Macroprudential Policy in Heterogeneous Environment – Application of Agent-based Modeling.

Table of variables & Pseudocodes

INDIVIDUALS (ind.-)

Variable	Name	Explanation	Values	Type	Restr.	Variable used in:	Value updated in:
INDIVIDUAL.ID	Individual id	Code identifying individuals	Integer (code)	Int	≥ 0	11; 12; 13; 14; 22; 24; 25; 27; 29; 30; 31; 32; 33; 34; 35; 36; 37; 38; 39; 40; 43; 47; 48; 49; 50; 54; 55;	29; 36;
HOUSEHOLD.ID	Household id	The identification code of households to which the individual belongs to	Integer (code)	Int	≥ 0	12; 13; 14; 25; 28; 30; 31; 34; 35; 47; 50;	36;
ESTABLISH.ID	Establishment id	Identification code of establishment in which the individual works	Integer (code)	Int	≥ 0	22; 49; 50;	29; 36; 49;
AGE	Age	Age of individual	Mixed fraction, from 0 to 110, but updated each quarter.	Double	≥ 0	13; 17; 18; 22; 24; 26; 27; 28; 31; 33; 34; 35; 37; 38; 47; 48; 50;	27; 36;
BANK.ID.1 (DEPOSITS)	Bank id	Bank 1 matched to the individual in which the deposits (savings) are hold	Integer (code)	Int	$\in \langle 102, 270 \rangle$	11; 31; 55;	36; 55;
BANK.ID.2 (CONS.LOANS)	Bank id	Bank 2 matched to the individual in which wants to take a consumer loan at first	Integer (code)	Int	$\in \langle 102, 270 \rangle$	13; 14; 15; 16; 54;	36;
BANK.ID.3 (RE.H.LOANS)	Bank id	Bank 2 matched to the individual in which wants to take a housing loan at first	Integer (code)	Int	$\in \langle 102, 270 \rangle$	13;	26; 36; 54;
BANK.ID.4 (RE.NH.LOANS)	Bank id	Bank 3 matched to the individual in which wants to take a non-housing loan at first	Integer (code)	Int	$\in \langle 102, 270 \rangle$	13;	26; 36; 54;
BANK.ID.5 (FIRM.INV.LOANS)	Bank id	Bank 4 matched to the individual in which wants to take a investment loan at first	Integer (code)	Int	$\in \langle 102, 270 \rangle$	13; 41.1; 51; 54;	36;
CONS.LOANS	Consumer loans	Consumer loans taken by an individual	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	19; 26; 54;	19; 36;
CONS.LOANS.MAT	Maturity of consumer loans	Maturity of consumer loans in quarters	Integer (eg. 20 years x 4, because quarterly)	Int	≥ 0	19;	19; 36;
CONS.LOANS.QUARTERLY	Consumer loans quarterly	Consumer loans taken by an individual entity (quarterly payments)	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	14; 24; 25; 54;	19; 36;
DEFAULT.IND	Defaults of individual	A normalized variable that determines the individual's credit history and therefore the probability of a default on loans	$\in \langle 0, 1 \rangle$	Double	$\in \langle 0, 1 \rangle$	17; 18; 41.1	13; 22; 36;
DEPOSITS	Deposits	Deposits (savings & current funds) on bank account of individual	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	11; 14; 22; 25; 29; 30; 31; 40; 41.1; 41.2; 55;	13; 20; 29; 36; 41.2; 43;
EDUC	Education	The variable assigns the current level of education or 0 if the individual does not study.	$\in \{1,2,3,4,5,6,7,8\}$	Int	$\in \{1,2,3,4,5,6,7,8\}$	32; 37; 38;	33; 36;
EDUC.LEVEL	Education level	Level of education completed by individual	$\in \{1,2,3,4,5,6,7,8\}$	Int	$\in \{1,2,3,4,5,6,7,8\}$	33; 37; 38; 48;	32; 36;
ENTREP.PAST	Entrepreneur in the past	The variable determining whether an individual was an entrepreneur in the past	1 - yes, 0 - no	Int or Boolean	$\in \{0, 1\}$	37; 38;	36; 43; 45;
ENTREP.SPIRIT	Entrepreneur spirit	The variable determining the probability of becoming an entrepreneur in the future (expectation)	$\in \langle 0, 1 \rangle$	Double	$\in \{0, 1\}$	24; 37;	36; 37;
ENTREPRENEUR	Entrepreneur	The variable determining whether an individual is an entrepreneur	1 - An individual has not set up a company, but wants to set up in the future. 2 - an individual is already a business owner, 0 - an individual does not own any company and do not want to set up a firm in the future.	Int	$\in \{0; 1; 2\}$	24; 37; 38; 47; 50; 55;	29; 36; 37; 43; 45;
FIRM.INV.LOANS	Investment loans of a firm	Investment loans taken by an individual to invest in a firm that he owns or co-owns	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	26; 51; 54;	36; 41.1.1; 54;
FIRM.INV.LOANS.MAT	Maturity of investment loans	Maturity of investment loans	Integer (eg. 20 year x 4, because quarterly)	Int	≥ 0		36; 41.1.1
FIRM.INV.LOANS.QUARTERLY	Investment loans of a firm quarterly	Investment loans taken by the individuals for the investment in a firm which he owns or co-owns (quarterly payment)	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	14; 24; 25; 54;	36; 41.1.1;

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Variable	Name	Explanation	Values	Type	Restr.	Variable used in:	Value updated in:
GENDER	Gender	Gender	0 - woman, 1 - man	Int or Boolean	$\in \{0, 1\}$	27; 33; 34; 35; 37; 47; 48; 50;	36;
INCOME	Income	Income of an individual	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	12; 34;	11; 36;
INTEREST.TO.BE.PAID.CONS.LOANS	Interests on consumer loans to be paid	Interests to be paid from the total amount of consumer loans.	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	19; 26;	19; 36; 54;
INTEREST.TO.BE.PAID.CONS.LOANS.QUARTERLY	Interests on consumer loans to be paid quarterly	Interests to be paid from the total amount of consumer loans in a quarter.	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	14; 24; 25; 54;	19; 36;
INTEREST.TO.BE.PAID.FIRM.INV.LOANS	Interests on investment loans to be paid	Interests to be paid from the total amount of investment loans.	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	26; 41.1.1;	36; 41.1.1; 54;
INTEREST.TO.BE.PAID.FIRM.INV.LOANS.QUARTERLY	Interests on investment loans to be paid quarterly	Interests to be paid from the total amount of investment loans in a quarter.	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	24; 25; 54;	36; 41.1.1;
INTEREST.TO.BE.PAID.RE.H.LOANS	Interests on housing loans to be paid	Interests to be paid from the total amount of housing loans.	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	26;	26; 26.1; 26.2; 36; 54;
INTEREST.TO.BE.PAID.RE.H.LOANS.QUARTERLY	Interests on housing loans to be paid quarterly	Interests to be paid from the total amount of housing loans in a quarter.	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	14; 22; 24; 25; 54;	26; 26.1; 26.2; 36;
INTEREST.TO.BE.PAID.RE.NH.LOANS	Interests on nonhousing loans to be paid	Interests to be paid from the total amount of non-housing loans.	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	26;	26; 36; 54;
INTEREST.TO.BE.PAID.RE.NH.LOANS.QUARTERLY	Interests on nonhousing loans to be paid quarterly	Interests to be paid from the total amount of non-housing loans in a quarter.	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	14; 24; 25; 54;	26; 36;
LABOR.PERIODS	Labor periods	Number of periods since the last change of status on the labor market (1 iteration = 1 period = 3 months, 1 quarter).	Int	≥ 0	26; 33; 37; 47; 48; 50;	27; 29; 36; 43; 45; 47; 49;	
LABOR.STATUS	Labor status	Status on the labor market of individual.	1 - student, 2 - unemployed, 3 - employed, 4 - inactive, 5 - owner of a firm	Int	$\in \{1, 2, 3, 4, 5\}$	17; 18; 22; 24; 26; 28; 29; 33; 37; 47; 48; 49; 50;	29; 33; 36; 43; 45; 47; 49;
NO.CONS.LOANS	Number of consumer loans	Number of consumer loans already taken	Integer	Int	≥ 0	17; 18	36;
PENDING.TO.BE.PAID.CONS.LOANS	Pending to be paid by the individual of consumer loans	The variable determining the sum of liabilities to the bank for outstanding consumer loans that have yet to be repaid in the given iteration.	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	13; 22; 54; 55;	36; 54;
PENDING.TO.BE.PAID.FIRM.INV.LOANS	Pending to be paid by the individual of investment loans	The variable determining the sum of liabilities to the bank for outstanding investment loans that have yet to be repaid in the given iteration.	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	13; 22; 51; 54; 55;	36; 54;
PENDING.TO.BE.PAID.RE.H.LOANS	Pending to be paid by the individual of housing loans	The variable determining the sum of liabilities to the bank for outstanding housing loans that have yet to be repaid in the given iteration.	Number (mixed fraction) with accuracy to at least 4 decimals	Int	≥ 0	13; 22; 54; 55;	36; 54;
PENDING.TO.BE.PAID.RE.NH.LOANS	Pending to be paid by the individual of nonhousing loans	The variable determining the sum of liabilities to the bank for outstanding nonhousing loans that have yet to be repaid in the given iteration.	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	13; 22; 54; 55;	36; 54;
PERC.1	Indicator of perception	Perception indicator.	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	58	36;
PERC.2	Indicator of perception	Perception indicator.	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	58	36;
PERC.3	Indicator of perception	Perception indicator.	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	58	36;
PERC.4	Indicator of perception	Perception indicator.	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	58	36;
PERC.PERC	Indicator of 'perception of perception'	Indicator of 'perception of perception'	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	58	36;

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Variable	Name	Explanation	Values	Type	Restr.	Variable used in:	Value updated in:
PERIODS.EDU	Periods of education	Number of periods in which an individual has been studying	Integer (we count 1 period as 1 quarter, so e.g. 2 years is already 8 periods in the model)	Int	≥ 0	32;	36;
RE.H.LOANS	Real estate housing loans	Loans under pledge of real estate for residential (housing) purposes	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	25; 26; 29; 30; 54;	26; 26.1; 26.2; 29; 30; 36; 54;
RE.H.LOANS.MAT	Maturity of real estate housing loans	Maturity of real estate housing loans	Integer	Int	≥ 0		26; 26.1; 26.2; 36;
RE.H.LOANS.QUARTERLY	Real estate housing loans quarterly	Loans under pledge of real estate for residential (housing) purposes (quarterly)	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	14; 22; 24; 25; 54;	26; 36;
RE.NH.LOANS	Real estate nonhousing loans	Loans under pledge of real estate for residential (non-housing) purposes	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	25; 26; 54;	26; 26.3; 26.4; 36; 54;
RE.NH.LOANS.MAT	Maturity of real estate nonhousing loans quarterly	Maturity of real estate nonhousing loans quarterly	Integer	Int	≥ 0		26; 26.3; 26.4; 36;
RE.NH.LOANS.QUARTERLY	Real estate nonhousing loans quarterly	Loans under pledge of real estate for residential (nonhousing) purposes (quarterly)	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	14; 24; 25; 54;	26; 26.3; 26.4; 36;
SHARES	Shares in firms	Shares of an individual in large and medium-sized companies	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0		36; 41.2;
SPATIAL.CODE.1	Spatial code level 1	Spatial code level 1	Integer (code), eg. 1 is city no. 1, after adaptation of GUS codes	Int	≥ 0	20; 49;	36;
SPATIAL.CODE.2	Spatial code level 2	Spatial code level 2	Integer (code)	Int	≥ 0	20; 49;	36;
SPATIAL.CODE.3	Spatial code level 3	Spatial code level 3	Integer (code)	Int	≥ 0	20; 49;	36;
SPATIAL.CODE.4	Spatial code level 4	Spatial code level 4	Integer (code)	Int	≥ 0	20; 49;	36;
STATUS.CIVIL	Civil status	Status civil	1 - single, 2 - married, 3 - widow, 4 - divorced	Int	$\in \{1, 2, 3, 4\}$	13; 20; 26; 34; 35; 36;	35; 36;
SUBSIDY	Subsidy	Public assistance for an individual	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	11; 29; 31;	29; 36; 50;
WAGE	Wage	Wage	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	11; 29; 31; 34; 50; 51;	36; 50;
WORKER.SKILLS	Skills of worker	Variable determining the skills of workers	Number $\in \langle 0, 1 \rangle$	Double	≥ 0	49;	36; 48;

HOUSEHOLDS (hh.-)

Variable	Name	Explanation	Values	Type	Restr.	Variable used in:	Value updated in:
HOUSEHOLD.ID	Household id	Code identifying households in the model	Integer (code)	Int	≥ 0	12;13; 22; 23; 24; 25; 26; 30; 31; 34; 35; 47; 50;	35;
ACCOM.COST	Accomodation cost	The cost of living in own property or renting a property by the household	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	13; 14; 17; 18; 24; 26;	22; 31; 34;
DONATIONS	Donations	Donations	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	12;	34;
DSTI	Debt service to income	DSTI	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	26;	25;
DTA	Debt to assets ratio	DTA	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	26;	25;
DTI	Debt to income ratio	DTI	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	26;	25;
LTV.H	Loan to value (housing loans)	LTV for housing loans	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	26;	25; 26; 26.1; 26.2;
LTV.NH	Loan to value (non-housing loans)	LTV for nonhousing loans	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	26;	25; 26; 26.3; 26.4;
PROPERTY.ID1	Property id 1	Code identifying the property in which the household lives	0 - if the household does not own this property, the property code if the household owns	Int	≥ 0	22;	
PROPERTY.ID2	Property id 2	Code identifying the second property (this property can be rented by other households or can be marked as for sale).	0 - if the household is not the owner of this property, the property code if the household owns this property	Int	≥ 0	22;	
REAL.ESTATE.REV	Real estate revenue	Household income from renting property	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	12;	23;
ST.OWNER	Status of the owner	Status of the owner	1 - owner, 2 - renter	Int	$\in \{1, 2\}$	22; 30;	
TOTAL.INC.FAM	Total income of the family (household)	Total household income	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	13; 14; 17; 18; 22; 24; 25; 47; 50;	12; 31; 34;

FIRMS (firm.-)

Variable	Name	Explanation	Values	Type	Restr.	Variable used in:	Value updated in:
FIRM.ID	Firm id	Indentification code of firm	Integer (code)	Int	≥ 0	5; 9; 10; 29; 38; 43; 44; 45; 46; 50; 51; 52; 53; 55;	40; 41.1.1; 41.2; 44;
SECTOR.ID	Sector id	Codes identifying the sectors in which the establishments of the firm operate	Integer (code)	Int	≥ 0	38; 46; 53;	40; 41.1.1; 41.2; 44
DEFAULT.FIRM	Defaults of firm	A variable that determines the probability of default of a company based on credit history	Number (mixed fraction) with accuracy to at least 4 decimals	Double	$\in \langle 0, 1 \rangle$	9; 10;	40; 41.1.1; 41.2; 51;
FINANCIAL.RISK	Financial risk of firm	The variable that determines the financial risk of the company	$\in \langle 0, 1 \rangle$	Double	≥ 0	5; 9; 10; 41.1; 42; 44; 46; 52; 53;	40; 41.1.1; 41.2; 52;
FIRM.AGE	Firm age	Number of periods that a firm operates on the market	Integer	Int	≥ 0	42; 45;	40; 41.1.1; 41.2; 52;
FIRM.DEBT	Firm debt	Debt of the company	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	5; 9; 10; 43; 44; 51; 52;	40; 41.1.1; 41.2; 43; 44; 50; 51; 52;
FIRM.MARKET.VALUE	Firm market value	The value of the firm in monetary terms	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	43; 44;	40; 41.1.1; 41.2; 42;
FIRM.PROFIT	Firm profit	Profits generated by the firm	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	9; 10; 38; 42; 43; 46; 50; 51; 53;	40; 41.1.1; 41.2; 52;
FIRM.TO.BE.SOLD	Firm to be sold	Variable determining whether a firm is marked as to be sold or not	1 - to be sold, 0 - not to be sold in the current period	Int lub Boolean	≥ 0	43; 44;	29; 40; 41.1.1; 41.2;
FIX.CAP.FIRM	Fixed capital of firm	Fixed capital of a firm	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	5; 9; 10; 43; 44;	40; 41.1.1; 41.2; 43; 44; 52;
INDIVIDUAL.ID	Individual id	Codes identifying business owners	Integer (code)	Int	≥ 0	29; 38; 43; 45; 55;	41.1.1; 41.2;
LIQ.ASSETS.FIRM	Liquid assets of firm	Liquid assets of a firm	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	9; 10; 43; 44; 51; 55;	40; 41.1.1; 41.2; 43; 44; 51; 52;
NO.ESTABLISH.OF.FIRM	No establishments of firm	Number of establishments of a firm in all sectors	Integer	Int	≥ 0	9; 10; 43; 44; 45; 51;	40; 41.1.1; 41.2; 43; 44;
TAX.PROFITS	Taxes on profits	Taxes on profits	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	52;	40; 41.1.1; 41.2; 52;
WF.FIRM	Work force of firm	Number of employees (work force) of a firm	Integer	Int	≥ 0	9; 10; 21; 42; 43; 44; 46; 51; 52;	40; 41.1.1; 41.2; 43; 44; 52;

Variable	Name	Explanation	Values	Type	Restr.	Variable used in:	Value updated in:
ESTABLISH.ID	Establishment id	The code identifying the establishments of a firm	Integer (code)	Int	≥ 0	2; 3; 4; 5; 6; 7; 8; 9; 10; 20; 21; 22; 29; 42; 49; 50; 51; 53;	40; 41.1.1; 41.2; 46;
BANK.Q.BUY.EST.ID	Id of bank that granted short-term loan to establishment	The code identifying the bank in which it borrows funds to purchase inputs	Integer (code)	Int	≥ 0	9; 10; 55;	40; 41.1.1; 41.2; 46;
COST	Cost	Costs incurred during production of goods in the current period	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	4; 51;	49; 40; 41.1.1; 41.2; 46; 51;
COST.TMINUS1	Cost in previous period	Costs incurred during the production of good in the previous period	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	4;	49; 40; 41.1.1; 41.2; 46;
DEFAULT.EST	Defaults of establishment	Credit history of the establishments and thus the likelihood of repayment of the loan for the purchase of inputs	$\in \langle 0, 1 \rangle$	Double	$\in \langle 0, 1 \rangle$		40; 41.1.1; 41.2; 46;
DEMAND	Demand	Demand for a good or service	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	2; 3;	6; 8; 9; 10; 20; 21; 40; 41.1.1; 41.2; 46;
EST.NEW	Establishment that is new	A variable that determines whether the locale is newly established or not	1 - new one, 0 - already operating on the market	Int lor Boolean	$\in \langle 0, 1 \rangle$	3; 4; 7; 51	40; 41.1.1; 41.2; 46; 51
EXP.DEMAND	Expected demand	Expected demand for a good or service	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	2; 3; 4;	3; 40; 41.1.1; 41.2; 46;
EXP.IMP	Export-Import	A variable that determines whether a given locale exports, imports, and possibly both	1 - if only imports 2 - if only exports, 3 - if both, 0 - if it does not import or export	Int	$\in \{0, 1, 2, 3\}$	6; 53;	40; 41.1.1; 41.2; 46;
FIRM.ID	Firm id	The code identifying the business to which the premises belongs	Integer (code)	Int	≥ 0	9; 10; 29; 42; 50; 51;	40; 41.1.1; 41.2; 46;
FIX.CAP.EST	Fixed capital of establishment	Fixed capital of the premises	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	2; 51;	40; 41.1.1; 41.2; 46; 51;
INPUTS	Inputs	Quantity of inputs required in the production of final goods expressed in monetary terms	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	51;	6; 8; 9; 10; 40; 41.1.1; 41.2; 46;
INTEREST.TO.BE.PAID.Q.BUY.EST	Interest on short-term firm loans to be paid	Interest on short-term firm loans to be paid	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0		9; 10; 40; 41.1.1; 41.2; 46;
INTEREST.TO.BE.PAID.Q.BUY.QUARTERLY	Interest on short-term firm loans to be paid quarterly	Interest on short-term firm loans to be paid quarterly	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	9;	9; 10; 40; 41.1.1; 41.2; 46;
KNOW.HOW	Know - how	A variable defining the know-how of a given establishment	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	2;	40; 41.1.1; 41.2; 46;
LIQ.ASSETS.EST	Liquid assets of a establishment	Liquid assets of a establishment	Number (mixed fraction) with accuracy to at least 4 decimals	Double		8; 9; 10; 51;	8; 9; 10; 20; 21; 40; 41.1.1; 41.2; 46; 51;
PERC.(EST)	Indicator of perception of establishment	Perception indicator of establishment	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	58;	40; 41.1.1; 41.2; 46;
PERC.PERC.(EST)	Indicator of 'perception of perception' of establishment	Indicator of 'perception of perception' of establishment	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	58;	40; 41.1.1; 41.2; 46;
PRICE	Price	Price of goods produced by the establishment in the current period	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	2; 3; 4; 7; 8; 9; 10; 20; 21; 24; 53;	2; 40; 41.1.1; 41.2; 46;
PRICE.TMINUS1	Price in previous period	The price of goods produced by the establishment in the previous period	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0		2; 3; 40; 41.1.1; 41.2; 46;

