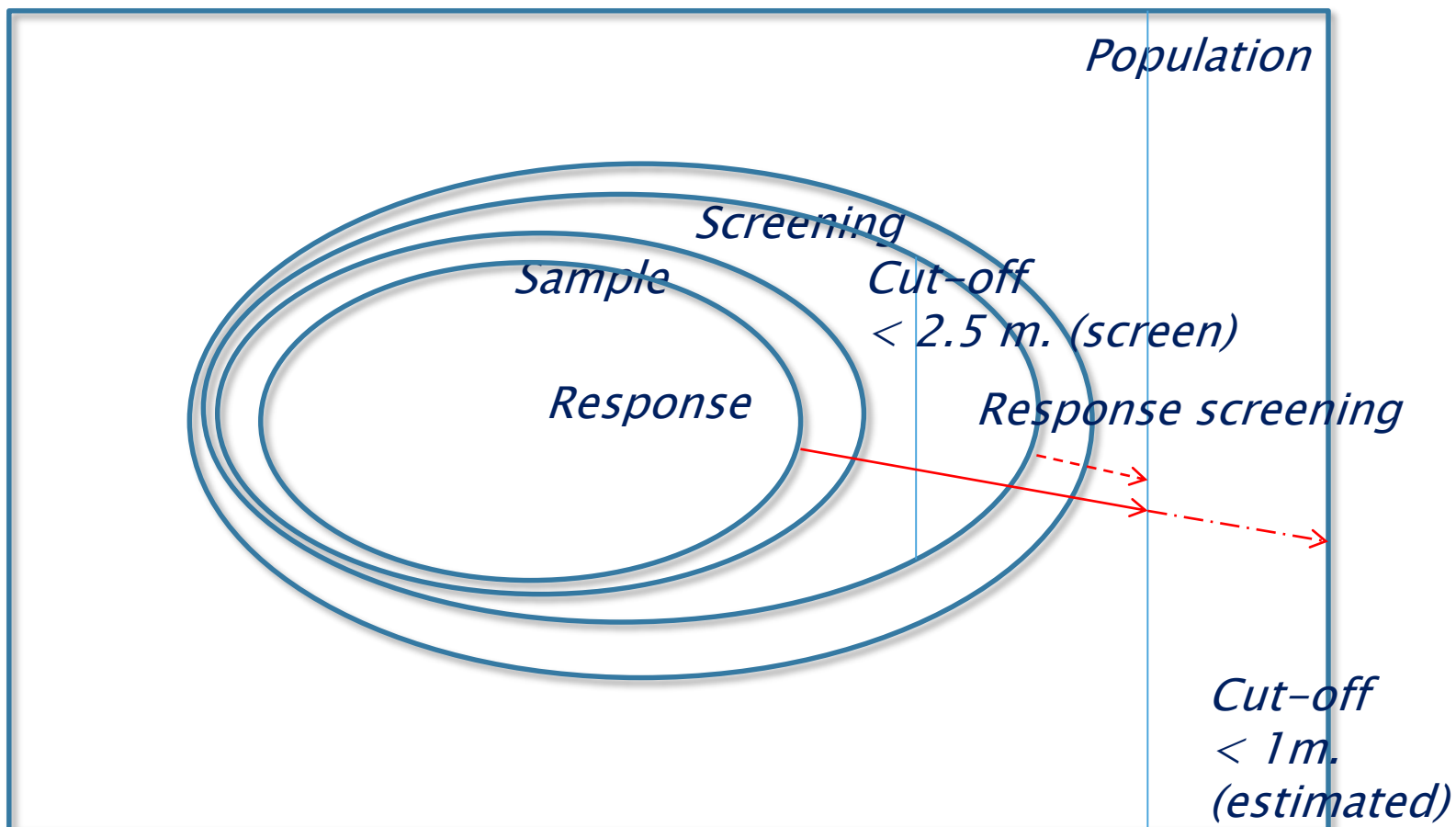
The final weights for estimating export,  $w_{exp,k}$ , is constructed to fulfil

$$\hat{t}_d^{export} = \sum_{k \in resp \cap d} w_{exp,k} export_{screen,k}$$

The final weights for estimating import,  $w_{imp,k}$  is constructed to fulfil

$$\sum_{k \in screen \cap d} \pi_k import_{screen,k} = \sum_{k \in resp \cap d} w_{imp,k} import_{screen,k}$$

# Sampling design and weighting



# Weighting/estimation

Example: For any export-related survey variable,  $y$ , the total is estimated

$$\hat{y} = \sum_{k \in resp} w_{exp,k} y_k$$

With correction for cut-off

$$\hat{y} = \sum_{k \in resp} factor_{(cut-off)} w_{exp,k} y_k$$

# Bias

- Attempting to avoid sampling only companies with no (i.e. 0 DKK) ITS  $\Longrightarrow$  overestimation of ITS
- Rare type of services are probably underestimated

# Sampling error

- Sampling error for survey variable  $y$  is quantified in terms of CV

$$CV(\hat{y}) = \frac{Stderr(\hat{y})}{\hat{y}} 100$$

- Calculated using CLAN (SAS-macros from Statistics Sweden). R-package “Survey” can do the same.
- The “hand-picked” companies do not contribute to the sampling variance

# Sampling error - in domains

- The reality: CV is estimated

$$\widehat{CV}(\hat{y}) = \frac{\widehat{Stderr}(\hat{y})}{\hat{y}} 100$$

- Trade originate from "hand-picked" companies

$$\Rightarrow \widehat{Stderr} = 0 \Rightarrow \widehat{CV} = 0$$

- Small domain  $\Rightarrow$  underestimation of trade as well as sampling error

# Present work

Five-year-routine is elaborated and of long duration  
(new sample based on population 3 years before)

- Population and sample updated every year
- Panel in the sample
- Spreading the workload
- 1 sample every 5 years  $\implies$  1/5 sample every year