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Variable	Name	Explanation	Values	Type	Restr.	Variable used in:	Value updated in:
PROD	Production	Production volume (quantity of produced goods) by the establishment	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	2; 6; 21; 51;	5; 40; 41.1.1; 41.2; 46;
Q.BUY.EST	Quantity to be bought	The amount of purchased goods from the supplier	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	7; 8; 9; 10;	6; 40; 41.1.1; 41.2; 46;
Q.BUY.EST.LOANS	Short-term loans for establishments	Loans taken by establishments to purchase inputs	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	9; 10;	9; 10; 40; 41.1.1; 41.2; 46;
Q.BUY.EST.LOANS.MAT	Maturity of short-term loans	Maturity of short-term loans	Integer	Int	≥ 0	9; 10;	9; 10; 40; 41.1.1; 41.2; 46;
Q.BUY.EST.LOANS.QUARTERLY	Short-term loans for establishments quarterly	Loans taken by establishments to purchase inputs (quarterly)	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0		9; 10; 40; 41.1.1; 41.2; 46;
QUALITY	Quality	A normalized variable that determines the quality of the product in the current period	$\in \langle 0, 1 \rangle$	Double	$\in \langle 0, 1 \rangle$	2; 3; 7; 20; 21; 53;	40; 41.1.1; 41.2; 46;
QUALITY.TMINUS1	Quality in previous period	A normalized variable that determines the quality of the product in the previous period	$\in \langle 0, 1 \rangle$	Double	$\in \langle 0, 1 \rangle$	3;	40; 41.1.1; 41.2; 46;
SALES.EMPLOYEE	Sales per employee	Sales per employee (expressed in monetary terms)	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0		40; 41.1.1; 41.2; 46; 51;
SALES.MONET	Sales expressed in monetary terms	Sales expressed in monetary terms	$\in \langle 0, 1 \rangle$	Double	≥ 0	4; 42; 51; 53;	6; 8; 9; 10; 20; 21; 40; 41.1.1; 41.2; 46;
SECTOR.ID	Sector id	Code identifying the sector in which the firm operates	Integer	Int	≥ 0	50; 53;	38; 40; 41.1.1; 41.2; 46;
SPATIAL.CODE.1	Spatial code - level 1	Spatial code - level 1	Integer (code)	Int	≥ 0	7; 8; 20; 22; 49;	40; 41.1.1; 41.2; 46;
SPATIAL.CODE.2	Spatial code - level 2	Spatial code - level 2	Integer (code)	Int	≥ 0	7; 8; 20; 22; 49;	40; 41.1.1; 41.2; 46;
SPATIAL.CODE.3	Spatial code - level 3	Spatial code - level 3	Integer (code)	Int	≥ 0	7; 8; 20; 22; 49;	40; 41.1.1; 41.2; 46;
SPATIAL.CODE.4	Spatial code - level 4	Spatial code - level 4	Integer (code)	Int	≥ 0	7; 8; 20; 22; 49;	40; 41.1.1; 41.2; 46;
STOCK	Stock	The amount of stored good in the current period	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	5; 7; 20; 21;	8; 9; 10; 20; 21;40; 41.1.1; 41.2; 46;
STOCK.OPT	Optimal stock	Optimal level of stored goods for the current period	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	5;	4; 40; 41.1.1; 41.2; 46;
TAX.PROP	Taxes on property	Property tax	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	51;	40; 41.1.1; 41.2; 46; 51;
WAGES.EST	Wages of all employees of establishment	The cost associated with the payment of wages by the premises	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	8; 9; 10; 51; 53;	40; 41.1.1; 41.2; 46; 51;
WF.EST	Work force of establishment	Total labor force (number of employees) of the premises	Integer	Int	≥ 0	3; 9; 10; 49; 51; 53;	29; 49; 40; 41.1.1; 41.2; 46;
WF.FIRED	Work force to be fired	Number of employees (labor force) to be fired in the current period	Integer	Int	≥ 0	49;	2; 49; 40; 41.1.1; 41.2; 46;
WF.HIRED	Work force to be hired	Number of employees (labor force) to be hired in the current period	Integer	Int	≥ 0	49;	2; 49; 40; 41.1.1; 41.2; 46;
WF.PROD	Work force involved in production	Workforce (number of employees) involved in the production of good in the establishment	Integer	Int	≥ 0		40; 41.1.1; 41.2; 46;

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Tablica 4 – *Continued from previous page*

Variable	Name	Explanation	Values	Type	Restr.	Variable used in:	Value updated in:
WORK.PROD	Workers involved in production	Number of employees engaged in the production of goods in the establishment	Integer	Int	≥ 0	2;	29; 40; 41.1.1; 41.2; 46;

BANKS (bank.-; -.b)

Variable	Name	Explanation	Values	Type	Restr.	Variable used in:	Value updated in:
BANK.ID	Bank id	Bank identification code	Integer (code)	Int	≥ 0	9; 10; 11; 13; 14; 15; 16; 26; 41.1; 51; 54; 55;	
BONDS	Bonds	The value of bonds	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	57;	
BANK.COSTS	Bank costs	Operating costs	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	56;	56;
BANK.DEFAULT	Bank default	A normalized variable determining the bank's insolvency. Value 1 means default, 0.5 means that capital decreased below regulatory requirement, 0 means that everything is fine.	$\in \{1; 0.5; 0\}$	Double	$\in \{0, 0.5, 1\}$		55; 57;
BANK.DEPOSITS	Bank deposits	The sum of deposits, ie the sum of funds deposited by individuals, owners of small and medium enterprises and large companies in banks.	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	57;	
BANK.RESERVES	Bank reserves	Bank reserves	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	57;	
BANKS.AVE.COSTS	Banks average costs	Average costs of banking operations in the sample	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	56;	
BANKS.ST.DEV.COSTS	Banks standard deviation of costs	Standard deviation of bank operating costs in the sample	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	56;	
DERIVATIVES	Derivatives held by bank	Derivatives held by bank	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0		
EQUITY	Equity of bank	Capital	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	55; 57;	55; 56;
IR.CONS.LOANS	Interest rate on consumer loans	Interest rate on consumer loans	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	14; 16; 19;	58;
IR.DEPOSITS	Interest rate on deposits	Interest rate on deposits	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	11; 14; 31;	58;
IR.FIRM.INV.LOANS	Interest rate on investment loans	Interest rate on loans for investment purposes	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	41.1;	58;
IR.Q.BUY.EST.LOANS	Interest rate on short term loans for firms (inputs purchase)	Interest rate on loans for the purchase of inputs	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	9; 10;	58;
IR.RE.H.LOANS	Interest rate on real estate (housing) loans	Interest rate on mortgages for residential purposes	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	26;	58;
IR.RE.NH.LOANS	Interest rate on real estate (non-housing) loans	Interest rate on mortgages for non-residential purposes	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	26;	58;
NO.DEFAULTS.IN.BANK	Number of defaults of agents related to bank	A variable that help us to determine the bank's default risk depending on the insolvency of agents in the non-financial sector	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0		13; 22;
NPL.Q.BUY.LOANS	Non-performing loans (only short term loans for firms)	A variable that compute non-performing loans of short-term loans as a result of insolvency of firms	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	55;	
NPL.FIRM.INV.LOANS	Non-performing loans (only investment loans)	A variable that compute non-performing loans of investments loans as a result of insolvency of firms	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	55;	13; 22; 51;
NPL.CONS.LOANS	Non-performing loans (only consumer loans)	A variable that compute non-performing loans of consumer loans as a result of insolvency of households	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	55;	13; 22;
NPL.RE.H.LOANS	Non-performing loans (only real estate housing loans)	A variable that compute non-performing loans of housing loans as a result of insolvency of households	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	55;	13; 22;

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Tablica 5 – *Continued from previous page*

Variable	Name	Explanation	Values	Type	Restr.	Variable used in:	Value updated in:
NPL.RE.NH.LOANS	Non-performing loans (only real estate non-housing loans)	A variable that compute non-performing loans of nonhousing loans as a result of insolvency of households	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	55;	13; 22;
REV.CONS.LOANS	Revenue on consumer loans	Income earned by the bank from interests on consumer loans	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	56; 57;	19;
REV.Q.BUY.EST	Revenue on short term loans	Income earned by the bank from interest on short-term loans	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	56; 57;	9; 10;
REV.RE.H.LOANS	Revenue on real estate loans (housing)	Income earned by the bank from interest on housing loans	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	56; 57;	26; 26.1; 26.2; 30;
REV.RE.NH.LOANS	Revenue on real estate loans (non-housing)	Income earned by the bank from interest on nonhousing loans	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	56; 57;	26; 26.3; 26.4;
REV.FIRM.INV.LOANS	Revenue on investment loans	Income earned by the bank from interest on investment loans	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	56; 57;	41.1.1;
SUPPLY.CONS.LOANS	Supply for consumer loans	Supply for consumer loans	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	15; 16; 55;	19;
SUPPLY.FIRM.INV.LOANS	Supply for firm investment loans	Supply for firm investment loans	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	41.1, 55;	41.1.1;
SUPPLY.Q.BUY.EST.LOANS	Supply for short-term loans	Supply for short-term loans	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	9; 10; 55;	9; 10;
SUPPLY.RE.H.LOANS	Supply for real estate (housing) loans	Supply for real estate (housing) loans	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	26; 55;	26; 26.1; 26.2;
SUPPLY.RE.NH.LOANS	Supply for real estate (non-housing) loans	Supply for real estate (non-housing) loans	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	26; 55;	26; 26.3; 26.4;
WIBID3M	Interest rate WIBID 3M	Interest rate WIBID 3M	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	58;	
WIBOR3M	Interest rate WIBOR 3M	Interest rate WIBOR 3M	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	58;	

INDUSTRIES (sector.-; -.s)

Variable	Name	Explanation	Values	Type	Restr.	Variable used in:	Value updated in:
SECTOR.ID	Sector id	Sector (industry) identification code	Integer (code)	Int	≥ 0	1; 20; 38; 41.1; 42; 46; 50; 53;	
AVE.FINANCIAL.RISK	Average financial risk of the industry (sector)	Average financial risk of the industry (sector)	$\in \langle 0, 1 \rangle$	Double	$\in \langle 0, 1 \rangle$	9; 10; 41.1; 42; 43; 46;	53;
AVE.SALES.FIRM.SECTOR	Average sales of firms in the industry (sector)	The variable determining the average level of sales of goods in firms in a given industry (sector)	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	3;	53;
AVE.SECT.WF.EST	Average work force of establishments in industry (sector)	Average work force of establishments in industry (sector)	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	9; 10; 39; 41.1; 46;	53;
AVE.WAGE.SECT	Average wage in industry (sector)	Average wage in industry (sector)	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	40; 50;	53;
LICENSE.EASINESS	License easiness	Easiness to get the license to open a firm in this industry (sector)	$\in \langle 0, 1 \rangle$	Double	≥ 0	39;	
PERC.EST.EXP	Percantage of establishments that export to other industry (sector)	Percantage of establishments that export to other industry (sector)	$\in \langle 0, 1 \rangle$	Double	≥ 0		53;
PERC.EST.IMP	Percantage of establishments that import to other industry (sector)	Percantage of establishments that import to other industry (sector)	$\in \langle 0, 1 \rangle$	Double	≥ 0		53;
PRICE.SECT	Average price in the sector	Average price of good or service in a given industry (sector) in the current period	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	3; 7; 14; 19; 20; 21 ; 53;	52; 53;
PRICE.SECT.TMINUS1	Average price in the industry (sector) in the previous period	Average price of good or service in the industry (sector) in the previous period	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	3; 52; 53;	53;
PROFIT.SECT	Profit in the industry (sector)	Total profit from the business of establishments in a given industry (sector)	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	1; 42; 46;	53;
QUALITY.SECT	Average quality in the industry (sector)	A variable defining the average quality of a good or service in a sector in the current period	$\in \langle 0, 1 \rangle$ (normalized value)	Double	≥ 0	2; 3; 7; 20; 53;	52; 53;
QUALITY.SECT.TMINUS1	Average quality in the industry (sector) in the previous period	A variable determining the average quality of a good or service in a given industry (sector) in a previous period	$\in \langle 0, 1 \rangle$ (normalized value)	Double	≥ 0	3; 52; 53;	53;
SECTOR.AVE.SIZE	Average size of firm in the industry (sector)	Average size of a firm in a given industry (sector)	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	42;	
SECT.SD.FIRM.SIZE	Standard deviation of firm size in the industry (sector)	Standard deviation of the size of firms in the sector (the size of the firms is the number of employees, not assets).	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	39;	
SECTOR.FIRMS	Number of firms in the industry (sector)	Number of firms operating in the industry (sector)	Integer	Int	≥ 0	1; 46;	53;
TAX.VAT	Tax VAT	VAT	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	14; 19;	

PROPERTIES (prop.-)

Variable	Name	Explanation	Values	Type	Restr.	Variable used in:	Value updated in:
PROPERTY.ID	Property id	Property identification code	Integer (code)	Int	≥ 0	22; 23; 26; 30; 31; 34;	31; 34;
HOUSEHOLD.ID	Household id	Code identifying the household that owns the property	Integer (code)	Int	≥ 0	23; 30; 34;	
NO.HHS.RENT	Number of households that rent the house	A variable that specifies how many households reside in a rental property	Integer	Int	≥ 0	22; 23;	
PRINC.HOUSING	Principal housing	Variable indicating whether a household property is the main residence	1 - yes, 0 - no	Int or Boolean	$\in \{0, 1\}$	23; 26;	
PROP.PRICE	Property price	Property price on the market	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	22; 23; 24; 25; 26; 30;	22; 30;
PROP.TO.BE.SOLD	Property to be sold	The variable that determines whether the given property is marked for sale	1 - yes, 0 - no	Int or Boolean	≥ 0	22; 23; 24; 26;	22; 30;
SPATIAL.CODE.1	Spatial code - level 1	Spatial code - level 1	Integer (code)	Int	≥ 0	22;	22;
SPATIAL.CODE.2	Spatial code - level 2	Spatial code - level 2	Integer (code)	Int	≥ 0	22;	22;
SPATIAL.CODE.3	Spatial code - level 3	Spatial code - level 3	Integer (code)	Int	≥ 0	22;	22;
SPATIAL.CODE.4	Spatial code - level 4	Spatial code - level 4	Integer (code)	Int	≥ 0	22;	22;

CONSUMERS (cons.-)

Variable	Name	Explanation	Values	Type	Restr.	Variable used in:	Value updated in:
HOUSEHOLD.ID	Household id	Household identification code	Integer (code)	Int	≥ 0	14; 19; 28; 31; 34; 35;	
CONS.TYPE	Consumer type	Consumer type attributed to the household	Integer: 1 - single over 67 , 2 - single under 67 , 3 - couple, at least 1 over 67 , 4 - couple, both under 67, 5 - household (also single) with children, 6 - extended household	Int	$\in \{1, 2, 3, 4, 5, 6\}$		28; 31; 34; 35;
CONSUMER.ID	Consumer id	Consumer identification code	Integer (code)	Int	≥ 0	14; 19; 20;	
SECTOR.ID	Sector id	The code identifying the sector from which a household of a given consumer type purchases products	Integer (code)	Int	≥ 0		
SUPPLIER.ID	Supplier id	The code identifying the supplier that provides the goods for the household	Integer (code)	Int	≥ 0	20;	20;
Q.BUY.CONS.all.s	Quantity of goods to be bought by consumers (in all sectors)	The amount of good that a household buys from suppliers in all sectors	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	20; 24;	14; 19;

SUPPLIERS (sup.-)

Variable	Name	Explanation	Values	Type	Restr.	Variable used in:	Value updated in:
ESTABLISH.ID	Establishment id	Code identifying establishment	Integer (code)	Int	≥ 0	7;	
Q.BUY.EST	Quantity of inputs to be bought by establishment	Amount of inputs to be purchased by establishment	Number (mixed fraction) with accuracy to at least 4 decimals	Double	≥ 0	7; 8; 9;	6;
SECTOR.ID	Sector id	Code identifying the sector in which the establishment operates	Integer (code)	Int	≥ 0		
SUPPLIER.ID	Supplier id	The code identifying the supplier for the establishment (supplier is also a establishment)	Integer (code); 0 means that the sector is empty and there is no potential supplier, in such case the establishment simply can not purchase from this sector	Int	≥ 0		7;

PARAMETERS

Parameter	Name	Remarks	Type
$\alpha_{1.s}$	Scaling parameter in temp.MAX.PROD Cobb-Douglas function in (2).	The multiplicity associated with the number of industries (sectors) in the model.	Double
$\alpha_{2.s}$	Output elasticity of labor in temp.MAX.PROD Cobb-Douglas function in (2).	The multiplicity associated with the number of industries (sectors) in the model.	Double
$\alpha_{3.s}$	Output elasticity of capital in temp.MAX.PROD Cobb-Douglas function in (2).	The multiplicity associated with the number of industries (sectors) in the model.	Double
$\alpha_{4.s}$	Output elasticity of relative quality of the product to the sector's product quality in temp.MAX.PROD Cobb-Douglas function in (2).	The multiplicity associated with the number of industries (sectors) in the model.	Double
$\alpha_{5.s}$	Output elasticity of know-how in temp.MAX.PROD Cobb-Douglas function in (2).	The multiplicity associated with the number of industries (sectors) in the model.	Double
α_{6}	Threshold for production to increase the price in (2).	One value.	Double
$\alpha_{7.s}$	Percentage of price to be increased in each industy (sector) in (2).	The multiplicity associated with the number of industries (sectors) in the model.	Double
α_{8}	Threshold for decision about demand relative to expected demand that affects the price levels in (2).	One value.	Double
α_{9}	Threshold for production relative to maximum potential production that affects the price levels in (2).	One value.	Double
$\alpha_{10.s}$	Percentage of price to be decreased in each of industry (sector) in (2).	The multiplicity associated with the number of industries (sectors) in the model.	Double
$\alpha_{11.s}$	Scaling parameter expressing the relative price to average price in the industry (sector) in current period used in expected demand updating (3).	The multiplicity associated with the number of industries (sectors) in the model.	Double
$\alpha_{12.s}$	Scaling parameter expressing the relative price to average price in the industry (sector) in previous period used in expected demand updating (3).	The multiplicity associated with the number of industries (sectors) in the model.	Double
$\alpha_{13.s}$	Scaling parameter expressing the relative quality to average quality in the industry (sector) in current period used in expected demand updating (3).	The multiplicity associated with the number of industries (sectors) in the model.	Double
$\alpha_{14.s}$	Scaling parameter expressing the relative quality to average quality in the industry (sector) in previous period used in expected demand updating (3).	The multiplicity associated with the number of industries (sectors) in the model.	Double
α_{15}	Scaling parameter expressing the percentage of expected demand that should be stored as optimal stock in (4).	One value.	Double
α_{16}	Scaling parameter expressing the percentage of relative revenue to costs incurred in the current period that should impact the optimal stock in (4).	One value.	Double
α_{17}	Scaling parameter expressing the percentage of relative revenue to costs incurred in the previous period that should impact the optimal stock in (4).	One value.	Double
α_{18}	Threshold for acceptable level of financial risk in (5).	One value.	Double
α_{19}	Threshold for acceptable level of leverage in (5).	One value.	Double
$\alpha_{20.s-buy.s}$	Parameter expressing the percentage of production that is to be bought from other industry (sector) if products are not necessarily exported or imported in (6).	The multiplicity associated with the number of industries (sectors) in the model. Please select the parameter for the sector of buyer.	Double
$\alpha_{21.s-buy.s}$	Parameter expressing the percentage of production that is to be bought from other industry (sector) if products are exported or imported in (6).	The multiplicity associated with the number of industries (sectors) in the model. Please select the parameter for the sector of buyer.	Double
$\alpha_{22.s-sup}$	Scaling parameter of quality of product or service given for the matched supplier in (7), (20).	The multiplicity associated with the number of industries (sectors) in the model. Please select the parameter for the sector of matched supplier.	Double
$\alpha_{22.s-est}$	Scaling parameter of quality of product or service given for any potential supplier in (7), (20).	The multiplicity associated with the number of industries (sectors) in the model. Please select the parameter for the establishment - new supplier (not the matched one).	Double
$\alpha_{23.s-sup}$	Scaling parameter of price given for the matched supplier in (7), (20).	The multiplicity associated with the number of industries (sectors) in the model. Please select the parameter for the sector of matched supplier.	Double
$\alpha_{23.s-est}$	Scaling parameter of price given for any potential supplier in (7), (20).	The multiplicity associated with the number of industries (sectors) in the model. Please select the parameter for the establishment - new supplier (not the matched one).	Double
$\alpha_{24.s-sup}$	Scaling parameter of average quality of the sector in which matched supplier operates in (7), (20).	The multiplicity associated with the number of industries (sectors) in the model. Please select the parameter for the sector of matched supplier.	Double
$\alpha_{24.s-est}$	Scaling parameter of average quality of the sector in which potential supplier operates in (7), (20).	The multiplicity associated with the number of industries (sectors) in the model. Please select the parameter for the establishment - new supplier (not the matched one).	Double
$\alpha_{25.s-sup}$	Scaling parameter of average price of the sector in which matched supplier operates in (7), (20).	The multiplicity associated with the number of industries (sectors) in the model. Please select the parameter for the sector of matched supplier.	Double
$\alpha_{25.s-est}$	Scaling parameter of average price of the sector in which potential supplier operates in (7), (20).	The multiplicity associated with the number of industries (sectors) in the model. Please select the parameter for the establishment - new supplier (not the matched one).	Double

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Tabella 10 – *Continued from previous page*

Parameter	Description	Remarks	Type
$\alpha_{26.s-sup}$	Parameter that help us to include the transportation costs in inputs expressed in monetary terms in (8), (9), (10).	The multiplicity associated with the number of industries (sectors) in the model. Please select the parameter for the sector of matched supplier.	Double
ξ_1	Probability of purchasing inputs from own funds without obtaining a loan in (8).	One value.	Double
α_{27}	Scaling parameter that affects the input loans (it is a percentage of liquid assets after paying wages & basic inputs in (9), (10).	One value.	Double
$\alpha_{28.b}$	Threshold for minimum ROA in (9), (10).	The multiplicity associated with the number of banks in the model.	Double
$\alpha_{29.b}$	Threshold for minimum ROE in (9), (10).	The multiplicity associated with the number of banks in the model.	Double
$\alpha_{30.b}$	Threshold for minimum profit for employee in (9), (10).	The multiplicity associated with the number of banks in the model.	Double
$\alpha_{31.b}$	Threshold for maximum ratio of debt to fixed capital of the firm in (9), (10).	The multiplicity associated with the number of banks in the model.	Double
$\alpha_{32.b}$	Threshold for max. financial risk in (9), (10).	The multiplicity associated with the number of banks in the model.	Double
$\alpha_{33.b}$	Threshold for max. average financial risk in the sector in (9), (10).	The multiplicity associated with the number of banks in the model.	Double
$\alpha_{34.b}$	Threshold for ratio of establishment' work force to average work force of establishments in the sector in (9), (10).	The multiplicity associated with the number of banks in the model.	Double
$\alpha_{35.b}$	Threshold for the ratio of loan to liquid assets in (9).	The multiplicity associated with the number of banks in the model.	Double
$\alpha_{36.b}$	Threshold for max. default rate of firm (proxy for credit history) in (9), (10).	The multiplicity associated with the number of banks in the model.	Double
$\alpha_{37.b}$	Threshold for the min. ratio of fixed capital of firm to number of establishments of the firm in (9), (10).	The multiplicity associated with the number of banks in the model.	Double
α_{38}	Value picked by the user as one of maturities in (9), (10).	One value.	Double
α_{39}	Value picked by the user as one of maturities in (9), (10).	One value.	Double
κ_1	Discount rate in (9), (10).	One value.	Double
α_{40}	Parameter expressing min. income per capita needed to survive (existance minimum) in (13).	One value.	Double
α_{41}	Parameter expressing social minimum in (13).	One value.	Double
α_{42}	Scaling parameter in net savings formula in (13).	One value.	Double
$\alpha_{43.tc.s}$	Parameters expressing how much (what % of) goods can be bought from different sectors taking into account deposits and loans burden in (14), (19).	The multiplicity associated with the occurrence of six types of consumers and a specified number of industries (sectors) in the model.	Double
ξ_2	Probability of taking a consumer loan in (14).	One value.	Double
α_{44}	Parameter expressing social minimum in (14), it can be equal to social minimum in (13) or it could be different, it depends on the user.	One value.	Double
$\alpha_{45.tc.s}$	Parameter that express how much consumer loan will be given (it depends on type of consumer, sector of goods the consumer wants to buy, percentage of total income of family less costs and loans burden) in (14).	The multiplicity associated with the occurrence of six types of consumers and a specified number of industries (sectors) in the model.	Double
$\alpha_{46.s}$	Fixed cost of obtaining a consumer loan. It depends on the sector of goods the consumer wants to buy in (14).	The multiplicity associated with the number of industries (sectors) in the model.	Double
ξ_3	Probability of obtaining a consumer loan in the matched bank in (14).	One value.	Double
α_{47}	Parameter expressing sectoral exposure regulation in (15), (16).	One value. .	Double
α_{48}	Percentage of consumer loan (always less than 1 to ensure adjustment of values) in (16).	One value.	Double
$\alpha_{49.b}$	Threshold for credit history of individuals for the purpose of consumer loans in (17), (18).	The multiplicity associated with the number of banks in the model. $\alpha_{49.m.b}$ means $\alpha_{49.b}$ for matched bank in the database or from the previous iteration.	Double
$\alpha_{50.b}$	Threshold for income less burden of individuals for the purpose of consumer loans in (17), (18).	The multiplicity associated with the number of banks in the model. $\alpha_{50.m.b}$ means $\alpha_{50.b}$ for matched bank in the database or from the previous iteration.	Double
α_{51}	Threshold for the quantity of loan that adjust the maturity to 20 iterations in (19).	One value.	Double
α_{52}	Threshold for the quantity of loan that adjust the maturity to 12 iterations in (19).	One value.	Double
α_{53}	Threshold for the quantity of loan that adjust the maturity to 8 iterations in (19).	One value.	Double
κ_2	Discount factor in case of consumer loans in (19).	One value.	Double
α_{54}	Auxiliary parameter needed to compute the probability of signing public contract – fixed part – in (21).	One value.	Double
α_{55}	Auxiliary parameter needed to compute the probability of signing public contract – scaling parameter expressing how this probability depends on firm work force – in (21).	One value.	Double
α_{56}	Auxiliary parameter needed to compute the probability of signing public contract – scaling parameter expressing how this probability depends on quality of the product – in (21).	One value.	Double
α_{57}	Percentage of production that should be stored in (21).	One value.	Double
α_{58}	Scaling parameter expressing how liquid assets and sales monetary changes after signing a public contract in (21).	One value.	Double
β_0	Parameter expressing fixed cost (part of the accomodation cost) if the household owns the property in (22).	One value.	Double

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Parameter	Description	Remarks	Type
β_1	Parameter determining the variable cost (part of the accomodation cost) if the household owns or rent the property in (22). It is a percentage of real estate loans burden.	One value.	Double
β_2	Parameter expressing the percentage of household's total income used as a threshold to determine housing stress in (22).	One value.	Double
β_3	Parameter expressing the percentage of price in $t-1$ after the property being marked as to be sold in (22), (23).	One value.	Double
β_4	The percentage of the property price that is attributable to this household. This information is used in the formula for accomodation cost in (22) and to update revenues when the property is sold in (23).	One value.	Double
β_5	Higher bound (threshold) for the price of the property to be bought (percentage of household's total income) in (22).	One value.	Double
β_6	Lower bound (threshold) for the price of the property to be bought (percentage of household's total income) in (22).	One value.	Double
β_7	Threshold for excessive burden in case of housing loans in (22).	One value.	Double
ξ_4	Probability of taking a housing loan (even if the household has enough funds to buy by cash) in (24).	One value.	Double
β_8	Regulatory DSTI cap in (26).	One value.	Double
β_9	Regulatory DTI cap in (26).	One value.	Double
β_{10}	Regulatory DTA cap in (26).	One value.	Double
β_{11}	Probability of applying for a housing loan in (26).	One value.	Double
β_{12}	Regulatory LTV cap for housing loans in (26).	One value.	Double
$\beta_{13.tc}$	Percentage of the difference between the price of property and available funds of household. It approximates the amount of non-housing loan that the household can obtain in (26). It depends on the type of consumers.	The multiplicity associated with the occurrence of six types of consumers and a specified number of industries (sectors) in the model.	Double
β_{14}	Regulatory LTV cap for non-housing loans on the pledge of the propoerty in (26).	One value.	Double
β_{15}	Percentage of the difference between deposits and debt of the household that can be used to obtain a housing loan in (26).	One value.	Double
κ_3	Discount rate in housing loans in (26.1), (26.2), (26.3), (26.4).	One value.	Double
β_{16}	Value of maturity set by the user based on empirical studies and expert knowledge in (26.3), (26.4).	One value.	Double
β_{17}	Value of maturity set by the user based on empirical studies and expert knowledge in (26.3), (26.4).	One value.	Double
β_{18}	Value of maturity set by the user based on empirical studies and expert knowledge in (26.3), (26.4).	One value.	Double
β_{19}	Threshold for the value of housing loans that determines the maturity of loans in (26.1), (26.2).	One value.	Double
ρ_0	Probability of decease in case of man over 10 or less, in (27).	One value.	Double
ρ_1	Probability of decease in case of man over 20 or less, but more than 10, in (27).	One value.	Double
ρ_2	Probability of decease in case of man over 30 or less, but more than 20, in (27).	One value.	Double
ρ_3	Probability of decease in case of man over 40 or less, but more than 30, in (27).	One value.	Double
ρ_4	Probability of decease in case of man over 50 or less, but more than 40, in (27).	One value.	Double
ρ_5	Probability of decease in case of man over 60 or less, but more than 50, in (27).	One value.	Double
ρ_6	Probability of decease in case of man over 70 or less, but more than 60, in (27).	One value.	Double
ρ_7	Probability of decease in case of man over 80 or less, but more than 70, in (27).	One value.	Double
ρ_8	Probability of decease in case of man over 90 or less, but more than 80, in (27).	One value.	Double
ρ_9	Probability of decease in case of man over 100 or less, but more than 90, in (27).	One value.	Double
ρ_{10}	Probability of decease in case of woman over 10 or less, in (27).	One value.	Double
ρ_{11}	Probability of decease in case of woman over 20 or less, but more than 10, in (27).	One value.	Double
ρ_{12}	Probability of decease in case of woman over 30 or less, but more than 20, in (27).	One value.	Double
ρ_{13}	Probability of decease in case of woman over 40 or less, but more than 30, in (27).	One value.	Double
ρ_{14}	Probability of decease in case of woman over 50 or less, but more than 40, in (27).	One value.	Double
ρ_{15}	Probability of decease in case of woman over 60 or less, but more than 50, in (27).	One value.	Double
ρ_{16}	Probability of decease in case of woman over 70 or less, but more than 60, in (27).	One value.	Double
ρ_{17}	Probability of decease in case of woman over 80 or less, but more than 70, in (27).	One value.	Double
ρ_{18}	Probability of decease in case of woman over 90 or less, but more than 80, in (27).	One value.	Double
ρ_{19}	Probability of decease in case of woman over 100 or less, but more than 90, in (27).	One value.	Double
β_{20}	Probability set by the user to allow for inheritance and aging in (27).	One value.	Double
β_{21}	Percentage of the difference between deposits and pending to be paid loans that is lost when inheritance in (29). Proxy for taxes and costs.	One value.	Double

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Tabella 10 – *Continued from previous page*

Parameter	Description	Remarks	Type
β_{22}	Percentage of the price of property that is lost when inheritance in (30). Proxy for taxes and costs.	One value.	Double
β_{23}	Probability of continuing education on second level when characteristics described in (33) are fulfilled.	One value.	Double
β_{24}	Probability of continuing education on third level when characteristics described in (33) are fulfilled.	One value.	Double
β_{25}	Probability of continuing education on third level when characteristics described in (33) are fulfilled.	One value.	Double
β_{26}	Probability of continuing education on fourth level when characteristics described in (33) are fulfilled.	One value.	Double
β_{27}	Probability of continuing education on fourth level when characteristics described in (33) are fulfilled.	One value.	Double
β_{28}	Probability of continuing education on fourth level when characteristics described in (33) are fulfilled.	One value.	Double
β_{29}	Probability of continuing education on fourth level when characteristics described in (33) are fulfilled.	One value.	Double
β_{30}	Probability of continuing education on fourth level when characteristics described in (33) are fulfilled.	One value.	Double
β_{31}	Probability of continuing education on fourth level when characteristics described in (33) are fulfilled.	One value.	Double
β_{32}	Probability of continuing education on fifth level when characteristics described in (33) are fulfilled.	One value.	Double
β_{33}	Probability of continuing education on fifth level when characteristics described in (33) are fulfilled.	One value.	Double
β_{34}	Probability of continuing education on sixth level when characteristics described in (33) are fulfilled.	One value.	Double
β_{35}	Probability of continuing education on sixth level when characteristics described in (33) are fulfilled.	One value.	Double
β_{36}	Probability of continuing education on seventh level when characteristics described in (33) are fulfilled.	One value.	Double
β_{37}	Probability of continuing education on seventh level when characteristics described in (33) are fulfilled.	One value.	Double
β_{38}	Probability of continuing education on eighth level when characteristics described in (33) are fulfilled.	One value.	Double
β_{39}	Percentage of wage that is donated for each child in (34).	One value.	Double
$\beta_{40.age}$	Probability of getting divorced that depends on age in (34).	Multiplicity associated with the ages intervals in the model.	Double
$\beta_{41.age}$	Probability of getting married that depends on age and ind.STATUS.CIVIL = 1, in (35)	Multiplicity associated with the ages intervals in the model.	Double
$\beta_{42.age}$	Probability of getting married that depends on age and ind.STATUS.CIVIL = 3, in (35)	Multiplicity associated with the ages intervals in the model.	Double
$\beta_{43.age}$	Probability of getting married that depends on age and ind.STATUS.CIVIL = 4, in (35)	Multiplicity associated with the ages intervals in the model.	Double
$\beta_{44.age}$	Probability of birth that depends on age of the mother and ind.STATUS.CIVIL != 2, in (36)	Multiplicity associated with the ages intervals in the model.	Double
$\beta_{45.age}$	Probability of birth that depends on age of the mother and ind.STATUS.CIVIL = 2, in (36)	Multiplicity associated with the ages intervals in the model.	Double
β_{46}	Parameter expressing how the entrepreneur spirit depends on gender, in (37), in case of unemployed person.	One value.	Double
β_{47}	Parameter expressing how the entrepreneur spirit depends on education level, in (37), in case of unemployed person.	One value.	Double
β_{48}	Parameter expressing how the entrepreneur spirit depends on experience as an entrepreneur in the past, in (37), in case of unemployed person.	One value.	Double
β_{49}	Parameter expressing how the entrepreneur spirit depends on age, in (37), in case of unemployed person.	One value.	Double
β_{50}	Parameter expressing how the entrepreneur spirit depends on periods from last change of status on the labor market, in (37), in case of unemployed person.	One value.	Double
β_{51}	Parameter expressing the lowest level of entrepreneur spirit in case of person older than 16 and unemployed, in (37), in case of unemployed person.	One value.	Double
β_{52}	Parameter expressing how the entrepreneur spirit depends on gender, in (37), in case of employed person.	One value.	Double
β_{53}	Parameter expressing how the entrepreneur spirit depends on education level, in (37), in case of employed person.	One value.	Double
β_{54}	Parameter expressing how the entrepreneur spirit depends on experience as an entrepreneur in the past, in (37), in case of employed person.	One value.	Double
β_{55}	Parameter expressing how the entrepreneur spirit depends on age, in (37), in case of unemployed person.	One value.	Double
β_{56}	Parameter expressing how the entrepreneur spirit depends on periods from last change of status on the labor market, in (37), in case of unemployed person.	One value.	Double

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Tablica 10 – *Continued from previous page*

Parameter	Description	Remarks	Type
β_{57}	Parameter expressing the lowest level of entrepreneur spirit in case of person employed, in (37).	One value.	Double
β_{58}	Parameter expressing how the entrepreneur spirit depends on gender, in (37), in case of inactive person.	One value.	Double
β_{59}	Parameter expressing how the entrepreneur spirit depends on education level, in (37), in case of inactive person.	One value.	Double
β_{60}	Parameter expressing how the entrepreneur spirit depends on experience as an entrepreneur in the past, in (37), in case of inactive person.	One value.	Double
β_{61}	Parameter expressing how the entrepreneur spirit depends on age, in (37), in case of inactive person.	One value.	Double
β_{62}	Parameter expressing how the entrepreneur spirit depends on periods from last change of status on the labor market, in (37), in case of inactive person.	One value.	Double
β_{63}	Parameter expressing the lowest level of entrepreneur spirit in case of person inactive, in (37).	One value.	Double
β_{64}	Parameter expressing how the entrepreneur spirit depends on gender, in (37), in case of person employed in public sector or owner of firm.	One value.	Double
β_{65}	Parameter expressing how the entrepreneur spirit depends on education level, in (37), in case of person employed in public sector or owner of firm.	One value.	Double
β_{66}	Parameter expressing how the entrepreneur spirit depends on experience as an entrepreneur in the past, in (37), in case of person employed in public sector or owner of firm.	One value.	Double
β_{67}	Parameter expressing how the entrepreneur spirit depends on age, in (37), in case of person employed in public sector or owner of firm.	One value.	Double
β_{68}	Parameter expressing how the entrepreneur spirit depends on periods from last change of status on the labor market, in (37), in case of person employed in public sector or owner of firm.	One value.	Double
β_{69}	Parameter expressing the lowest level of entrepreneur spirit in case of person employed in public sector or owner of firm, in (37).	One value.	Double
γ_0	Probability of opening a new firm by the entrepreneur in (38).	One value.	Double
γ_1	Scaling parameter in case of comparing firm's profits with the sector with the highest profits, in (38).	One value.	Double
γ_2	Parameter expressing how the probability of opening a new firm depends on other factors, in (38).	One value.	Double
γ_3	Parameter expressing how the probability of opening a new firm depends on experience in being an entrepreneur, in (38).	One value.	Double
γ_4	Parameter expressing how the probability of opening a new firm depends on level of education, in (38).	One value.	Double
γ_5	Parameter expressing how the probability of opening a new firm depends on age (scaling parameter), in (38).	One value.	Double
γ_6	Parameter expressing how the probability of opening a new firm depends on age (additonal effects), in (38).	One value.	Double
γ_7	Parameter expressing how the probability of opening a new firm depends on other factors, in (38).	One value.	Double
γ_8	Parameter expressing how the probability of opening a new firm depends on experience in being an entrepreneur, in (38).	One value.	Double
γ_9	Parameter expressing how the probability of opening a new firm depends on level of education, in (38).	One value.	Double
γ_{10}	Parameter expressing how the probability of opening a new firm depends on age (scaling parameter), in (38).	One value.	Double
γ_{11}	Parameter expressing how the probability of opening a new firm depends on age (additonal effects), in (38).	One value.	Double
γ_{12}	Scaling parameter related to the average work force in the establishments in the sector, in (39)	One value.	Double
γ_{13}	Scaling parameter related to the average work force in the establishments in the sector in the distribution of sizes of firms, in (39)	One value.	Double
γ_{14}	Scaling parameter related to the standar deviation of firm sizes in the distribution of sizes of firms, in (39).	One value.	Double
γ_{15}	Parameter that expresses the probability of obtaining a new license that also depends on license easiness and relative firm size to the average size in the sector, in (39).	One value.	Double
γ_{16}	Scaling parameter for the cost of new firm creation, in (40).	One value.	Double
$\gamma_{17.s}$	Scaling parameter for the cost of new firm creation, in (40), specific to the industry,	The multiplicity associated with the number of industries (sectors) in the model.	Double
γ_{18}	Scaling parameter for the firm market value that depends on cost of firm creation and other fixed capital, given by the entrepreneurs, in (40), (41.1.1), (41.2).	The multiplicity associated with the number of industries (sectors) in the model.	Double
γ_{19}	Scaling parameter for the liquid assets, in practice it is a percentage of fixed capital, given by the entrepreneurs, in (40), (41.1.1), (41.2).	The multiplicity associated with the number of industries (sectors) in the model.	Double

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Tabella 10 – *Continued from previous page*

Parameter	Description	Remarks	Type
γ_{20}	Threshold for the firms size to treat them as small and medium or big companies, in (40).	One value.	Double
γ_{21}	Sectoral exposure regulation, in (41.1).	One value.	Double
$\gamma_{22.b}$	Threshold for leverage ratio, in case of firm creation funding, in (41.1).	The multiplicity associated with the number of banks in the model.	Double
$\gamma_{23.b}$	Bank's ability to tolerate financial risk in new firm creation funding, in (41.1).	The multiplicity associated with the number of banks in the model.	Double
$\gamma_{24.b}$	Parameter expressing the tolerance of banks to deviations of new firm sizes from the sector average, in (41.1).	The multiplicity associated with the number of banks in the model.	Double
$\gamma_{25.b}$	Maximum acceptable level of sector's financial risk, in (41.1).	The multiplicity associated with the number of banks in the model.	Double
$\gamma_{26.b}$	Parameter expressing the acceptable credit history of the potential owner of a new firm, in (41.1).	The multiplicity associated with the number of banks in the model.	Double
γ_{27}	Parameter expressing the level of costs incurred in firm creation, that determines the maturity of investment loan, in (41.1.1).	One value.	Double
γ_{28}	Parameter expressing the maturity of loan depending on the costs incurred in firm creation, in (41.1.1).	One value.	Double
γ_{29}	Parameter expressing the level of costs incurred in firm creation, that determines the maturity of investment loan, in (41.1.1).	One value.	Double
γ_{30}	Parameter expressing the maturity of loan depending on the costs incurred in firm creation, in (41.1.1).	One value.	Double
γ_{31}	Parameter expressing the level of costs incurred in firm creation, that determines the maturity of investment loan, in (41.1.1).	One value.	Double
γ_{32}	Parameter expressing the maturity of loan depending on the costs incurred in firm creation, in (41.1.1).	One value.	Double
γ_{33}	Parameter expressing the maturity of loan depending on the costs incurred in firm creation, in (41.1.1).	One value.	Double
κ_4	Discount rate in case of investment loans, in (41.1.1).	One value.	Double
γ_{34}	Percentage of individual deposits that is provided to fund a new firm, in (41.2).	One value.	Double
γ_{35}	Parameter expressing how much market value depends on square root of firm's age, in (42).	One value.	Double
γ_{36}	Parameter expressing how much market value depends on relative profits to the average in the sector, in (42).	One value.	Double
γ_{37}	Parameter expressing how much market value depends on relative risk to the average in the sector, in (42).	One value.	Double
γ_{38}	Parameter expressing how much market value depends on square root of firm's age, in (42).	One value.	Double
γ_{39}	Parameter expressing how much market value depends on relative profits to the average in the sector, in (42).	One value.	Double
γ_{40}	Parameter expressing how much market value depends on relative risk to the average in the sector, in (42).	One value.	Double
γ_{41}	Parameter expressing how much market value depends on square root of firm's age, in (42).	One value.	Double
γ_{42}	Parameter expressing how much market value depends on relative profits to the average in the sector, in (42).	One value.	Double
γ_{43}	Parameter expressing how much market value depends on relative risk to the average in the sector, in (42).	One value.	Double
γ_{44}	Parameter expressing how much market value depends on square root of firm's age, in (42).	One value.	Double
γ_{45}	Parameter expressing how much market value depends on relative profits to the average in the sector, in (42).	One value.	Double
γ_{46}	Parameter expressing how much market value depends on relative risk to the average in the sector, in (42).	One value.	Double
γ_{47}	Parameter expresses the max ratio of debt to profits that should not be exceeded (this parameter is a percentage of firm profits), in (43).	One value. .	Double
γ_{48}	Parameter expresses the max ratio of debt to liquid assets and fixed capital that should not be exceeded (this parameter is a percentage of firm assets), in (43).	One value.	Double
γ_{49}	Parameter expresses the minimum market value that is acceptable in order to consider mergers, in (43).	One value.	Double
γ_{50}	Percentage of firms in the same sector to be chosen randomly, in (43).	One value.	Double
γ_{51}	Parameter expresses the level of market value that is acceptable in order to consider mergers, in (43).	One value.	Double
γ_{52}	Parameter expressing how firm debt is affected by the market value of the merged company, in (43).	One value.	Double
γ_{53}	Parameter expressing how owner's deposits are affected by the market value of the merged company, in (43).	One value.	Double
γ_{54}	Percentage of firms in the same sector to be chosen randomly, in (43), different than in case of γ_{42}.	One value.	Double
γ_{55}	Percentage of work force of firm, in (44), less than or equal to one.	One value.	Double
γ_{56}	Percentage of firm debt, in (44), less than or equal to one.	One value.	Double

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Tablica 10 – *Continued from previous page*

Parameter	Description	Remarks	Type
$\gamma_{57.age}$	Probability of getting unemployed, taking into account age and other factors expressed in (47).	Multiplicity associated with the ages intervals in the model.	Double
$\gamma_{58.age}$	Probability of getting unemployed, taking into account age and other factors expressed in (47).	Multiplicity associated with the ages intervals in the model.	Double
$\gamma_{59.age}$	Probability of getting inactive, taking into account age and other factors expressed in (47).	Multiplicity associated with the ages intervals in the model.	Double
γ_{60}	Auxiliary parameter used to define probability of getting inactive, taking into account age and other factors expressed in (47).	One value.	Double
γ_{61}	Auxiliary parameter used to define probability of getting inactive, taking into account age and other factors expressed in (47).	One value.	Double
$\gamma_{62.age}$	Probability of getting inactive, taking into account age and other factors expressed in (47).	Multiplicity associated with the ages intervals in the model.	Double
γ_{63}	Auxiliary parameter used to define probability of getting inactive, taking into account age and other factors expressed in (47).	One value.	Double
γ_{64}	Auxiliary parameter used to define probability of getting inactive, taking into account age and other factors expressed in (47).	One value.	Double
γ_{65}	Auxiliary parameter that ensures the dynamics of model. If individual is inactive, younger than 55 and does not have enough income to live, the status is changed to unemployed, in (47).	One value.	Double
γ_{66}	Parameter that relates the workers skills with age, in (48), when the individual is not unemployed.	One value.	Double
γ_{67}	Parameter that relates the workers skills with gender, in (48), when the individual is not unemployed.	One value.	Double
γ_{68}	Parameter that relates the workers skills with labor status, in (48), when the individual is not unemployed.	One value.	Double
γ_{69}	Parameter that relates the workers skills with level of education, in (48), when the individual is not unemployed.	One value.	Double
γ_{70}	Parameter that relates the workers skills with age, in (48), when the individual is unemployed.	One value.	Double
γ_{71}	Parameter that relates the workers skills with labor periods, in (48), when the individual is unemployed.	One value.	Double
γ_{72}	Percentage of work force to be hired, in (49).	One value.	Double
δ_1	Minimum subsidy according to the law, in (50), under predefined conditions.	One value.	Double
δ_2	Percentage of wage to be used in subsidy computation, in (50), under predefined conditions.	One value.	Double
δ_3	Predefined level of household income that conditions the level of subsidy, in (50), under predefined conditions.	One value.	Double
δ_4	Predefined level of subsidy, in (50), under predefined conditions.	One value.	Double
δ_5	Predefined level of subsidy, in (50), other than in δ_4, under predefined conditions.	One value.	Double
δ_6	Parameter that relates the wage with gender, in (50), under predefined conditions.	One value.	Double
δ_7	Parameter that relates the wage with gender, in (50), under predefined conditions.	One value.	Double
δ_8	Parameter that relates the wage with age, in (50), under predefined conditions.	One value.	Double
δ_9	Parameter that relates the wage with age and subsidy with wage, in (50), under predefined conditions.	One value.	Double
δ_{10}	Percentage that is recuparated after profit distribution in form of dividend, in (50).	One value.	Double
δ_{11}	Parameter that related the subsidy with gender, in (50), under predefined conditions.	One value.	Double
δ_{12}	Parameter that related the subsidy with gender, in (50), under predefined conditions.	One value.	Double
δ_{13}	Parameter that related the subsidy with average wage in the sector, in (50), under predefined conditions.	One value.	Double
δ_{14}	Percentage of profits that are redistributed as dividends, in (50).	One value.	Double
δ_{15}	Scaling parameter that help us to calibrate the wage, in (50), under predefined conditions.	One value.	Double
δ_{16}	Parameter expressing which part of input generates the cost for establishment, in (51).	One value.	Double
δ_{17}	Parameter expressing which part of establishment's debt generates the cost for establishment, in (51).	One value. .	Double
$\delta_{18.s}$	Parameter expressing which part of production generates the cost for establishment, in (51). Production from different sectors.	The multiplicity associated with the number of industries (sectors) in the model.	Double
$\delta_{19.s}$	Parameter expressing which part of work force generates the cost for establishment, in (51), from different sectors.	The multiplicity associated with the number of industries (sectors) in the model.	Double
δ_{20}	Parameter expressing which part of wages generates the cost for establishment, in (51).	One value.	Double
δ_{21}	Threshold for the ratio of profits per work force of the firm, in (51).	One value.	Double
δ_{22}	Parameter scaling in liquid assets updating in (51), direct relation with fixed capital of establishment.	One value.	Double
δ_{23}	Scaling parameter in liquid assets updating & fixed capital updating in (51).	One value.	Double
δ_{24}	Scaling parameter in fixed capital updating in (51).	One value.	Double
$\delta_{25.s}$	Scaling parameter of work force of establishment.	The multiplicity associated with the number of industries (sectors) in the model.	Double
$\delta_{26.s}$	Scaling parameter of work force of establishment.	The multiplicity associated with the number of industries (sectors) in the model.	Double

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Tablica 10 – *Continued from previous page*

Parameter	Description	Remarks	Type
δ_{27}	Threshold for sales monetary in (51).	One value.	Double
δ_{28}	Tax per worker in the establishment in (51).	One value.	Double
$\delta_{29.s}$	Financial risk specific to the industry (sector) in (52).	The multiplicity associated with the number of industries (sectors) in the model.	Double
δ_{30}	Parameter that relates firm's financial risk with work force in the firm, in (52).	One value.	Double
$\delta_{31.s}$	Parameter that relates firm's financial risk with ratio of work force in the firm to firm's debt, in (52). The values depend on sectors.	The multiplicity associated with the number of industries (sectors) in the model.	Double
δ_{32}	Scaling parameter that expresses how firm debt depends on financial risk, in (52).	One value.	Double
φ_1	Percentage of sum of loans grantes that is used to get approximation of cash, in (57).	One value.	Double
$\varphi_{lcr.min}$	Parameter expressing min LCR according to regulation, in (57).	One value.	Double
φ_3	Percentage of approximation of cash used in liquidity demand to central bank, in (57).	One value.	Double
φ_4	Parameter defining expected cash outflow, in (57).	One value.	Double
φ_5	Scaling parameter of bank deposits, used in outflow computing, in (57).	One value.	Double
φ_6	Scaling parameter of liquidity demand, used in outflow computing, in (57).	One value.	Double
φ_7	Parameter defining expected cash inflow, in (57).	One value.	Double
φ_8	Scaling parameter of sum of loans granted that defines expected cash inflow, in (57).	One value.	Double
φ_9	Scaling parameter of approximation of cash defining expected cash inflow, in (57).	One value.	Double
φ_{10}	Scaling parameter of bonds in expected cash inflow, in (57).	One value.	Double
φ_{11}	Scaling parameter of bank reserves in expected cash inflows, in (57).	One value.	Double
$\varphi_{min.c.req}$	Parameter expressing minimal capital requirement, in (57).	One value.	Double
φ_{13}	Percentage of bank deposits, in (57), to be compared with LCR.	One value.	Double
μ_1	Percentage of bank's supply given for the purpose of consumer loans, in (57, v.1, v.2).	One value.	Double
μ_2	Percentage of bank's supply given for the purpose of housing loans, in (57, v.1, v.2).	One value.	Double
μ_3	Percentage of bank's supply given for the purpose of non-housing loans, in (57, v.1, v.2).	One value.	Double
μ_4	Percentage of bank's supply given for the purpose of investment loans, in (57, v.1, v.2).	One value.	Double
μ_5	Percentage of bank's supply given for the purpose of loans for input purchase, in (57, v.1, v.2).	One value.	Double
ψ_1	Scaling paremeter in average perception indicator of individuals, in (58, v.2).	One value.	Double
ψ_2	Scaling paremeter in average perception indicator of individuals, in (58, v.2).	One value.	Double
ψ_3	Scaling paremeter in average perception indicator of individuals, in (58, v.2).	One value.	Double
ψ_4	Scaling paremeter in average perception indicator of individuals, in (58, v.2).	One value.	Double
ψ_5	Scaling paremeter in average perception of perception indicator of individuals, in (58, v.2).	One value.	Double
ψ_6	Scaling paremeter in average perception indicator of establishments, in (58, v.2).	One value.	Double
ψ_7	Scaling paremeter in average perception of perception indicator of establishments, in (58, v.2).	One value.	Double
v_1	Scaling parameter in 46.	One value.	Double
v_2	Scaling parameter in 46.	One value.	Double
v_3	Parameter that affects the defaults of firms (the level of indebtedness that is acceptable).	One value.	Double
$\zeta_1 - \zeta_9$	Parameters that set the margin of product being sold.	One value.	Double

Pseudocodes

Data: GUS
Result: Sector profitability (1)
Initialization;
for *all sectors* **do**
  if *sector.SECTOR.FIRMS$_t$!=0 && sector.PROFIT.SECT$_t$ $\geq$0* **then**
    temp.SECT.EXPECT.PROF.sector = $\frac{\text{sector.PROFIT.SECT}_t}{\text{sector.SECTOR.FIRMS}_t}$
  else
    temp.SECT.EXPECT.PROF.sector =0
  end
end

order according to relative profitability

compute two with highest profitability

temp.HI.SECT.EXP.PROF = sector.id.1
temp.SEC.SECT.EXP.PROF = sector.id.2

for *all banks* **do**
  remember the values of supply of different credit
  temp.SUPPLY.CONS.LOANS = bank.SUPPLY.CONS.LOANS$_t$
  temp.SUPPLY.RE.H.LOANS = bank.SUPPLY.RE.H.LOANS$_t$
  temp.SUPPLY.RE.NH.LOANS = bank.SUPPLY.RE.NH.LOANS$_t$
  temp.SUPPLY.FIRM.INV.LOANS = bank.SUPPLY.FIRM.INV.LOANS$_t$
  temp.SUPPLY.Q.BUY.EST = bank.SUPPLY.Q.BUY.EST$_t$
  /*we use the values in (55)*/
end

Data: GUS
Result: Price updating (2)
for *all establishments* **do**
  set
  est.PRICE$_{t-1}$ = est.PRICE$_t$
  est.WF.HIRED$_t$ = 0
  est.WF.FIRED$_t$ = 0
  compute
  if *sector.QUALITY.SECT != 0* **then**
    temp.MAX.PROD = $\alpha_{1.s}$(est.WORK.PROD$_t$+1)$^{\alpha 2.s}$ (est.FIX.CAP.EST$_t$)$^{\alpha 3.s}$ ($\frac{\text{est.QUALITY}_t}{\text{sector.QUALITY.SECT}_t}$)$^{\alpha 4.s}$ (est.KNOW.HOW$_t$)$^{\alpha 5.s}$
  else
    temp.MAX.PROD = $\alpha_{1.s}$(est.WORK.PROD$_t$+1)$^{\alpha 2.s}$ (est.FIX.CAP.EST$_t$)$^{\alpha 3.s}$ ($\frac{\text{est.QUALITY}_t}{0.0001}$)$^{\alpha 4.s}$ (est.KNOW.HOW$_t$)$^{\alpha 5.s}$
  end
  if *est.DEMAND$_t$ > est.EXP.DEMAND$_t$ && est.PROD$_t$ > α_6 $\times$ temp.MAX.PROD* **then**
    est.PRICE$_t$ = max{0, $\alpha_{7.s}$ $\times$ est.PRICE$_t$};
  else if *est.DEMAND$_t$ < α_8 $\times$ est.EXP.DEMAND$_t$ && est.PROD$_t$ < α_9 $\times$ temp.MAX.PROD* **then**
    est.PRICE$_t$ = max{0, $\alpha_{10.s}$ $\times$ est.PRICE$_t$};
  else
    nothing changes;
  end
end

Data: GUS
Result: Expected demand updating (3)
for *all establishments* **do**
  compute
  if *sector.PRICE.SECT$_t$ =0 || sector.PRICE.SECT$_{t-1}$ = 0|| sector.QUALITY.SECT$_t$=0 || sector.QUALITY.SECT$_{t-1}$ =0* **then**
    temp.EXP.DEMAND = 0.8
  else
    temp.EXP.DEMAND = $\alpha_{11.s}\frac{\text{est.PRICE}_t}{\text{sector.PRICE.SECT}_t}+\alpha_{12.s}\frac{\text{est.PRICE}_{t-1}}{\text{sector.PRICE.SECT}_{t-1}}+\alpha_{13.s}\frac{\text{est.QUALITY}_t}{\text{sector.QUALITY.SECT}_t}+\alpha_{14.s}\frac{\text{est.QUALITY}_{t-1}}{\text{sector.QUALITY.SECT}_{t-1}}$
  end
  if *est.EST.NEW$_t$ = 0 && est.DEMAND$_t$>0* **then**
    est.EXP.DEMAND$_t$ = max{0, temp.EXP.DEMAND $\times$ est.DEMAND$_t$};
  else
    est.EXP.DEMAND$_t$ = max{0, temp.EXP.DEMAND $\times$ (est.WF.EST$_t$+1) $\times$ sector.AVE.SALES.FIRM.SECT$_t$};
  end
end

Data: GUS
Result: Expected stock of products updating (4)
for *all establishments* **do**
  if *est.EST.NEW$_t$>0* **then**
    est.STOCK.OPT$_t$ = max{0,α_{15} $\times$ est.EXP.DEMAND$_t$};
  else
    est.STOCK.OPT$_t$ = max{0,α_{15} $\times$ est.EXP.DEMAND$_t$ + α_{16} $\times$ $\frac{\text{est.PRICE}_t \times \text{est.EXP.DEMAND}_t}{\text{est.COST}_t}$ + α_{17} $\times$ $\frac{\text{est.SALES.MONET}_t}{\text{est.COST}_{t-1}}$};
  end
end

Data: GUS
Result: Production (5)
for *all firms* **do**
  temp.firm.LEVER = max{0, $\frac{\text{firm.FIRM.DEBT}_t}{\text{firm.FIX.CAP.FIRM}_t}$}
end
for *all establishments* **do**
  check to which firm belongs establishment
  if *est.STOCK.OPT$_t$ < est.STOCK$_t$* **then**
    est.PROD$_t$ = 0;
  else if *firm.FINANCIAL.RISK$_t$ < α_{18} && temp.firm.LEVER < α_{19}* **then**
    est.PROD$_t$ =max{0, min(temp.MAX.PROD; est.STOCK.OPT$_t$ $-$ est.STOCK$_t$)};
    est.STOCK$_t$ + = est.PROD$_t$;
  else
    est.PROD$_t$ = 0;
  end
end

Data: GUS
Result: Quantity of inputs, import & export (6)
for *all establishments* **do**
  check est.SECTOR.ID and according to sector select appropriate $\alpha_{20.\mathbf{s}\text{-}buy.s}$
  set
  est.INPUTS$_t$ = 0
  est.SALES.MONET$_t$ = 0
  est.DEMAND$_t$ = 0
  if *(est.EXP.IMP$_t$ == 1 || est.EXP.IMP$_t$ == 3)* **then**
    for *all sectors* **do**
      compute the value of inputs from the sector
      buy.(sup).Q.BUY.EST(.s)$_t$= max{0,$\alpha_{20.\mathbf{s}\text{-}buy.s}$ × est.PROD$_t$ × $\alpha_{21-buy.s}$};
    end
    compute the value of total quantity of inputs from all sectors that are needed
    for *all sectors* **do**
      buy.(sup.)Q.BUY.EST$_t$ + = buy.(sup).Q.BUY.EST(.s)$_t$
    end
  else
    for *all sectors* **do**
      compute the value of inputs from the sector
      buy.(sup).Q.BUY.EST(.s)$_t$ = max{0,$\alpha_{20.\mathbf{s}\text{-}buy.s}$ × est.PROD$_t$};
    end
    compute the value of total quantity of inputs from all sectors that are needed
    for *all sectors* **do**
      buy.(sup.)Q.BUY.EST$_t$ + = buy.(sup).Q.BUY.EST(.s)$_t$;
    end
  end
end

Result: Supplier selection (7)
for *all establishments* **do**
  for *all sectors* **do**
  look for supplier in each of sectors (−.s)
  if for any sector s buy.(sup).Q.BUY.EST(.s.)$_t$ = 0, then supplier matched in the system will be maintained and will give you 0 of his supply

  e.g. establishment from sector 1 ($buy._{s=1}$) wants to buy inputs buy.(sup).Q.BUY.EST(.s.)$_t$ from each sector s (e.g. s = 1,.., 8 or 73). The amount of inputs buy.(sup).Q.BUY.EST(.s.)$_t$ is different for each of sectors from (1) to (73) /*or (1) to (8) sectors if we group establishments-suppliers from different industries defined by GUS into our 'sectors'*/.

  buy.(sup).Q.BUY.EST(.s.)$_t$ is different for each sector because $\alpha_{20.s-buy.s}$ in (6) is sector-to-sector specific (specific for the sector that buys and sector that sells).

  The sum of buy.(sup).Q.BUY.EST(.s.)$_t$ would give us all inputs from different sectors that are needed to produce final goods by a buyer.

  check the matched supplier first (first verse of code, the rest of code is for not a matched supplier).

  if *sup.(est.)(.s)STOCK$_t$ > buy.(est.)Q.BUY.EST(.s)$_t$* && $\frac{\alpha_{22.s-sup} \times sup.(est.)(.s)QUALITY_t}{\alpha_{23.s-sup} \times sup.(est.)(.s)PRICE_t} > \frac{\alpha_{24.s-sup} \times sector.QUALITY.SECT_t}{\alpha_{25.s-sup} \times sector.PRICE.SECT_t}$ **then**
    Go to ***Purchase*** ;
  Get the establishments (est) of sector s-sup with est.SPATIAL.CODE1=buy.SPATIAL.CODE1 &&
  est.SPATIAL.CODE2=buy.SPATIAL.CODE2 && est.SPATIAL.CODE3=buy.SPATIAL.CODE3 &&
  est.SPATIAL.CODE4=buy.SPATIAL.CODE4
  For each selected establishment
  else if *(est.(.s)STOCK$_t$ > buy.Q.BUY.EST(.s)$_t$* && $\frac{\alpha_{22.s-est} \times est.(.s)QUALITY_t}{\alpha_{23.s-est} \times est.(.s)PRICE_t} > \frac{\alpha_{24.s-est} \times sector.QUALITY.SECT_t}{\alpha_{25.s-est} \times sector.PRICE.SECT_t}$ *)*
  || (est.(.s)STOCK$_t$ > buy.Q.BUY.EST(.s)$_t$ && est.(.s)EST.NEW$_t$ > 0) **then**
    buy.supplier.id=establishment.id
    Go to ***Purchase*** ;
  Get the establishments (est) of sector s-sup with est.SPATIAL.CODE1!=buy.SPATIAL.CODE1 &&
  est.SPATIAL.CODE2=buy.SPATIAL.CODE2 && est.SPATIAL.CODE3=buy.SPATIAL.CODE3 &&
  est.SPATIAL.CODE4=buy.SPATIAL.CODE4
  For each selected establishment
  else if *est.(.s)STOCK$_t$ > buy.Q.BUY.EST(.s)$_t$* && $\frac{\alpha_{22.s-est} \times est.(.s)QUALITY_t}{\alpha_{23.s-est} \times est.(.s)PRICE_t} > \frac{\alpha_{24.s-est} \times sector.QUALITY.SECT_t}{\alpha_{25.s-est} \times sector.PRICE.SECT_t}$
  || (est.(.s)STOCK$_t$ > buy.Q.BUY.EST(.s)$_t$ && est.(.s)EST.NEW$_t$ > 0) **then**
    buy.supplier.id=establishment.id
    Go to ***Purchase*** ;
  Get the establishments (est) of sector s-sup with est.SPATIAL.CODE1!=buy.SPATIAL.CODE1 &&
  est.SPATIAL.CODE2!=buy.SPATIAL.CODE2 && est.SPATIAL.CODE3=buy.SPATIAL.CODE3 &&
  est.SPATIAL.CODE4=buy.SPATIAL.CODE4
  For each selected establishment
  else if *est.(.s)STOCK$_t$ > buy.Q.BUY.EST(.s)$_t$* && $\frac{\alpha_{22.s-est} \times est.(.s)QUALITY_t}{\alpha_{23.s-est} \times est.(.s)PRICE_t} > \frac{\alpha_{24.s-est} \times sector.QUALITY.SECT_t}{\alpha_{25.s-est} \times sector.PRICE.SECT_t}$
  || (est.(.s)STOCK$_t$ > buy.Q.BUY.EST(.s)$_t$ && est.(.s)EST.NEW$_t$ > 0) **then**
    buy.supplier.id=establishment.id
    Go to ***Purchase*** ;
  Get the establishments (est) of sector s-sup with est.SPATIAL.CODE1!=buy.SPATIAL.CODE1 &&
  est.SPATIAL.CODE2!=buy.SPATIAL.CODE2 && est.SPATIAL.CODE3!=buy.SPATIAL.CODE3 &&
  est.SPATIAL.CODE4=buy.SPATIAL.CODE4
  For each selected establishment
  else if *est.(.s)STOCK$_t$ > buy.Q.BUY.EST(.s)$_t$* && $\frac{\alpha_{22.s-est} \times est.(.s)QUALITY_t}{\alpha_{23.s-est} \times est.(.s)PRICE_t} > \frac{\alpha_{24.s-est} \times sector.QUALITY.SECT_t}{\alpha_{25.s-est} \times sector.PRICE.SECT_t}$
  || (est.(.s).STOCK$_t$ > buy.Q.BUY.EST(.s)$_t$ && est.(.s)EST.NEW$_t$ > 0) **then**
    buy.supplier.id=establishment.id
    Go to ***Purchase*** ;
    Get the establishments (est) of sector s-sup with est.SPATIAL.CODE1!=buy.SPATIAL.CODE1 &&
    est.SPATIAL.CODE2!=buy.SPATIAL.CODE2 && est.SPATIAL.CODE3!=buy.SPATIAL.CODE3 &&
    est.SPATIAL.CODE4!=buy.SPATIAL.CODE4
    For each selected establishment
    else if *est.(.s)STOCK$_t$ > buy.Q.BUY.EST(.s)$_t$* && $\frac{\alpha_{22.s-est} \times est.(.s)QUALITY_t}{\alpha_{23.s-est} \times est.(.s)PRICE_t} > \frac{\alpha_{24.s-est} \times sector.QUALITY.SECT_t}{\alpha_{25.s-est} \times sector.PRICE.SECT_t}$
    || (est.(.s)STOCK$_t$ > buy.Q.BUY.EST(.s)$_t$ && est.(.s)EST.NEW$_t$ > 0) **then**
      buy.supplier.id=establishment.id
      Go to ***Purchase*** ;
    end
  else
    buy part from the first one and the second part from the second one, both from the same sector
    check {*8.1. *} after pseudocodes 8
  end
end

Data: GUS
Result: Inputs purchase (8)
for *all establishments* **do**
  set
  temp.TRAN.COST = 0
  if *buy.(est.)SPATIAL.CODE4!=sup.(est.)SPATIAL.CODE4 || buy.(est.)SPATIAL.CODE3!=sup.(est.)SPATIAL.CODE3 || buy.(est.)SPATIAL.CODE2!=sup.(est.)SPATIAL.CODE2* **then**
    temp.TRAN.COST=1;
  else
    temp.TRAN.COST=0 ;
  end

  check whether it has sufficient buy.(est).LIQ.ASSETS.EST$_t$
  for *all suppliers that the establishment has from different sectors* **do**
    compute the sum of inputs expressed monetary from each supplier from each sector
    temp.COST.OF.BUYING.INPUTS + = (1+ $\alpha_{26.s-sup}$ × temp.TRAN.COST)×sup.(est.)PRICE$_t$ × buy.(sup.)Q.BUY.EST(.s)$_t$
  end
  if *buy.(est.)LIQ.ASSETS.EST$_t$− buy.(est.)WAGES.EST$_t$ ≥ temp.COST.OF.BUYING.INPUTS* **then**
    if *probability* ξ_1 **then**
      buy.(est.)INPUTS$_t$+ = temp.COST.OF.BUYING.INPUTS ;
      buy.(est.)LIQ.ASSETS.EST$_t$− = temp.COST.OF.BUYING.INPUTS;
      for *all suppliers from all sectors that provided inputs to establishment* **do**
        sup.(est)SALES.MONET$_t$+ = sup.(est.)PRICE$_t$ × (1 + ζ_1) ×buy.(sup.)Q.BUY.EST(.s)$_t$;
        sup.(est.)DEMAND$_t$+ = buy.(sup.)Q.BUY.EST(.s)$_t$;
        sup.(est.)LIQ.ASSETS.EST$_t$+ = sup.(est.)PRICE$_t$ × (1 + ζ_2)× buy.(sup.)Q.BUY.EST(.s)$_t$;
        sup.(est.)STOCK$_t$− = buy.(sup.)Q.BUY.EST(.s)$_t$;
      end
    else
      Go to ***Bank credit admissibility.1***
    end
  else
    if *buy.(est.)LIQ.ASSETS.EST$_t$ < temp.COST.OF.BUYING.INPUTS* **then**
      check whether you could get funding from bank
      Go to ***Bank credit admissibility.2***
    else
      readjust the quantity
      for *all suppliers from all sectors that provided inputs to establishment* **do**
        if *sup.(est.)PRICE$_t$>0* **then**
          temp.round.Q.BUY.EST.(s)=max{0,round.4.decimals($\frac{(\text{buy.LIQ.ASSETS.EST}_t - \text{est.WAGES.EST}_t)\times\alpha_{20.s-buy.s}}{\text{sup.(est.)PRICE}_t\times(1+\alpha_{26.s.-sup}\times\text{temp.TRAN.COST})}$)}
        else
          temp.round.Q.BUY.EST.(s)=max{0,round.4.decimals($\frac{(\text{buy.LIQ.ASSETS.EST}_t - \text{est.WAGES.EST}_t)\times\alpha_{20.s-buy.s}}{1\times(1+\alpha_{26.s.-sup}\times\text{temp.TRAN.COST})}$)}
        end
        temp.round.INPUTS(.s) = temp.round.Q.BUY.EST.(s) × sup.(est.)PRICE$_t$ × (1+ $\alpha_{26.s-sup}$ × temp.TRAN.COST)
      end
      compute temp.round.INPUTS as a sum of temp.round.INPUTS(.s) for all sectors;
      for *all sectors that provided inputs to establishment* **do**
        temp.round.INPUTS + = temp.round.INPUTS(.s)
      end
      buy only that quantity of total inputs
      for *establishment− buyer* **do**
        buy.(est.)INPUTS$_t$+= temp.round.INPUTS;
        buy.(est.)LIQ.ASSETS.EST$_t$ −=temp.round.INPUTS
      end
      for *all suppliers from all sectors that provided inputs to establishment* **do**
        sup.(est.)SALES.MONET$_t$+=sup.(est.)PRICE$_t$ × (1 + ζ_1)×temp.round.Q.BUY.EST(.s);
        sup.(est.)DEMAND$_t$+= temp.round.Q.BUY.EST(.s);
        sup.(est.)LIQ.ASSETS.EST$_t$+=sup.(est.)PRICE$_t$ × (1 + ζ_2)× temp.round.Q.BUY.EST(.s);
        sup.(est.)STOCK$_t$−= temp.round.Q.BUY.EST(.s)
      end
      Go to ***Pseudocode 11***: ***Individual income***
    end
  end
end

Pseudocode (8.1.) The last part of pseudocode {* *}

If for determined sector there was no chance to buy all buy.Q.BUY.EST(.s)$_t$ from one supplier (matched or any other establishment form this sector)

buy part from the matched establishment-supplier from the sector and the rest from any other

check whether the establishment–buyer has sufficient buy.(est.)LIQ.ASSETS.EST$_t$ to buy inputs

for *all suppliers that the establishment has from different sectors* **do**

compute the sum of inputs expressed monetary from each supplier from each sector

temp.COST.OF.BUYING.INPUTS + = sup.(est.)PRICE$_t$ × buy.(sup.)Q.BUY.EST(.s)$_t$× (1+ $\alpha_{26.s-sup}$ × temp.TRAN.COST)

end

if *buy.(est.)LIQ.ASSETS.EST$_t$– buy.(est.)WAGES.EST$_t$ ≥ temp.COST.OF.BUYING.INPUTS* **then**

if *probability* ξ_1 **then**

for *establishment – buyer* **do**

for *suppliers from each of the sectors* **do**

buy.(est.)INPUTS$_t$+ =[(1 + $\alpha_{26.s-sup}$× temp.TRAN.COST)×sup.(est1).(s).STOCK$_t$× sup.(est1).PRICE] + [(1 + $\alpha_{26.s-sup}$× temp.TRAN.COST)× [(sup2.(est)PRICE$_t$ × (buy.(sup.)Q.BUY.EST(.s)$_t$– sup.(est1).(s).STOCK$_t$)];

buy.(est.)LIQ.ASSETS.EST$_t$ – = (1+ $\alpha_{26.s-sup}$× temp.TRAN.COST) × sup.(est.)PRICE$_t$× buy.(sup.)Q.BUY.EST(.s)$_t$;

end

end

for *all sectors* **do**

for *all suppliers in the sector that provide inputs to the buyer* **do**

sup.(est1)SALES.MONET$_t$+ = sup.(est1.)PRICE$_t$ × (1 + ζ_3) × sup.(est1.)STOCK$_t$;

sup.(est2)SALES.MONET$_t$+ = sup.(est2.)PRICE$_t$ × (1 + ζ_3) × (buy.(sup.)Q.BUY.EST(.s)$_t$ - sup.(est1.)STOCK$_t$) ;

sup.(est1.)DEMAND$_t$+ = sup.(est1).(s).STOCK$_t$;

sup.(est2.)DEMAND$_t$+ = buy.(sup.)Q.BUY.EST(.s)$_t$ - sup.(est1).(s).STOCK$_t$;

sup.(est2).(s).STOCK$_t$ – = buy.Q.BUY.EST(.s)$_t$–sup.(est1).(s).STOCK$_t$

sup.(est1).(s).STOCK$_t$ = 0

sup.(est1.)LIQ.ASSETS.EST$_t$+ = sup.(est.)PRICE$_t$ × (1 + ζ_4)× sup.(est1).(s).STOCK$_t$;

sup.(est2.)LIQ.ASSETS.EST$_t$+ = sup.(est.)PRICE$_t$ × (1 + ζ_4)× (buy.(sup.)Q.BUY.EST(.s)$_t$– sup.(est1).(s).STOCK$_t$) ;

end

end

else

Go to ***Bank credit admissibility.1***

end

else

if *buy.(est.)LIQ.ASSETS.EST$_t$ < temp.COST.OF.BUYING.INPUTS* **then**

check whether you could get funding from bank

Go to ***Bank credit admissibility.2***

else

readjust the quantity

for *all suppliers from all sectors that provided inputs to establishment* **do**

if *sup.(est.)PRICE$_t$>0* **then**

temp.round.Q.BUY.EST(.s)=max{0,round.4.decimals($\frac{(\text{buy.LIQ.ASSETS.EST}_t-\text{est.WAGES.EST}_t)\times\alpha_{20.s-buy.s}}{\text{sup.(est).PRICE}_t\times(1+\alpha_{26.s-sup}\times\text{temp.TRAN.COST})}$)}

else

temp.round.Q.BUY.EST(.s)=max{0,round.4.decimals($\frac{(\text{buy.LIQ.ASSETS.EST}_t-\text{est.WAGES.EST}_t)\times\alpha_{20.s-buy.s}}{1\times(1+\alpha_{26.s-sup}\times\text{temp.TRAN.COST})}$)}

end

temp.round.INPUTS(.s) = temp.round.Q.BUY.EST(.s) × sup.(est1).PRICE$_t$ × (1+ $\alpha_{26.s-sup}$ × temp.TRAN.COST)

end

compute temp.round.INPUTS as a sum for temp.round.Q.BUY.EST(.s) for all sectors ;

for *all sectors that provided inputs to establishments* **do**

temp.round.INPUTS + = temp.round.INPUTS(.s)

end

buy only that quantity of total inputs

for *establishment – buyer* **do**

buy.(est.)INPUTS$_t$+= temp.round.INPUTS;

buy.(est.)LIQ.ASSETS.EST$_t$–= temp.round.INPUTS

end

for *suppliers in the sectors* **do**

sup.(est.)SALES.MONET$_t$+=sup.(est.)PRICE$_t$ × (1 + ζ_3)× sup.(est.)STOCK$_t$;

sup.(est.)SALES.MONET$_t$+=sup.(est.)PRICE$_t$ × (1 + ζ_3)×(temp.round.Q.BUY.EST(.s)$_t$ – sup.(est.)STOCK$_t$;

sup.(est1.)DEMAND$_t$+= sup.(est1).STOCK$_t$;

sup.(est2.)DEMAND$_t$+= temp.round.Q.BUY.EST(.s);

sup.(est1.)LIQ.ASSETS.EST$_t$ + = sup.(est.)PRICE$_t$ ×(1 + ζ_4)× sup.(est1.)(s).STOCK$_t$

sup.(est2.)LIQ.ASSETS.EST$_t$ + = sup.(est.)PRICE$_t$ ×(1 + ζ_4)× (temp.round.Q.BUY.EST(.s)– sup.(est1).(s).STOCK$_t$)

sup.(est2.)STOCK$_t$–= temp.round.Q.BUY.EST(.s)–sup.(est1).(s).STOCK$_t$;

sup.(est1.)STOCK$_t$= 0

end

end

end

Data: GUS, SIS

Result: Bank short term credit admissibility.1 (9)
compute quantity of loan to buy inputs
est.Q.BUY.EST.LOANS$_t$ = α_{27} × (buy.(est.)LIQ.ASSETS.EST$_t$ − est.WAGES.EST$_t$− temp.COST.OF.BUYING.INPUTS)
check whether the matched bank is able to give that quantity (est.BANK.Q.BUY.EST.ID, auxiliary: bank.BANK.ID)
if *bank.SUPPLY.Q.BUY.LOANS$_t$* ≥ *est.Q.BUY.EST.LOANS$_t$* **then**
  check whether the establishment is suitable for a loan in that bank ;
  check to which firm the establishment belongs to (est.FIRM.ID, auxiliary: firm.FIRM.ID) ;
  if *firm.FIRM.PROFIT$_t$ =!0* **then**
    temp.firm.ROA = max{0, $\frac{\text{firm.FIRM.PROFIT}_t}{\text{firm.LIQ.ASSETS.FIRM}_t}$}
  else
    temp.firm.ROA=0
  end
  if *firm.FIX.CAP.FIRM$_t$ =!0* **then**
    temp.firm.ROE = max{0, $\frac{\text{firm.FIRM.PROFIT}_t}{\text{firm.FIX.CAP.FIRM}_t}$}
  else
    temp.firm.ROE=0
  end
  if temp.firm.ROA > $\alpha_{28.b}$ && temp.firm.ROE > $\alpha_{29.b}$
  && $\frac{\text{firm.FIRM.PROFIT}_t}{\text{firm.WF.FIRM}_t+1}$ >$\alpha_{30.b}$
  && max{0, $\frac{\text{firm.FIRM.DEBT}_t}{\text{firm.FIX.CAP.FIRM}_t}$} < $\alpha_{31.b}$ && firm.FINANCIAL.RISK$_t$ < $\alpha_{32.b}$
  && sector.AVE.FINANCIAL.RISK$_t$ < $\alpha_{33.b}$
  && $\frac{(\text{est.WF.EST}_t+1)}{\text{sector.AVE.SECT.WF.EST}_t}$ > $\alpha_{34.b}$ && $\frac{\text{est.Q.BUY.EST.LOANS}_t}{\text{est.Q.BUY.EST.LOANS}_t+\text{est.LIQ.ASSETS.EST}_t-\text{est.WAGES.EST}_t}$ < $\alpha_{35.b}$
  && firm.DEFAULT.FIRM$_t$< $\alpha_{36.b}$
  && $\frac{\text{firm.FIX.CAP.FIRM}_t}{\text{firm.NO.ESTABLISH.OF.FIRM}_t}$ > $\alpha_{37.b}$ **then**
    bank gives the credit
    {* **choose** at random est.Q.BUY.EST.LOANS.MAT$_t$ from set {4, α_{38}, α_{39}}
    check the interest rate that has to be paid bank.IR.Q.BUY.EST.LOANS$_t$
    for *establishment-buyer* **do**
      tempQ.BUY.EST.LOANS=0
      tempQ.BUY.EST.LOANS = α_{27} × buy.(est.)LIQ.ASSETS.EST$_t$ − est.WAGES.EST$_t$− temp.COST.OF.BUYING.INPUTS
      est.Q.BUY.EST.LOANS$_t$+= α_{27} × (buy.(est.)LIQ.ASSETS.EST$_t$ − est.WAGES.EST$_t$− temp.COST.OF.BUYING.INPUTS)
      est.Q.BUY.EST.LOANS.QUARTERLY$_t$ = $\frac{\text{est.Q.BUY.EST.LOANS}_t}{\text{est.Q.BUY.EST.LOANS.MAT}_t}$ est.INTEREST.TO.BE.PAID.Q.BUY.EST$_t$ + =
        $\frac{1}{\kappa_1}$ × (temp.Q.BUY.EST.LOANS × (1 + 0.25 × bank.IR.Q.BUY.EST$_t$)$^{\text{est.Q.BUY.EST.LOANS.MAT}_t}$ −
        temp.Q.BUY.EST.LOANS)
      temp.AUXILIARY = $\frac{\text{est.INTEREST.TO.BE.PAID.Q.BUY.EST}_t}{\text{est.Q.BUY.EST.LOANS.MAT}_t}$
      est.INTEREST.TO.BE.PAID.Q.BUY.EST.QUARTERLY$_t$ = $\frac{\text{est.INTEREST.TO.BE.PAID.Q.BUY.EST}_t}{\text{est.Q.BUY.EST.LOANS.MAT}_t}$
      buy.(est.)INPUTS$_t$+= temp.COST.OF.BUYING.INPUTS;
      buy.(est.)LIQ.ASSETS.EST$_t$−= temp.COST.OF.BUYING.INPUTS - temp.Q.BUY.EST.LOANS
    end
    for *bank* **do**
      bank.REV.Q.BUY.EST$_t$ + = temp.AUXILIARY
      bank.SUPPLY.Q.BUY.EST.LOANS$_t$ − =
        α_{27} × (buy.(est.)LIQ.ASSETS.EST$_t$ − est.WAGES.EST$_t$-temp.COST.OF.BUYING.INPUTS)
    end
    for *all suppliers from sectors that provided inputs to establishment* **do**
      sup.(est.)SALES.MONET$_t$+=sup.(est.)PRICE$_t$ × (1 + ζ_5)×est.Q.BUY.EST(.s)$_t$;
      sup.(est.)DEMAND$_t$+= est.(est.)Q.BUY.EST(.s)$_t$;
      sup.(est.)LIQ.ASSETS.EST$_t$+=sup.(est.)PRICE$_t$ × (1 + ζ_6)× est.Q.BUY.EST(.s)$_t$;
      sup.(est.)STOCK$_t$−= est.Q.BUY.EST(.s)$_t$
    end
    *}
  else
    look for another bank that has that quantity
    do list of banks
    if *any bank has that quantity* **then**
      choose the bank with lowest interest rate bank.IR.Q.BUY.EST.LOANS$_t$
      check whether the establishment is suitable for a loan in that bank
      if *yes* **then**
        bank gives loan
        update {* *}
      else
        repeat with next bank
      end
    else
      establishment can only buy a part of its demand for inputs (round).est.Q.BUY.EST$_t$
      try 90% of previous quantity until you adjust
    end
  end
else
  do list of banks
  if *any bank has that quantity* **then**
    choose the bank with lowest interest rate bank.IR.Q.BUY.EST.LOANS$_t$
    check whether the establishment is suitable for a loan in that bank
    if *yes* **then**
      bank gives loan
      update {* *}
    else
      repeat with next bank
    end
  else
    establishment can only buy a part of its demand for inputs (round).est.Q.BUY.EST$_t$
    try 90% of previous quantity until you adjust
  end
end

Data: GUS
Result: Bank short term credit admissibility.2 (10)
compute quantity of loan to buy inputs (est.Q.BUY.EST.LOANS$_t$)
est.Q.BUY.EST.LOANS$_t$ = temp.COST.OF.BUYING.INPUTS−(buy.(est.)LIQ.ASSETS.EST$_t$ − buy.(est.)WAGES.EST$_t$)
check whether the matched bank to establishment (est.BANK.Q.BUY.EST.ID, auxiliary: bank.BANK.ID) is able to lend that quantity
if *bank.SUPPLY.Q.BUY.EST.LOANS$_t$* $\geq$ *est.Q.BUY.EST.LOANS$_t$* **then**
    check whether the establishment is suitable for a loan in that bank ;
    check to which firm the establishment belongs to (est.FIRM.ID, auxiliary: firm.FIRM.ID) ;
    temp.firm.ROA=$\frac{\text{firm.FIRM.PROFIT}_t}{\text{firm.LIQ.ASSETS.FIRM}_t}$;
    temp.firm.ROE=$\frac{\text{firm.FIRM.PROFIT}_t}{\text{firm.FIX.CAP.FIRM}_t}$;
    if temp.firm.ROA $> \alpha_{28.b}$ && temp.firm.ROE $> \alpha_{29.b}$
    && $\frac{\text{firm.FIRM.PROFIT}_t}{\text{firm.WF.FIRM}_t} > \alpha_{30.b}$ && $\frac{\text{firm.FIRM.DEBT}_t}{\text{firm.FIX.CAP.FIRM}_t} < \alpha_{31.b}$
    && firm.FINANCIAL.RISK$_t$ $< \alpha_{32.b}$
    && sector.AVE.FINANCIAL.RISK$_t$ $< \alpha_{33.b}$
    && $\frac{(\text{est.WF.EST}_t+1)}{\text{sector.AVE.SECT.WF.EST}_t} > \alpha_{34.b}$
    && $\frac{\text{est.Q.BUY.EST.LOANS}_t}{\text{est.Q.BUY.EST.LOANS}_t+\text{est.LIQ.ASSETS.EST}_t-\text{est.WAGES.EST}_t} < \alpha_{35.b}$
    && firm.DEFAULT.FIRM$_t$< $\alpha_{36.b}$
    && $\frac{\text{firm.FIX.CAP.FIRM}_t}{\text{firm.NO.ESTABLISH.OF.FIRM}_t} > \alpha_{37.b}$ **then**
        bank gives the credit
        {* **choose** at random est.Q.BUY.EST.LOANS.MAT$_t$ from set {4, α_{38}, α_{39}}
        check the interest rate that has to be paid bank.IR.Q.BUY.EST.LOANS$_t$
        for *establishment-buyer* **do**
            temp1.Q.BUY.LOANS=0
            temp1.Q.BUY.LOANS = temp.COST.OF.BUYING.INPUTS −(buy.(est.)LIQ.ASSETS.EST$_t$ − buy.(est.)WAGES.EST$_t$)
              est.Q.BUY.EST.LOANS$_t$+= temp.COST.OF.BUYING.INPUTS −(buy.(est.)LIQ.ASSETS.EST$_t$ − buy.(est.)WAGES.EST$_t$)
            est.Q.BUY.EST.LOANS.QUARTERLY$_t$ = $\frac{\text{est.Q.BUY.EST.LOANS}_t}{\text{est.Q.BUY.EST.LOANS.MAT}_t}$
            est.INTEREST.TO.BE.PAID.Q.BUY.EST$_t$ + =
              $\frac{1}{\kappa_2}$ × (temp1.Q.BUY.EST.LOANS × (1 + 0.25 × bank.IR.Q.BUY.EST.LOANS$_t$)$^{\text{est.Q.BUY.EST.LOANS.MAT}_t}$ −
              temp1.Q.BUY.EST.LOANS)
            temp1.AUXILIARY = $\frac{\text{est.INTEREST.TO.BE.PAID.Q.BUY.EST}_t}{\text{est.Q.BUY.EST.LOANS.MAT}_t}$
            est.INTEREST.TO.BE.PAID.Q.BUY.EST.QUARTERLY$_t$ = $\frac{\text{est.INTEREST.TO.BE.PAID.Q.BUY.EST}_t}{\text{est.Q.BUY.EST.LOANS.MAT}_t}$
            buy.(est.)INPUTS$_t$+= temp.COST.OF.BUYING.INPUTS;
            buy.(est.)LIQ.ASSETS.EST$_t$=0;
        end
        for *bank* **do**
            bank.REV.Q.BUY.EST$_t$ + = temp1.AUXILIARY
            bank.SUPPLY.Q.BUY.EST.LOANS$_t$ −=
              temp.COST.OF.BUYING.INPUTS−(buy.(est.)LIQ.ASSETS.EST$_t$ − buy.(est.)WAGES.EST$_t$)
        end
        for *all suppliers from sectors that provided inputs to establishments* **do**
            sup.(est.)SALES.MONET$_t$+=sup.(est.)PRICE$_t$ × (1 + ζ_7)×est.Q.BUY.EST(.s)$_t$;
            sup.(est.)DEMAND$_t$+= est.(est.)Q.BUY.EST(.s)$_t$;
            sup.(est.)LIQ.ASSETS.EST$_t$+=sup.(est.)PRICE$_t$ × (1 + ζ_8)× est.Q.BUY.EST(.s)$_t$;
            sup.(est.)STOCK$_t$ −= est.Q.BUY.EST(.s)$_t$
        end
          *}
    else
        look for another bank that has that quantity
        do list of banks
        if *any bank has that quantity* **then**
            choose the bank with lowest interest rate bank.IR.Q.BUY.EST.LOANS$_t$
            check whether the establishment is suitable for a loan in that bank
            if *yes* **then**
                bank gives credit
                update {* *}
            else
                repeat with next bank
            end
        else
            establishment can only buy a part of its demand for inputs (round.)est.Q.BUY.EST$_t$
            try 90% of previous quantity until you adjust
        end
    end
else
    do list of banks
    if *any bank has that quantity* **then**
        choose the bank with lowest interest rate bank.IR.Q.BUY.EST.LOANS$_t$
        check whether the establishment is suitable for a loan in that bank
        if *yes* **then**
            bank gives credit
            update {* *}
        else
            repeat with next bank
        end
    else
        establishment can only buy a part of its demand for inputs (round.)est.Q.BUY.EST$_t$
        try 90% of previous quantity until you adjust
    end
end

Data: BZGD

Result: Individuals income (11)

for *all individuals* **do**

check the bank matched to individual (ind.BANK.ID.1, auxiliary: bank.BANK.ID) and offered interest rates for deposits (bank.IR.DEPOSITS$_t$)

compute

ind.INCOME$_t$ = ind.WAGE$_t$ + ind.SUBSIDY$_t$ + bank.IR.DEPOSITS$_t$ × ind.DEPOSITS$_t$

end

Data: BZGD

Result: Households income computing (12)

for *each household* **do**

set

temp.INC.FAMILY=0

for *each individual of household* **do**

temp.INC.FAMILY + = ind.INCOME$_t$

end

compute

hh.TOTAL.INC.FAM$_t$ = temp.INC.FAMILY + hh.DONATIONS$_t$ + hh.REAL.ESTATE.REV$_t$

if *an individual is elder or equal to 16* **then**

temp.CONSUMERS.FAM ++

else

temp.CONSUMERS.FAM +=0.5

end

end

Data: BZGD
Result: Net savings (13)
for *each household* **do**
  temp.ADULTS.COUNTER=0
  for *all individuals in the households with ind.AGE>18* **do**
    temp.ADULTS.COUNTER++
  end
  if $hh.TOTAL.INC.FAM_t - hh.ACCOM.COST_t \geq \alpha_{40} \times temp.CONSUMERS.FAM$ **then**
    check who is the eldest in the household
    temp.NETSAVINGS=max{0; $\frac{\sqrt{\text{eldest.AGE}_t - 16}}{\alpha_{42}}$ ×(hh.TOTAL.INC.FAM$_t$ − hh.ACCOM.COST$_t$ − α_{41} × temp.CONSUMERS.FAM)}
    for *each individual with ind.AGE>18 in the household* **do**
      ind.DEPOSITS$_t$ + = $\frac{1}{\text{temp.ADULTS.COUNTER}}$ × temp.NETSAVINGS
    end
  else
    if $hh.TOTAL.INC.FAM_t - hh.ACCOM.COST_t \leq 0$ **then**
      temp.NETSAVINGS = max{0,hh.TOTAL.INC.FAM$_t$ − hh.ACCOM.COST$_t$ − α_{41} × temp.CONSUMERS.FAM}
      if $temp.ADULTS.COUNTER=1$ **then**
        if $ind.DEPOSITS_t \leq 0$ **then**
          check whether the household is the owner of the property ST.OWNER =!2
          if $hh.ST.OWNER=1$ **then**
            try to sell all properties that he owns
            for *all properties that the household owns* **do**
              look for a household that would like to buy with temp.ADULTS.COUNTER<3 &&
              {* deposits - debt burden computes as: *}
              ((wife+husb.).DEPOSITS$_t$ − {(wife+husb).CONS.LOANS.QUARTERLY$_t$ +
                (wife+husb).INTEREST.TO.BE.PAID.CONS.LOANS.QUARTERLY$_t$} −
                {(wife+husb).FIRM.INV.LOANS.QUARTERLY$_t$ +
                (wife+husb).INTEREST.TO.BE.PAID.FIRM.INV.LOANS.QUARTERLY$_t$} −
                {(wife+husb)RE.NH.LOANS.QUARTERLY$_t$ +
                (wife+husb).INTEREST.TO.BE.PAID.RE.NH.LOANS.QUARTERLY$_t$} −
                {(wife+husb).RE.H.LOANS.QUARTERLY$_t$ +
                (wife+husb).INTEREST.TO.BE.PAID.RE.H.LOANS.QUARTERLY$_t$} > prop.PROP.PRICE$_t$)||
                (ind(adult).DEPOSITS$_t$ − {ind(adult).CONS.LOANS.QUARTERLY$_t$ +
                ind(adult).INTEREST.TO.BE.PAID.CONS.LOANS.QUARTERLY$_t$} −
                {ind(adult).FIRM.INV.LOANS.QUARTERLY$_t$ +
                ind(adult).INTEREST.TO.BE.PAID.FIRM.INV.LOANS.QUARTERLY$_t$} −
                {ind(adult).RE.NH.LOANS.QUARTERLY$_t$ +
                ind(adult).INTEREST.TO.BE.PAID.RE.NH.LOANS.QUARTERLY$_t$} −
                {ind(adult).RE.H.LOANS.QUARTERLY$_t$ +
                ind(adult).INTEREST.TO.BE.PAID.RE.H.LOANS.QUARTERLY$_t$} > prop.PROP.PRICE$_t$)
              if *found the buyer* **then**
                update to the buyer(s):ind.DEPOSITS$_t$ − = (1/temp.ADULTS.COUNTER)×prop.PROP.PRICE$_t$
                update to the sellers (ind with ind.AGE$_t$ ≥ 18 from the same household):
                ind.DEPOSITS$_t$ + =(1/temp.ADULTS.COUNTER)×prop.PROP.PRICE$_t$
                change hh.ST.OWNER$_t$=2
                look for a property to rent globally
                update to this new property prop.NO.HHS.RENT ++
              else
                he couldn't find a new buyer, so bank is a new owner, update defaults and non-performing loans
                ind.DEFAULT.IND$_t$ = 1
                check banks matched to individual (from bank.BANK.ID1 to bank.BANK.ID5)
                update in the corresponding one:
                bank.NO.DEFAULTS.IN.BANK$_t$ ++
                bank.NPL.CONS.LOANS$_t$ += ind.PENDING.TO.BE.PAID.CONS.LOANS$_t$
                bank.NPL.RE.H.LOANS$_t$ += ind.PENDING.TO.BE.PAID.RE.H.LOANS$_t$
                bank.NPL.RE.NH.LOANS$_t$ += ind.PENDING.TO.BE.PAID.RE.NH.LOANS$_t$
                bank.NPL.FIRM.INV.LOANS$_t$ += ind.PENDING.TO.BE.PAID.FIRM.INV.LOANS$_t$
                bank wants to sell the property for 80% of the prop.PROP.PRICE, so look for a household
                with deposits - debt burden computed by formula {* *} as above ≥ 0.8×prop.PROP.PRICE$_t$
                if *found* **then**
                  assign property to the new owner
                  update to the bank bank.REV.RE.H.LOANS$_t$ + = 0.8 × prop.PROP.PRICE$_t$
                else
                  assign the property to any household at random temporally and set prop.PROP.TO.BE.SOLD$_t$=1,
                  show the message:'no hh found to buy the prop from bank, prop assigned to the hh to be managed!'
                end
              end
            end
          else
            lived for rent, update to this property which he rented prop.NO.HHS.RENT −−
            update defaults in the bank
            ind.DEFAULT.IND$_t$ = 1
            check banks matched to individual (from bank.BANK.ID1 to bank.BANK.ID5)
            update in the corresponding one:
            bank.NO.DEFAULTS.IN.BANK$_t$ ++
            bank.NPL.CONS.LOANS$_t$ += ind.PENDING.TO.BE.PAID.CONS.LOANS$_t$
            bank.NPL.RE.H.LOANS$_t$ += ind.PENDING.TO.BE.PAID.RE.H.LOANS$_t$
            bank.NPL.RE.NH.LOANS$_t$ += ind.PENDING.TO.BE.PAID.RE.NH.LOANS$_t$
            bank.NPL.FIRM.INV.LOANS$_t$ += ind.PENDING.TO.BE.PAID.FIRM.INV.LOANS$_t$
            delete individual from the system & all associated records that is:
            delete all records in Consumers for hh, delete records in Consumers that are in relation to Suppliers, delete records
            for establishments of firm if the individual was the owner of a firm, delete records of firms that the individual was
            the owner, delete individual, delete household
          end
        else
          nothing changes, individual still has deposits to cover expenses
        end
      else
        for *all individuals with ind.AGE>18 in the household* **do**
          ind.DEPOSITS + = $\frac{1}{\text{temp.ADULTS.COUNTER}}$ × temp.NETSAVINGS
        end
        if $\sum_{i=1}^{k} ind.DEPOSITS_t \leq 0$ **then**
          check the pseudocode on the next page Net savings (13.1.)
        else
          household still has deposits to cover expenses
        end
      end
    else
      check who is the eldest in the household and **compute**
      temp.NETSAVINGS=max{0; $\frac{\sqrt{\text{eldest.AGE}_t - 16}}{3 \times \alpha_{42}}$ ×(hh.TOTAL.INC.FAM$_t$−hh.ACCOM.COST$_t$ −
        α_{41} × temp.CONSUMERS.FAM)}
      for *all individuals in the household with ind.AGE>18* **do**
        ind.DEPOSITS + = $\frac{1}{\text{temp.ADULTS.COUNTER}}$ × temp.NETSAVINGS
      end
    end
  end
end

Net savings (13.1) – please introduce it in the (13)

check whether the household is the owner of the property ST.OWNER =!2
if *hh.ST.OWNER=1* **then**
    try to sell all properties that the marriage owns
    for *all properties that the household owns* **do**
        look for a household that would like to buy with temp.ADULTS.COUNTER<3 &&
        {* deposits - debt burden computes as: *}
        ((wife+husb.).DEPOSITS$_t$ – {(wife+husb).CONS.LOANS.QUARTERLY$_t$ +
          (wife+husb).INTEREST.TO.BE.PAID.CONS.LOANS.QUARTERLY$_t$} – {(wife+husb).FIRM.INV.LOANS.QUARTERLY$_t$ +
          (wife+husb).INTEREST.TO.BE.PAID.FIRM.INV.LOANS.QUARTERLY$_t$} – {(wife+husb)RE.NH.LOANS.QUARTERLY$_t$ +
          (wife+husb).INTEREST.TO.BE.PAID.RE.NH.LOANS.QUARTERLY$_t$} – {(wife+husb).RE.H.LOANS.QUARTERLY$_t$ +
          (wife+husb).INTEREST.TO.BE.PAID.RE.H.LOANS.QUARTERLY$_t$} > prop.PROP.PRICE$_t$)|| (ind(adult).DEPOSITS$_t$ –
          {ind(adult).CONS.LOANS.QUARTERLY$_t$ + ind(adult).INTEREST.TO.BE.PAID.CONS.LOANS.QUARTERLY$_t$} –
          {ind(adult).FIRM.INV.LOANS.QUARTERLY$_t$ + ind(adult).INTEREST.TO.BE.PAID.FIRM.INV.LOANS.QUARTERLY$_t$} –
          {ind(adult).RE.NH.LOANS.QUARTERLY$_t$ + ind(adult).INTEREST.TO.BE.PAID.RE.NH.LOANS.QUARTERLY$_t$} –
          {ind(adult).RE.H.LOANS.QUARTERLY$_t$ + ind(adult).INTEREST.TO.BE.PAID.RE.H.LOANS.QUARTERLY$_t$} >
          prop.PROP.PRICE$_t$)
        if *found the buyer* **then**
            update to the buyer(s):ind.DEPOSITS$_t$ – = (1/temp.ADULTS.COUNTER)×prop.PROP.PRICE$_t$
            update to the sellers (wife and husband) (ind with ind.AGE$_t$ ≥ 18 from the same household):
            ind.DEPOSITS$_t$ + =(1/temp.ADULTS.COUNTER)×prop.PROP.PRICE$_t$
            change hh.ST.OWNER$_t$=2
            look for a property to rent globally
            update to this new property prop.NO.HHS.RENT ++
        else
            he couldn't find a new buyer, so bank is a new owner, update defaults and non-performing loans
            ind.DEFAULT.IND$_t$ = 1
            check banks matched to individuals in the households (from bank.BANK.ID1 to bank.BANK.ID5 to wife and husband)
            update in the corresponding one of wife and the in the corresponding one of husband:
            bank.NO.DEFAULTS.IN.BANK$_t$ ++
            bank.NPL.CONS.LOANS$_t$ += ind.PENDING.TO.BE.PAID.CONS.LOANS$_t$
            bank.NPL.RE.H.LOANS$_t$ += ind.PENDING.TO.BE.PAID.RE.H.LOANS$_t$
            bank.NPL.RE.NH.LOANS$_t$ += ind.PENDING.TO.BE.PAID.RE.NH.LOANS$_t$
            bank.NPL.FIRM.INV.LOANS$_t$ += ind.PENDING.TO.BE.PAID.FIRM.INV.LOANS$_t$
            banks want to sell the property for 80% of the prop.PROP.PRICE, so look for a household
            with deposits - debt burden computed by formula {* *} as above ≥ 0.8×prop.PROP.PRICE$_t$
            if *found* **then**
                assign property to the new owner
                update to two banks (bank of wife and bank of husband) bank.REV.RE.H.LOANS$_t$ + =0.5 × 0.8 × prop.PROP.PRICE$_t$
            else
                assign the property to any household at random temporally and set prop.PROP.TO.BE.SOLD$_t$=1,
                show the message:'no hh found to buy the prop from banks, prop assigned to the hh to be managed!'
            end
        end
    end
else
    lived for rent, update to this property which he rented prop.NO.HHS.RENT −−
    update defaults in the banks of wife and husband
    ind.DEFAULT.IND$_t$ = 1
    check banks matched to individuals (respectively wife and husband) (from bank.BANK.ID1 to bank.BANK.ID5 for wife and then for husband)
    update in the corresponding one:
    bank.NO.DEFAULTS.IN.BANK$_t$ ++
    bank.NPL.CONS.LOANS$_t$ += ind.PENDING.TO.BE.PAID.CONS.LOANS$_t$
    bank.NPL.RE.H.LOANS$_t$ += ind.PENDING.TO.BE.PAID.RE.H.LOANS$_t$
    bank.NPL.RE.NH.LOANS$_t$ += ind.PENDING.TO.BE.PAID.RE.NH.LOANS$_t$
    bank.NPL.FIRM.INV.LOANS$_t$ += ind.PENDING.TO.BE.PAID.FIRM.INV.LOANS$_t$
end
delete individual from the system & all associated records that is:
delete all records in Consumers for hh, delete records in Consumers that are in relation to Suppliers, delete records
for establishments of firm if the individual was the owner of a firm, delete records of firms that the individual was
the owner, delete individual, delete household

Data: BZGD

Result: Consumer credits updating (14)

compute

for *all individuals in households (and for all their loans) and all households as a consumers* **do**

temp.LOANS.BURDEN.QUARTERLY=

(ind.CONS.LOANS.QUARTERLY$_t$ + ind.INTEREST.TO.BE.PAID.CONS.LOANS.QUARTERLY$_t$) +

(ind.RE.H.LOANS.QUARTERLY$_t$ + ind.INTEREST.TO.BE.PAID.RE.H.LOANS.QUARTERLY$_t$) +

(ind.RE.NH.LOANS.QUARTERLY$_t$ + ind.INTEREST.TO.BE.PAID.RE.NH.LOANS.QUARTERLY$_t$) +

(ind.FIRM.INV.LOANS.QUARTERLY$_t$ + ind.INTEREST.TO.BE.PAID.FIRM.INV.LOANS.QUARTERLY$_t$)

if *sector.PRICE.SECT$_t$!=0* **then**

temp.QQ.BUY= max{0, $\frac{\alpha_{43.tc.s}}{\text{sector.PRICE.SECT}_t \times (1 + \text{sector.TAX.VAT})_t}$ × {(ind1+ind2).DEPOSITS$_t$

− temp.LOANS.BURDEN.QUARTERLY}}

else

temp.QQ.BUY= max{0, $\frac{\alpha_{43.tc.s}}{1 \times (1 + \text{sector.TAX.VAT})_t}$ × {(ind1+ind2).DEPOSITS$_t$

− temp.LOANS.BURDEN.QUARTERLY}}

end

end

for *all households as a consumers* **do**

if *rndm(0,1)* $\leq \xi_2$ **then**

no new consumer loan

cons.Q.BUYall.s = temp.QQ.BUY

Go to ***Supplier searching*** & update ind.DEPOSITS$_t$ in ***Purchase.hh***

else

check basic condition

if *{hh.TOTAL.INC.FAM$_t$ − hh.ACCOM.COST$_t$ − temp.LOANS.BURDEN.QUARTERLY}* $\geq \alpha_{44}$ × *temp.CONSUMERS.FAM*, **then**

temp.CONS.LOANS = $\alpha_{45.tc.s}$ × {hh.TOTAL.INC.FAM$_t$ − hh.ACCOM.COST$_t$ − temp.LOANS.BURDEN.QUARTERLY} + $\alpha_{46.s}$

if *rndm(0,1)* $\geq \xi_3$ **then**

check in the matched bank (ind.BANK.ID2)

(if wife and husband have different matched banks pick one of the two at random)

Go to ***Supply side checking.1***

if *passed* **then**

Go to ***Consumer credit admissibility.1***

else

resign from taking a credit

cons.Q.BUY.all.s$_t$ = temp.QQ.BUY

end

else

check in other bank

order banks according to interest rate (bank.IR.CONS.LOANS$_t$)

Go to ***Supply side checking.2***

if *passed* **then**

Go to ***Consumer credit admissibility.2***

else

resign from taking a credit

cons.Q.BUY.all.s$_t$ = temp.QQ.BUY

Go to ***Supplier searching*** & update ind.DEPOSITS$_t$ in ***Purchase.hh***

end

end

else

no new consumer loan

cons.Q.BUYall.s$_t$ = temp.QQ.BUY

Go to ***Supplier searching*** & update ind.DEPOSITS$_t$ in ***Purchase.hh***

end

end

end

Data: SIS, NB300

Result: Supply side checking in the bank matched to individual (ind.BANK.ID.2, auxiliary: bank.BANK.ID) and implicitly his household(15)

check whether your bank is able to give you that quantity

bank.SUPPLY.CONS.LOANS$_t$ $\geq$ temp.CONS.LOANS

check whether there is no excessive sectoral exposure: temp.CONS.LOANS.s $< \alpha_{47}$

Result: Supply side checking in the bank other than matched to individual (bank.BANK.ID != (bank.BANK.ID=ind.BANK.ID.2)

& with not excessive sectoral exposure (16)

make a list of banks according to their offered interest rate bank.IR.CONS.LOANS$_t$

choose the one with the lowest interest rate

check

if *bank.SUPPLY.CONS.LOANS$_t$ $\geq$ temp.CONS.LOANS.s* **then**

- proceed with checking no excessive sectoral exposure: temp.CONS.LOANS.s $< \alpha_{47}$
- proceed to ***Consumer credit admissibility.2***

else

- try another one
- **if** *found any from the list* **then**
  - proceed with checking sectoral exposure (temp.CONS.LOANS.s $< \alpha_{47}$)
  - proceed to ***Consumer credit admissibility.2***
- **else**
  - try whether any bank could give only the part
  - bank.SUPPLY.CONS.LOANS$_t$ $\geq \alpha_{48} \times$ temp.CONS.LOANS.s
  - if needed, readjust the quantity
  - proceed with checking ***Consumer credit admissibility.2***
- **end**

end

Data: SIS, NB300

Result: Consumer credit admissibility.1 (17)

if $hh.TOTAL.INC.FAM_t - hh.ACCOM.COST_t - temp.LOANS.BURDEN.QUARTERLY \geq \alpha_{50.m.b} \times temp.CONSUMERS.FAM$
&& $\frac{(hh.)ind.DEFAULT.IND_t}{temp.CONSUMERS.FAM} \leq \alpha_{49.m.b}$ && $hh.(ind.)NO.CONS.LOANS_t \leq 3$ && $(ind.AGE_t > 18$ && $ind.LABOR.STATUS_t = \{3||5\})$ **then**

- credit accepted
- **Go to** ***Consumer credit and purchase after passing conditions***

else

- credit rejected

end

Data: SIS, NB300

Result: Consumer credit admissibility.2 (18)

if $hh.TOTAL.INC.FAM_t - hh.ACCOM.COST_t - temp.LOANS.BURDEN.QUARTERLY \geq \alpha_{50.b} \times temp.CONSUMERS.FAM$
&& $\frac{(hh.)ind.DEFAULT.IND_t}{temp.CONSUMERS.FAM} \leq \alpha_{49.b}$ && $hh.(ind.)NO.CONS.LOANS_t \leq 3$ && $(ind.AGE_t > 18$ && $ind.LABOR.STATUS_t = \{3||5\})$ **then**

  credit accepted

  Go to ***Consumer credit and purchase after passing conditions***

else

  credit rejected

end

Data: SIS, NB300

Result: Consumer credit and purchase after passing supply side conditions and credit admissibility (19)

check maturity

if $temp.CONS.LOANS > \alpha_{51}$ **then**

  $\text{ind.CONS.LOANS.MAT}_t = 20$

else if $temp.CONS.LOANS > \alpha_{52}$ **then**

  $\text{ind.CONS.LOANS.MAT}_t = 12$

else if $temp.CONS.LOANS > \alpha_{53}$ **then**

  $\text{ind.CONS.LOANS.MAT}_t = 8$

else

  $\text{ind.CONS.LOANS.MAT}_t = 4$

end

temp.ADULTS.COUNTER=0

for *all individuals in the households that are elder than 18 (ind.AGE > 18)* **do**

  temp.ADULTS.COUNTER++

  if *temp.ADULTS.COUNTER>1* **then**

    for *all individuals in the household with ind.AGE>18* **do**

      $\text{ind.CONS.LOANS}_t += \frac{1}{\text{temp.ADULTS.COUNTER}} \times \text{temp.CONS.LOANS}$

      $\text{ind.PENDING.TO.BE.PAID.CONS.LOANS}_t += \frac{1}{\text{temp.ADULTS.COUNTER}} \times \text{temp.CONS.LOANS}$

      $\text{ind.CONS.LOANS.QUARTERLY}_t += \frac{1}{\text{temp.ADULTS.COUNTER}} \times \frac{\text{temp.CONS.LOANS}}{\text{ind.1.CONS.LOANS.MAT}_t}$

      $\text{ind.INTEREST.TO.BE.PAID.CONS.LOANS}_t += \frac{1}{\kappa_2 \text{ temp.ADULTS.COUNTER}} \times (\text{temp.CONS.LOANS} \times (1+0.25\times \text{ bank.IR.CONS.LOANS}_t)^{\text{ind.CONS.LOANS.MAT}_t} - \text{temp.CONS.LOANS})$

      $\text{ind.INTEREST.TO.BE.PAID.CONS.LOANS.QUARTERLY}_t = \frac{\text{ind.INTEREST.TO.BE.PAID.CONS.LOANS}_t}{\text{ind.CONS.LOANS.MAT}_t}$

      $\text{bank.SUPPLY.CONS.LOANS}_t -= \text{temp.CONS.LOANS}$

      $\text{bank.REV.CONS.LOANS}_t += (\text{ind1+ind2 + ... ind.k}).\text{INTEREST.TO.BE.PAID.CONS.LOANS.QUARTERLY}_t$ /* it is a sum of interests paid by individuals with ind.AGE>18 belonging to the same hh*/

      if $ind.CONS.LOANS.MAT_t != 0$ && $sector.PRICE.SECT_t != 0$ **then**

        $\text{cons.Q.BUY.CONSall.s}_t = \text{temp.QQ.BUY.CONS} + \frac{\alpha_{43.tc.s} \times \text{temp.CONS.LOANS}}{\text{ind.CONS.LOANS.MAT}_t \times \{\text{sector.PRICE.SECT}_t \times (1+\text{sector.TAX.VAT}_t)\}}$

      else

        $\text{cons.Q.BUY.CONSall.s}_t = \text{temp.QQ.BUY.CONS} + \frac{\alpha_{43.tc.s} \times \text{temp.CONS.LOANS}}{4 \times \{1 \times (1+\text{sector.TAX.VAT}_t)\}}$

      end

    end

  else

    $\text{ind.CONS.LOANS}_t += \text{temp.CONS.LOANS}$

    $\text{ind.CONS.LOANS.QUARTERLY}_t += \frac{\text{temp.CONS.LOANS}}{\text{ind.CONS.LOANS.MAT}_t}$

    $\text{ind.INTEREST.TO.BE.PAID.CONS.LOANS}_t += \frac{1}{\kappa_2} \times (\text{temp.CONS.LOANS} \times (1+0.25 \times \text{bank.IR.CONS.LOANS}_t)^{\text{ind.CONS.LOANS.MAT}_t} - \text{temp.CONS.LOANS})$

    $\text{ind.INTEREST.TO.BE.PAID.CONS.LOANS.QUARTERLY}_t = \frac{\text{ind.INTEREST.TO.BE.PAID.CONS.LOANS}_t}{\text{ind.CONS.LOANS.MAT}_t}$

    $\text{ind.PENDING.TO.BE.PAID.CONS.LOANS}_t += \text{temp.CONS.LOANS}$

    $\text{bank.SUPPLY.CONS.LOANS}_t -= \text{temp.CONS.LOANS}$

    $\text{bank.REV.CONS.LOANS}_t += \text{ind.INTEREST.TO.BE.PAID.CONS.LOANS.QUARTERLY}_t$

    if $ind.CONS.LOANS.MAT_t != 0$ && $sector.PRICE.SECT_t != 0$ **then**

      $\text{cons.Q.BUY.CONSall.s}_t = \text{temp.QQ.BUY.CONS} + \frac{\alpha_{43.tc.s} \times \text{temp.CONS.LOANS}}{\text{ind.CONS.LOANS.MAT}_t \times \{\text{sector.PRICE.SECT}_t \times (1+\text{sector.TAX.VAT}_t)\}}$

    else

      $\text{cons.Q.BUY.CONSall.s}_t = \text{temp.QQ.BUY.CONS} + \frac{\alpha_{43.tc.s} \times \text{temp.CONS.LOANS}}{4 \times \{1 \times (1+\text{sector.TAX.VAT}_t)\}}$

    end

  end

end

Result: Supplier searching & Purchase.hhs (20)

for *each sector for each household (cons.-)* **do**

check cons.SUPPLIER.ID

each cons.SUPPLIER.ID corresponds to est.ESTABLISH.ID and we can check its est.STOCK

if $sup.(est.)STOCK_t \geq cons.Q.BUY.CONS.all.s_t$ && $\frac{\alpha_{22.s-sup} \times sup.(est.)QUALITY_t}{\alpha_{23.s-sup} \times sup.(est.)PRICE_t} > \frac{\alpha_{24.s-sup} \times sector.QUALITY.SECT_t}{\alpha_{25.s-sup} \times sector.PRICE.SECT_t}$ **then**

Go to ***Purchase.hh***

else

Get establishments (est) of sector s-sup with est.SPATIAL.CODE1=hh.(ind.)SPATIAL.CODE1 && est.SPATIAL.CODE2=hh.(ind.)SPATIAL.CODE2 && est.SPATIAL.CODE3=hh.(ind.)SPATIAL.CODE3 && est.SPATIAL.CODE4=hh.(ind.)SPATIAL.CODE4

for *each selected establishments* **do**

if $est.STOCK_t \geq cons.Q.BUY.CONS.all.s_t$ && $\frac{\alpha_{22.s-est} \times est.QUALITY_t}{\alpha_{23.s-est} \times sup.(est.)PRICE_t} > \frac{\alpha_{24.s-est} \times sector.QUALITY.SECT_t}{\alpha_{25.s-est} \times sector.PRICE.SECT_t}$ ||

$(est.STOCK_t > cons.Q.BUY.CONS.all.s_t$ && $est.EST.NEW_t > 0)$ **then**

cons.SUPPLIER.ID = ESTABLISHID

Go to ***Purchase.hh***

else

Get establishments (est) of sector s-sup with est.SPATIAL.CODE1!=hh.(ind.)SPATIAL.CODE1 && est.SPATIAL.CODE2=hh.(ind.)SPATIAL.CODE2 && est.SPATIAL.CODE3=hh.(ind.)SPATIAL.CODE3 && est.SPATIAL.CODE4=hh.(ind.)SPATIAL.CODE4

for *each selected establishments* **do**

if $est.STOCK_t \geq cons.Q.BUY.CONS.all.s_t$ && $\frac{\alpha_{22.s-est} \times est.QUALITY_t}{\alpha_{23.s-est} \times sup.(est.)PRICE_t} > \frac{\alpha_{24.s-est} \times sector.QUALITY.SECT_t}{\alpha_{25.s-est} \times sector.PRICE.SECT_t}$ **then**

cons.SUPPLIER.ID = ESTABLISH.ID

Go to ***Purchase.hh***

else

Get establishments (est) of sector s-sup with est.SPATIAL.CODE1!=hh.(ind.)SPATIAL.CODE1 && est.SPATIAL.CODE2!=hh.(ind.)SPATIAL.CODE2 && est.SPATIAL.CODE3=hh.(ind.)SPATIAL.CODE3 && est.SPATIAL.CODE4=hh.(ind.)SPATIAL.CODE4

for *each selected establishments* **do**

if $est.STOCK_t \geq cons.Q.BUY.CONS.all.s_t$ && $\frac{\alpha_{22.s-est} \times est.QUALITY_t}{\alpha_{23.s-est} \times sup.(est.)PRICE_t} > \frac{\alpha_{24.s-est} \times sector.QUALITY.SECT_t}{\alpha_{25.s-est} \times sector.PRICE.SECT_t}$

then

cons.SUPPLIER.ID= ESTABLISH.ID

Go to ***Purchase.hh***

else

Get establishments (est) of sector s-sup with est.SPATIAL.CODE1!=hh.(ind.)SPATIAL.CODE1 && est.SPATIAL.CODE2!=hh.(ind.)SPATIAL.CODE2 && est.SPATIAL.CODE3!=hh.(ind.)SPATIAL.CODE3 && est.SPATIAL.CODE4=hh.(ind.)SPATIAL.CODE4

for *each selected establishments* **do**

if $est.STOCK_t \geq cons.Q.BUY.CONS.all.s_t$ &&

$\frac{\alpha_{22.s-est} \times est.QUALITY_t}{\alpha_{23.s-est} \times sup.(est.)PRICE_t} > \frac{\alpha_{24.s-est} \times sector.QUALITY.SECT_t}{\alpha_{25.s-est} \times sector.PRICE.SECT_t}$ **then**

cons.SUPPLIER.ID = ESTABLISH.ID

Go to ***Purchase.hh***

else

Get establishments (est) of sector s-sup with est.SPATIAL.CODE1!=hh.(ind.)SPATIAL.CODE1 && est.SPATIAL.CODE2!=hh.(ind.)SPATIAL.CODE2 && est.SPATIAL.CODE3!=hh.(ind.)SPATIAL.CODE3 && est.SPATIAL.CODE4!=hh.(ind.)SPATIAL.CODE4

if $est.STOCK_t \geq cons.Q.BUY.CONS.all.s_t$ &&

$\frac{\alpha_{22.s-est} \times est.QUALITY_t}{\alpha_{23.s-est} \times sup.(est.)PRICE_t} > \frac{\alpha_{24.s-est} \times sector.QUALITY.SECT_t}{\alpha_{25.s-est} \times sector.PRICE.SECT_t}$ **then**

cons.SUPPLIER.ID = ESTABLISH.ID

Go to ***Purchase.hh***

else

choose at random

show the message: "Supplier has been chosen at random."

end

end

end

end

end

end

end

end

end

Purchase.hh

est.(sup.)SALES.MONET$_t$ + = est.(sup.)PRICE$_t$ × (1 + ζ_9)× cons.Q.BUY.CONS.all.s$_t^*$

est.(sup.)DEMAND$_t$ + = cons.Q.BUY.CONS.all.s$_t^*$

est.(sup.)STOCK$_t$ − = cons.Q.BUY.CONS.all.s$_t^*$

est.(sup.)LIQ.ASSETS.EST$_t$ + = est.(sup.)PRICE$_t$ × (1 + ζ_{10}) × cons.Q.BUY.CONS.all.s$_t^*$

* sum of the values for sectors

/*If no consumer loans, update ind.DEPOSITS$_t$, because she/he/they buy(s) from deposits*/

Check for this household the number of adults

temp.ADULTS.COUNTER=0

for *all individuals in the household with ind.AGE>18* **do**

temp.ADULTS.COUNTER++

end

for *all individuals with ind.AGE>18 in the household* **do**

ind.DEPOSITS$_t$ − = $\frac{1}{\text{temp.ADULTS.COUNTER}}$ × est.(sup.)PRICE$_t$× cons.Q.BUY.CONS.all.s$_t^*$

end

Data: BZGD
Result: Public contracts (21)
for *all establishments* **do**
  if $est.PRICE_t \leq sector.PRICE.SECT_t$ &&
  $rndm(0,1) > \alpha_{54} + \alpha_{55} \times \sqrt{firm.WF.FIRM_t} + \alpha_{56} \times est.QUALITY_t$ **then**
    $\text{est.STOCK}_t \; - = \max\{0, \min(\text{est.STOCK}_t, \alpha_{57} \times \text{est.PROD}_t)\}$;
    $\text{est.DEMAND}_t \; + = \min(\text{est.STOCK}_t, \alpha_{57} \times \text{est.PROD}_t)$;
    $\text{est.LIQ.ASSETS.EST}_t \; + = \alpha_{58} \times \min(\text{est.STOCK}_t, \alpha_{57} \times \text{est.PROD}_t)$;
    $\text{est.SALES.MONET}_t \; + = \alpha_{58} \times \min(\text{est.STOCK}_t, \alpha_{57} \times \text{est.PROD}_t)$;
  else
    nothing changes ;
  end if
end

Data: BZGD
Result: Accommodation cost and housing stress (22)

for *all households* **do**
  check hh.ST.OWNER$_t$
  if *hh.ST.OWNER$_t$ = 1* **then**
    Here we sum up for all individuals in the household with ind.AGE>18
    temp1.ACCOM.COST$_t$ =
    $\beta_0 + \beta_1 \times$ {hh.(ind1.+ind2).RE.H.LOANS.QUARTERLY$_t$ + hh.(ind1.+ind2).INTEREST.TO.BE.PAID.RE.H.QUARTERLY$_t$}
    hh.ACCOM.COST$_t$ = temp1.ACCOM.COST
    if *temp1.ACCOM.COST* $> \beta_2 \times$ *hh.TOTAL.INC.FAM$_t$* **then**
      housing stress regime
      if *the household owns (PROPERTY.ID1, PROPERTY.ID2)* **then**
        check which one is prop.PRINC.HOUSING $\neq 1$
        for *this property* **do**
          if *prop.PROP.TO.BE.SOLD$_t$=1* **then**
            prop.PROP.PRICE$_t$ = $\beta_3 \times$ prop.PROP.PRICE$_t$
          else
            do not change price
            prop.PROP.TO.BE.SOLD$_t$=1
          end
        end
      else
        (only owns PROPERTY.ID1)
        for *this one property that the household owns* **do**
          if *prop.PROP.TO.BE.SOLD$_t$=1* **then**
            prop.PROP.PRICE$_t$ = $\beta_3 \times$ prop.PROP.PRICE$_t$
          else
            do not change price
            prop.PROP.TO.BE.SOLD$_t$=1
          end
        end
      end
    else
      there is no housing stress, nothing changes
    end
  else
    Here we sum up for all individuals in the household with ind.AGE>18
    temp2.ACCOM.COST=
    $\beta_1 \times$ {hh.(ind1.+ind2).RE.H.LOANS.QUARTERLY$_t$ + hh.(ind1.+ind2).INTEREST.TO.BE.PAID.RE.H.QUARTERLY$_t$}
    $+ \beta_4 \times \frac{\text{prop.PROP.PRICE}_t}{\text{prop.NO.HHS.RENT}_t}$ /* at t=0 in the database, all household that rent property has them assigned in hh.PROPERTY.ID1 –> *see:* database */
    hh.ACCOM.COST$_t$ = temp2.ACCOM.COST
    if *temp2.ACCOM.COST* $> \beta_2 \times$ *hh.TOTAL.INC.FAM$_t$* **then**
      check labor status of households members
      if *at least one individual with ind.LABOR.STATUS$_t$={3 || 5} found in the household* **then**
        get randomly one individual of this household with ind.LABOR.STATUS$_t$={3 || 5}
        get his ind.ESTABLISH.ID
        look for properties with following characteristics /*it doesn't matter whether this property is the first or second property for anybody, it could be PROPERTY.ID1 or PROPERTY.ID2 for other household (the owner)*/
        prop.SPATIAL.CODE4=est.SPATIAL.CODE4 && prop.SPATIAL.CODE3=est.SPATIAL.CODE3 &&
        prop.SPATIAL.CODE2=est.SPATIAL.CODE2 &&
        prop.PROP.TO.BE.SOLD$_t$=1 && prop.PROP.PRICE$_t$ $< \beta_5 \times$ hh.TOTAL.INC.FAM$_t$ &&
        prop.PROP.PRICE$_t$ $> \beta_6 \times$ hh.TOTAL.INC.FAM$_t$
        if *at least one property found* **then**
          choose one at random
          hh.PROPERTY.ID1=this.PROPERTY.ID /*we assign to the household that rent hh.PROPERTY.ID1 = this property id*/
          update SPATIAL.CODE4, SPATIAL.CODE3, SPATIAL.CODE2, SPATIAL.CODE1 for every individual in the household
        else
          look for a property with following properties
          prop.PROP.TO.BE.SOLD$_t$=1 && prop.PROP.PRICE$_t$ $< \beta_5 \times$ hh.TOTAL.INC.FAM$_t$ &&
          prop.PROP.PRICE$_t$ $> \beta_6 \times$ hh.TOTAL.INC.FAM$_t$
          if *at least one found* **then**
            choose one at random
            hh.PROPERTY.ID1=this.prop.PROPERTY.ID /*we assign to the household that rent hh.PROPERTY.ID1 = this property id*/
            update spatial codes
          else
            stay at old house one period more
          end
        end
      else
        if *each individual of the household has ind.LABOR.STATUS$_t$=1 || ind.LABOR.STATUS$_t$=2 &&Here we sum up for all individuals in the household with ind.AGE>18*
        {hh.(ind1+ind2).DEPOSITS$_t$–hh.(ind1+ind2).RE.H.LOANS.QUARTERLY$_t$ + hh.(ind1+ind2).INTEREST.TO.BE.PAID.RE.H.QUARTERLY$_t$} $< \beta_7$ **then**
          check his ind.AGE$_t$
          if *ind.AGE$_t$* $\leq$ *25* **then**
            Go to next household
          else
            for *each adult member of household* **do**
              ind.DEFAULT.IND$_t$ = 1
              check bank matched to individuals from this household and update
              bank.NO.DEFAULTS.IN.BANK$_t$++
              bank.NPL.LOANS.CONS$_t$+=hh.(ind1+ind2).PENDING.TO.BE.PAID.CONS.LOANS$_t$
              bank.NPL.RE.H.LOANS$_t$+=hh.(ind1+ind2).PENDING.TO.BE.PAID.RE.H.LOANS$_t$
              bank.NPL.RE.NH.LOANS$_t$+ = hh.(ind1+ind2).PENDING.TO.BE.PAID.RE.NH.LOANS$_t$
              bank.NPL.FIRM.INV.LOANS$_t$+ = hh.(ind1+ind2).PENDING.TO.BE.PAID.FIRM.INV.LOANS$_t$
              delete individuals from the system and all associated records /*delete similarly to the Pseudocode 13*/
            end
          end
        else
          still have deposits to pay rent
          Go to next household
        end
      end
    else
      no housing stress
      Go to next household
    end
  end

Data: BZGD
Result: Profits from rent (23)

for *each prop.HOUSEHOLD.ID* **do**
- **check** the prop.PROPERTY.ID that they own and in which house they live (prop.PRINC.HOUSING$_t$=1)
- **for** *each property of this household* **do**
  - **if** *prop.PRINC.HOUSING$_t$=1* **then**
    - go to the next property
    - if there is no other property
    - go to the next household
  - **else**
    - **check** the number of households that lives there (that rent the house)
    - prop.NO.HHS.RENT$_t$=count no of households with hh.(prop.)PROPERTY.ID=this property
    - **if** *prop.NO.HHS.RENT$_t$ = 0* **then**
      - **if** *prop.PROP.TO.BE.SOLD$_t$ = 1* **then**
        - prop.PROP.PRICE$_t$ = $\beta_3 \times$ prop.PROP.PRICE$_t$
      - **else**
        - prop.PROP.TO.BE.SOLD$_t$ = 1
        - price does not change
      - **end**
    - **else**
      - hh.REAL.ESTATE.REV$_t$ + = $\beta_4 \times$ prop.PROP.PRICE$_t$
    - **end**
  - **end**
- **end**

end

Data: BZGD
Result: Decisions about funding housing and non-housing purchase (24)

for *all households* **do**
- **check** who are the adult members of the household
- temp.ADULTS.COUNTER=0
- **for** *all individuals with ind.AGE>18* **do**
  - temp.ADULTS.COUNTER++
- **end**
- **check** what loans they have already had
- Sum up deposits and loans of all individuals with ind.AGE>18 in the household.
- temp.DEP.FOR.RE=(ind1+ind2).DEPOSITS$_t$
- $-${(ind1+ind2).CONS.LOANS.QUARTERLY$_t$ + (ind1+ind2).INTEREST.TO.BE.PAID.CONS.LOANS.QUARTERLY$_t$}
- $-${(ind1+ind2).FIRM.INV.LOANS.QUARTERLY$_t$ +(ind1+ind2).INTEREST.TO.BE.PAID.FIRM.INV.LOANS.QUARTERLY$_t$}
- $-${(ind1+ind2).RE.NH.LOANS.QUARTERLY$_t$ + (ind1+ind2).INTEREST.TO.BE.PAID.RE.NH.LOANS.QUARTERLY$_t$}
- **check** the quantity the household needs to buy a house
- **check** min.prop.PROP.PRICE$_t$ in the list of properties with prop.PROP.TO.BE.SOLD$_t$=1
- **if** none found, skip this step
- **if** at least one found
- **check** whether the household is able to pay it without a loan
- **if** *temp.DEP.FOR.RE > min.prop.PROP.PRICE$_t$* **then**
  - **if** *at least one adult in the household: (ind.ENTREPRENEUR$_t$=2 || (ind.LABOR.STATUS$_t$=2 && ind.ENTREP.SPIRIT$_t$ > 0.5)* **then**
    - do not buy, he will probably invest in a new firm
    - ind.ENTREPRENEUR$_t$=1
  - **else**
    - **if** *rndm(0,1) > ξ_4* **then**
      - **Go to** ***Macroprudential ratios***
    - **else**
      - buy by cash
    - **end**
  - **end**
- **else**
  - **Go to** ***Macroprudential ratios***
- **end**

end

Data: BZGD
Result: Macroprudential ratios (25)

for *all households* **do**

check their housing, nonhousing and consumer credits, credits for firms

compute macroprudential ratios

Zsumowac po wszystkich indywidualach z ind.AGE>18 w householdzie a nie tylko ind1 i ind2 w 3 zmiennych tymczasowych!

temp.hh.TOTAL.DEBT.QUARTERLY = (ind1+ind2).CONS.LOANS.QUARTERLY$_t$ + (ind1+ind2).FIRM.INV.LOANS.QUARTERLY$_t$ + (ind1+ind2).RE.H.LOANS.QUARTERLY$_t$ + (ind1+ind2).RE.NH.LOANS.QUARTERLY$_t$

temp.hh.TOTAL.DEBT.SERVICE.QUARTERLY =(ind1+ind2).INTEREST.TO.BE.PAID.CONS.LOANS.QUARTERLY$_t$ + (ind1+ind2).INTEREST.TO.BE.PAID.FIRM.INV.LOANS.QUARTERLY$_t$ + (ind1+ind2).INTEREST.TO.BE.PAID.RE.H.LOANS.QUARTERLY$_t$ + (ind1+ind2).INTEREST.TO.BE.PAID.RE.NH.LOANS.QUARTERLY$_t$

temp.hh.TOTAL.ASSETS.QUARTERLY=(ind1+ind2.)(hh).DEPOSITS$_t$

if *temp.hh.TOTAL.ASSETS.QUARTERLY !=0* **then**
  hh.DTA$_t$=max{0, $\frac{\text{temp.hh.TOTAL.DEBT.QUARTERLY}}{\text{temp.hh.TOTAL.ASSETS.QUARTERLY}}$}
else
  hh.DTA$_t$=max{0,temp.hh.TOTAL.DEBT.QUARTERLY}
end

if *hh.TOTAL.INC.FAM$_t$!=0* **then**
  hh.DTI$_t$= max{0, $\frac{\text{temp.hh.TOTAL.DEBT.QUARTERLY}}{\text{hh.TOTAL.INC.FAM}_t}$}
else
  hh.DTI$_t$= max{0,temp.hh.TOTAL.DEBT.QUARTERLY}
end

if *hh.TOTAL.INC.FAM$_t$!=0* **then**
  hh.DSTI$_t$= max{0, $\frac{\text{temp.hh.TOTAL.DEBT.SERVICE}}{\text{hh.TOTAL.INC.FAM}_t}$}
else
  hh.DSTI$_t$= max{0,temp.hh.TOTAL.DEBT.SERVICE}
end

if *prop.PROP.PRICE$_t$!=0* **then**
  hh.LTV.H$_t$ = max{0, $\frac{\text{ind.RE.H.LOANS}_t}{\text{prop.PROP.PRICE}_t}$}
else
  hh.LTV.H$_t$ = 2
end

if *prop.PROP.PRICE$_t$!=0* **then**
  hh.LTV.NH$_t$ =max{0, $\frac{\text{ind.RE.NH.LOANS}_t}{\text{prop.PROP.PRICE}_t}$}
else
  hh.LTV.NH$_t$ = 2
end

end
Go to ***Housing and non-housing loans***

Data: BZGD
Result: Housing and non-housing loans (26)

for *all households* **do**

if *temp.ADULTS.COUNTER>2 // hh.DSTI$_t$ > β_8 || hh.DTI$_t$ >β_9 || hh.DTA$_t$ > β_{10}|| || (ind).LABOR.STATUS$_t$={ 1 || 2 || 4} || (ind).LABOR.STATUS$_t$=3 && (ind).AGE$_t$<30 && ind.LABOR.PERIODS$_t$ $\leq$ 4)|| (ind1&ind2).STATUS.CIVIL$_t$=2 && (ind1&ind2).LABOR.STATUS$_t$={ 1 || 2 || 4} || (ind1&ind2).LABOR.STATUS$_t$=3 && (ind1&ind2).AGE$_t$<30 && ind.LABOR.PERIODS$_t$ $\leq$ 4)* **then**

no credit is given

else

for *all properties that household owns* **do**

temp.MAX.COLLATERAL + = prop.PROP.PRICE$_t$

/*if the household doesn't own properties, then the temp.MAX.COLLATERAL will be computer later as the value of property that the household tries to purchase*/

end

check what type of credit the household wants

if *rndm(0,1) > β_{11}* **then**

check the quantity the household needs to buy a house

check min.prop.PROP.PRICE$_t$ in the list of properties with prop.PROP.TO.BE.SOLD$_t$=1

temp.hh.TOTAL.DEBT = (ind1+ind2).PENDING.TO.BE.PAID.CONS.LOANS$_t$ + (ind1+ind2).PENDING.TO.BE.PAID.FIRM.INV.LOANS$_t$ + (ind1+ind2).PENDING.TO.BE.PAID.RE.H.LOANS$_t$ + (ind1+ind2).PENDING.TO.BE.PAID.RE.NH.LOANS$_t$

temp.hh.TOTAL.DEBT.SERVICE =(ind1+ind2).INTEREST.TO.BE.PAID.CONS.LOANS$_t$ + (ind1+ind2).INTEREST.TO.BE.PAID.FIRM.INV.LOANS$_t$ + (ind1+ind2).INTEREST.TO.BE.PAID.RE.H.LOANS$_t$ + (ind1+ind2).INTEREST.TO.BE.PAID.RE.NH.LOANS$_t$

temp.RE.H.LOANS = min.prop.PROP.PRICE$_t$ $-$ β_{15} $\times$ (temp.DEP.FOR.RE$-$temp.hh.TOTAL.DEBT $-$ temp.hh.TOTAL.DEBT.SERVICE)

make a list of banks according to bank.IR.RE.H.LOANS$_t$

check the lowest interest rate

if *temp.MAX.COLLATERAL > 0*

temp.LTV.H = $\frac{\text{temp.RE.H.LOANS}}{\text{temp.MAX.COLLATERAL}}$

else

temp.LTV.H = $\frac{\text{temp.RE.H.LOANS}}{\text{min.prop.PROP.PRICE}_t}$

end

check whether bank would give the quantity taking into account hh.LTV.H$_t$

if *temp.LTV.H < β_{12}* **then**

check whether bank has that quantity

bank.SUPPLY.RE.H.LOANS$_t$ $\geq$ temp.RE.H.LOANS

check in another bank if that bank does not have that quantity

if *yes* **then**

bank.SUPPLY.RE.H.LOANS$_t$ $-$ = temp.RE.H.LOANS

if *ind.STATUS.CIVIL$_t$=2* **then**

Go to ***Updating 26.1***

else

Go to ***Updating 26.2***

end

if *prop.PRINC.HOUSING$_t$=1* **then**

hh.ACCOM.COST$_t$ + = temp.RE.H.LOANS

else

do not update

end

else

none has funds, then no property will be purchased

end

else

no admissible for a loan

Go to ***Pseudocode 27: Inheritor or life***

end

else

check the quantity the household wants, value of properties is a collateral

temp.RE.NH.LOANS = $\beta_{13.tc}$ $\times$ {min.prop.PROP.PRICE$_t$ $-$ β_{15} $\times$ (temp.DEP.FOR.RE $-$ temp.hh.TOTAL.DEBT $-$ temp.hh.TOTAL.DEBT.SERVICE)}

make a list of banks according to bank.IR.RE.NH.LOANS$_t$

check the lowest interest rate

if *temp.MAX.COLLATERAL > 0*

temp.LTV.NH = $\frac{\text{temp.RE.NH.LOANS}}{\text{temp.MAX.COLLATERAL}}$

else

temp.LTV.NH = $\frac{\text{temp.RE.NH.LOANS}}{\text{min.prop.PROP.PRICE}_t}$

end

check whether bank would give the quantity taking into account LTV.NH:

if *temp.LTV.NH < β_{14}* **then**

check whether bank has that quantity

bank.SUPPLY.RE.NH.LOANS$_t$ $\geq$ temp.RE.NH.LOANS

if *yes* **then**

bank.SUPPLY.RE.NH.LOANS$_t$ $-$ = temp.RE.NH.LOANS

if *ind.STATUS.CIVIL$_t$=2* **then**

Go to ***Updating 26.3***

else

Go to ***Updating 26.4***

end

else

none has funds, then no property will be purchased

end

else

no admissible for a loan

Go to ***Pseudocode 27: Inheritor or life***

end

end

end

end

Updating 26.1

check maturity

if *temp.RE.H.LOANS* $> \beta_{19}$ **then**

$\text{ind.RE.H.LOANS.MAT}_t = 120$

else

$\text{ind.RE.H.LOANS.MAT}_t = 80$

end

$\text{ind1.RE.H.LOANS}_t \mathrel{+}= 0.5 \times \text{temp.RE.H.LOANS}$

$\text{ind2.RE.H.LOANS}_t \mathrel{+}= 0.5 \times \text{temp.RE.H.LOANS}$

$\text{ind1.PENDING.TO.BE.PAID.RE.H.LOANS}_t \mathrel{+}= 0.5 \times \text{temp.RE.H.LOANS}$

$\text{ind2.PENDING.TO.BE.PAID.RE.H.LOANS}_t \mathrel{+}= 0.5 \times \text{temp.RE.H.LOANS}$

$$\text{ind1.RE.H.LOANS.QUARTERLY}_t \mathrel{+}= 0.5 \times \frac{\text{temp.RE.H.LOANS}}{\text{ind.RE.H.LOANS.MAT}_t}$$

$$\text{ind2.RE.H.LOANS.QUARTERLY}_t \mathrel{+}= 0.5 \times \frac{\text{temp.RE.H.LOANS}}{\text{ind.RE.H.LOANS.MAT}_t}$$

$$\text{ind1.INTEREST.TO.BE.PAID.RE.H.LOANS}_t \mathrel{+}= \frac{0.5}{\kappa_3} \times$$
$$(\text{temp.RE.H.LOANS} \times (1 + 0.25 \times \text{bank.IR.RE.H.LOANS}_t)^{\text{ind.RE.H.LOANS.MAT}_t} - \text{temp.RE.H.LOANS})$$

$$\text{ind2.INTEREST.TO.BE.PAID.RE.H.LOANS}_t \mathrel{+}= \frac{0.5}{\kappa_3} \times$$
$$(\text{temp.RE.H.LOANS} \times (1 + 0.25 \times \text{bank.IR.RE.H.LOANS}_t)^{\text{ind.RE.H.LOANS.MAT}_t} - \text{temp.RE.H.LOANS})$$

$$\text{ind1.INTEREST.TO.BE.PAID.RE.H.LOANS.QUARTERLY}_t = \frac{\text{ind1.INTEREST.TO.BE.PAID.RE.H.LOANS}_t}{\text{ind.RE.H.LOANS.MAT}_t}$$

$$\text{ind2.INTEREST.TO.BE.PAID.RE.H.LOANS.QUARTERLY}_t = \frac{\text{ind2.INTEREST.TO.BE.PAID.RE.H.LOANS}_t}{\text{ind.RE.H.LOANS.MAT}_t}$$

$\text{bank.SUPPLY.RE.H.LOANS}_t \mathrel{-}= \text{temp.RE.H.LOANS}$

$\text{bank.REV.RE.H.LOANS}_t \mathrel{+}= \text{(ind1+ind2). INTEREST.TO.BE.PAID.RE.H.LOANS.QUARTERLY}_t$

check to which household individual belongs to

$\text{hh.LTV.H}_t = \text{temp.LTV.H}$

Updating 26.2

check maturity

if *temp.RE.H.LOANS* $> \beta_{19}$ **then**

$\text{ind.RE.H.LOANS.MAT}_t = 120$

else

$\text{ind.RE.H.LOANS.MAT}_t = 80$

end

$\text{ind.RE.H.LOANS}_t \mathrel{+}= \text{temp.RE.H.LOANS}$

$\text{ind.PENDING.TO.BE.PAID.RE.H.LOANS}_t \mathrel{+}= \text{temp.RE.H.LOANS}$

$$\text{ind.RE.H.LOANS.QUARTERLY}_t \mathrel{+}= \frac{\text{temp.RE.H.LOANS}}{\text{ind.RE.H.LOANS.MAT}_t}$$

$$\text{ind.INTEREST.TO.BE.PAID.RE.H.LOANS}_t \mathrel{+}= \frac{1}{\kappa_3} \times ($$
$$\text{temp.RE.H.LOANS} \times (1 + 0.25 \times \text{bank.IR.RE.H.LOANS}_t)^{\text{ind.RE.H.LOANS.MAT}_t} - \text{temp.RE.H.LOANS})$$

$$\text{ind.INTEREST.TO.BE.PAID.RE.H.LOANS.QUARTERLY}_t = \frac{\text{ind1.INTEREST.TO.BE.PAID.RE.H.LOANS}_t}{\text{ind.RE.H.LOANS.MAT}_t}$$

$\text{bank.SUPPLY.RE.H.LOANS}_t \mathrel{-}= \text{temp.RE.H.LOANS}$

$\text{bank.REV.RE.H.LOANS}_t \mathrel{+}= \text{(ind1+ind2).INTEREST.TO.BE.PAID.RE.H.LOANS.QUARTERLY}_t$

check to which household individual belongs to

$\text{hh.LTV.H}_t = \text{temp.LTV.H}$

Updating 26.3

choose at random one maturity from the set: $\{\beta_{16}, \beta_{17}, \beta_{18}\}$

$\text{ind1.RE.NH.LOANS}_t \mathrel{+}= 0.5 \times \text{temp.RE.NH.LOANS}$

$\text{ind2.RE.NH.LOANS}_t \mathrel{+}= 0.5 \times \text{temp.RE.NH.LOANS}$

$\text{ind1.PENDING.TO.BE.PAID.RE.NH.LOANS}_t \mathrel{+}= 0.5 \times \text{temp.RE.NH.LOANS}$

$\text{ind2.PENDING.TO.BE.PAID.RE.NH.LOANS}_t \mathrel{+}= 0.5 \times \text{temp.RE.NH.LOANS}$

$$\text{ind1.RE.NH.LOANS.QUARTERLY}_t \mathrel{+}= 0.5 \times \frac{\text{temp.RE.NH.LOANS}}{\text{ind.RE.NH.LOANS.MAT}_t}$$

$$\text{ind2.RE.NH.LOANS.QUARTERLY}_t \mathrel{+}= 0.5 \times \frac{\text{temp.RE.NH.LOANS}}{\text{ind.RE.NH.LOANS.MAT}_t}$$

$$\text{ind1.INTEREST.TO.BE.PAID.RE.NH.LOANS}_t \mathrel{+}= \frac{0.5}{\kappa_3} \times$$
$$(\text{temp.RE.NH.LOANS} \times (1 + 0.25 \times \text{bank.IR.RE.NH.LOANS}_t)^{\text{ind.RE.NH.LOANS.MAT}_t} - \text{temp.RE.NH.LOANS})$$

$$\text{ind2.INTEREST.TO.BE.PAID.RE.NH.LOANS}_t \mathrel{+}= \frac{0.5}{\kappa_3} \times$$
$$(\text{temp.RE.NH.LOANS} \times (1 + 0.25 \times \text{bank.IR.RE.NH.LOANS}_t)^{\text{ind.RE.NH.LOANS.MAT}_t} - \text{temp.RE.NH.LOANS})$$

$$\text{ind1.INTEREST.TO.BE.PAID.RE.NH.LOANS.QUARTERLY}_t = \frac{\text{ind1.INTEREST.TO.BE.PAID.RE.NH.LOANS}_t}{\text{ind.RE.NH.LOANS.MAT}_t}$$

$$\text{ind2.INTEREST.TO.BE.PAID.RE.NH.LOANS.QUARTERLY}_t = \frac{\text{ind2.INTEREST.TO.BE.PAID.RE.NH.LOANS}_t}{\text{ind.RE.NH.LOANS.MAT}_t}$$

$\text{bank.SUPPLY.RE.NH.LOANS}_t \mathrel{-}= \text{temp.RE.NH.LOANS}$

$\text{bank.REV.RE.NH.LOANS}_t \mathrel{+}= \text{(ind1+ind2).INTEREST.TO.BE.PAID.RE.NH.LOANS.QUARTERLY}_t$

check to which household individual belongs to

$\text{hh.LTV.NH}_t = \text{temp.LTV.NH}$

Updating 26.4

choose at random one maturity from the set: $\{\beta_{16}, \beta_{17}, \beta_{18}\}$

$\text{ind.RE.NH.LOANS}_t \mathrel{+}= \text{temp.RE.NH.LOANS}$

$\text{ind.PENDING.TO.BE.PAID.RE.NH.LOANS}_t \mathrel{+}= \text{temp.RE.NH.LOANS}$

$$\text{ind.RE.NH.LOANS.QUARTERLY}_t \mathrel{+}= \frac{\text{temp.RE.NH.LOANS}}{\text{ind.RE.NH.LOANS.MAT}_t}$$

$$\text{ind.INTEREST.TO.BE.PAID.RE.NH.LOANS}_t \mathrel{+}= \frac{1}{\kappa_3} \times$$
$$(\text{temp.RE.NH.LOANS} \times (1 + 0.25 \times \text{bank.IR.RE.NH.LOANS}_t)^{\text{ind.RE.NH.LOANS.MAT}_t} - \text{temp.RE.NH.LOANS})$$

$$\text{ind.INTEREST.TO.BE.PAID.RE.NH.LOANS.QUARTERLY}_t \mathrel{+}= \frac{\text{ind1.INTEREST.TO.BE.PAID.RE.NH.LOANS}_t}{\text{ind.RE.NH.LOANS.MAT}_t}$$

$\text{bank.SUPPLY.RE.NH.LOANS}_t \mathrel{-}= \text{temp.RE.NH.LOANS}$

$\text{bank.REV.RE.NH.LOANS}_t \mathrel{+}= \text{(ind1+ind2).INTEREST.TO.BE.PAID.RE.NH.LOANS.QUARTERLY}_t$

check to which household individual belongs to

$\text{hh.LTV.NH}_t = \text{temp.LTV.NH}$

If bought by cash or by loans, we look for a seller of the property with temp.ADULTS.COUNTER <3

The seller could have a re.h.loans and re.nh.loans on the pledge of the property and he tries to pay them back

check the re.h.loans and re.nh.loans of the seller

if *the owner (hh) is not a marriege* **then**
- **if** *ind.PENDING.TO.BE.PAID.RE.H.LOANS$_t$ > min.prop.PROP.PRICE$_t$* **then**
  - ind.PENDING.TO.BE.PAID.RE.H.LOANS$_t$ - = min.prop.PROP.PRICE$_t$
- **else**
  - **if** *ind.PENDING.TO.BE.PAID.RE.NH.LOANS$_t$ >min.prop.PROP.PRICE$_t$ -ind.PENDING.TO.BE.PAID.RE.H.LOANS$_t$* **then**
    - ind.PENDING.TO.BE.PAID.RE.H.LOANS$_t$ = 0
    - ind.PENDING.TO.BE.PAID.RE.NH.LOANS$_t$ - =min.prop.PROP.PRICE$_t$-ind.PENDING.TO.BE.PAID.RE.H.LOANS$_t$
  - **else**
    - ind.PENDING.TO.BE.PAID.RE.H.LOANS$_t$ =0
    - ind.PENDING.TO.BE.PAID.RE.NH.LOANS$_t$ = 0
    - ind.DEPOSITS$_t$ + = min.prop.PROP.PRICE$_t$-ind.PENDING.TO.BE.PAID.RE.H.LOANS$_t$
      -ind.PENDING.TO.BE.PAID.RE.NH.LOANS$_t$
  - **end**
- **end**

else
- Do the if statement below first for wife and then for husband - 2 times!!!
- **if** *ind.PENDING.TO.BE.PAID.RE.H.LOANS$_t$ > 0.5 × min.prop.PROP.PRICE$_t$* **then**
  - ind.PENDING.TO.BE.PAID.RE.H.LOANS$_t$ - =0.5× min.prop.PROP.PRICE$_t$
- **else**
  - **if** *ind.PENDING.TO.BE.PAID.RE.NH.LOANS$_t$ >0.5 × min.prop.PROP.PRICE$_t$ -ind.PENDING.TO.BE.PAID.RE.H.LOANS$_t$* **then**
    - ind.PENDING.TO.BE.PAID.RE.H.LOANS$_t$ = 0
    - ind.PENDING.TO.BE.PAID.RE.NH.LOANS$_t$ - =0.5 ×min.prop.PROP.PRICE$_t$-ind.PENDING.TO.BE.PAID.RE.H.LOANS$_t$
  - **else**
    - ind.PENDING.TO.BE.PAID.RE.H.LOANS$_t$ =0
    - ind.PENDING.TO.BE.PAID.RE.NH.LOANS$_t$ = 0
    - ind.DEPOSITS$_t$ + = 0.5 × min.prop.PROP.PRICE$_t$-ind.PENDING.TO.BE.PAID.RE.H.LOANS$_t$
      -ind.PENDING.TO.BE.PAID.RE.NH.LOANS$_t$
  - **end**
- **end**

end

Data: GUS, BZGD
Result: Inheritor or life (27)
for *all individuals* **do**
  if $ind.GENDER_t$ = 1 && $ind.AGE_t \leq 10$ **then**
    temp.DECEASEPROB = ρ_0
  else if $ind.GENDER_t$ = 1 && $ind.AGE_t \leq 20$ **then**
    temp.DECEASEPROB = ρ_1
  else if $ind.GENDER_t$ = 1 && $ind.AGE_t \leq 30$ **then**
    temp.DECEASEPROB =ρ_2
  else if $ind.GENDER_t$ = 1 && $ind.AGE_t \leq 40$ **then**
    temp.DECEASEPROB =ρ_3
  else if $ind.GENDER_t$ = 1 && $ind.AGE_t \leq 50$ **then**
    temp.DECEASEPROB =ρ_4
  else if $ind.GENDER_t$ = 1 && $ind.AGE_t \leq 60$ **then**
    temp.DECEASEPROB =ρ_5
  else if $ind.GENDER_t$ = 1 && $ind.AGE_t \leq 70$ **then**
    temp.DECEASEPROB =ρ_6
  else if $ind.GENDER_t$ = 1 && $ind.AGE_t \leq 80$ **then**
    temp.DECEASEPROB =ρ_7
  else if $ind.GENDER_t$ = 1 && $ind.AGE_t \leq 90$ **then**
    temp.DECEASEPROB =ρ_8
  else if $ind.GENDER_t$ = 1 && $ind.AGE_t \leq 100$ **then**
    temp.DECEASEPROB =ρ_9
  else if $ind.GENDER_t$ = 1 && $ind.AGE_t \geq 101$ **then**
    temp.DECEASEPROB = 1
  else if $ind.GENDER_t$ = 0 && $ind.AGE_t \leq 10$ **then**
    temp.DECEASEPROB =ρ_{10}
  else if $ind.GENDER_t$ = 0 && $ind.AGE_t \leq 20$ **then**
    temp.DECEASEPROB =ρ_{11}
  else if $ind.GENDER_t$ = 0 && $ind.AGE_t \leq 30$ **then**
    temp.DECEASEPROB =ρ_{12}
  else if $ind.GENDER_t$ = 0 && $ind.AGE_t \leq 40$ **then**
    temp.DECEASEPROB =ρ_{13}
  else if $ind.GENDER_t$ = 0 && $ind.AGE_t \leq 50$ **then**
    temp.DECEASEPROB =ρ_{14}
  else if $ind.GENDER_t$ = 0 && $ind.AGE_t \leq 60$ **then**
    temp.DECEASEPROB =ρ_{15}
  else if $ind.GENDER_t$ = 0 && $ind.AGE_t \leq 70$ **then**
    temp.DECEASEPROB =ρ_{16}
  else if $ind.GENDER_t$ = 0 && $ind.AGE_t \leq 80$ **then**
    temp.DECEASEPROB =ρ_{17}
  else if $ind.GENDER_t$ = 0 && $ind.AGE_t \leq 90$ **then**
    temp.DECEASEPROB =ρ_{18}
  else if $ind.GENDER_t$ = 0 && $ind.AGE_t \leq 100$ **then**
    temp.DECEASEPROB =ρ_{19}
  else
    temp.DECEASEPROB = 1
  end

  Continue reading on the next page
end
for *all individuals* **do**
  if *temp.DECEASEPROB* > $\beta_{20}\times$ *rndm(0,1)* **then**
    Go to ***Inheritor (28)***
  else
    ind.AGE_t+=0.25
    ind.LABOR.$PERIODS_t$++
    Go to ***Consumer type updating (31)***
  end
end

```
Result: Inheritor (28)
temp.ADULTS = 0 ;
temp.FAMILY.SIZE = 0 ;
for deceased individuals do
    temp.ADULT.STATUS = 0 ;
    check ind.AGE_t of the deceased person
    if ind.AGE_t ≥18 then
        temp.ADULT.STATUS = 1 /*deceased person was an adult*/
    else
        temp.ADULT.STATUS = 0/*deceased person was not an adult*/
    end
end
for each individual in the household of deceased person do
    if ind.AGE_t ≥ 18 then
        temp.FAMILY.SIZE++ /*include the deceased person*/
        temp.ADULTS++ /*include the deceased person*/
    else
        temp.FAMILY.SIZE++
    end
end
if temp.FAMILY.SIZE=1 /*one adult person has died and there is no one else in the household*/ then
    if ind.(dec).LABOR.STATUS = 5 then
        if firm.WF.FIRM = 0 then
            firm.FIRM.TO.BE.SOLD = 1
            select randomly an individual with ind.LABOR.STATUS_t =! 1 /*any individual who is not a child or student*/
            delete deceased individual from the database
            Go to Inheritance (i.e. 29aa - deposits and firm are inherited - and then 30)
        else
            select an individual with ind.(inh).ESTABLISH.ID = ind.(dec).ESTABLISH.ID with the highest ind.WAGE
            /* i.e. who worked in the same establishment and firm that the deceased owner and earned the most*/
            delete deceased individual from the database
            Go to Inheritance (i.e. 29aa - deposits and firm are inherited - and then 30)
        end
    else
        select randomly an individual with ind.LABOR.STATUS_t =! 1 /*any individual who is not a child or student*/
        delete deceased individual from the database
        Go to Inheritance (i.e. 29bb - only deposits are inherited, not firm - and then 30)
    end
else
    if temp.ADULT.STATUS=0 /*child died who has nothing to be inherited*/ then
        if temp.FAMILY.SIZE = 2 && temp.ADULTS = 1 then
            if ind.(inh).AGE_t < 67 then
                cons.CONS.TYPE_t=2
                delete deceased individual from the database
                Go to Probability of opening a new firm (38)
            else
                cons.CONS.TYPE_t = 1
                delete deceased individual from the database
                Go to Probability of opening a new firm (38)
            end
        else
            check whether there are more children
            if there are more children (temp.FAMILY.SIZE - temp.ADULTS >1) then
                cons.CONS.TYPE_t=5
                Go to Probability of opening a new firm (38)
            else
                if temp.FAMILY.SIZE=3 && temp.ADULTS=2 then
                    if (ind1&ind2).AGE_t < 67 then
                        cons.CONS.TYPE_t=4
                        delete deceased individual from the database
                        Go to Probability of opening a new firm (38)
                    else
                        cons.CONS.TYPE_t=3
                        delete deceased individual from the database
                        Go to Probability of opening a new firm (38)
                    end
                else
                    hh.CONS.TYPE_t=6 /*extended household*/
                    delete deceased individual from the database
                    Go to Probability of opening a new firm (38)
                end
            end
        end
    else
        /*adult died*/
        if temp.FAMILY.SIZE=2 && temp.ADULTS=2 /*adult died and 1 adult left*/ then
            if ind.(inh).AGE_t < 67 then
                cons.CONS.TYPE_t=2 /*alone adult less than 67*/
                delete deceased individual from the database
                see: {*1.*}
            else
                cons.CONS.TYPE_t = 1 /*alone adult over 67*/
                delete deceased individual from the database
                see: {*2.*}
            end
        else
            if temp.FAMILY.SIZE=3 && temp.ADULTS=3 ./*extended household with 3 individuals adults, 1 adult died*/ then
                if (ind1&ind2).AGE_t < 67) then
                    cons.CONS.TYPE_t=4 /*couple of adults both less than 67*/
                    see: {*3.*}
                else
                    cons.CONS.TYPE_t= 3 /*couple at least one over 67*/
                    see: {*4.*}
                end
            else
                if temp.FAMILY.SIZE > temp.ADULTS then
                    if only child(ren) left then
                        Go to Adoption
                    else
                        cons.CONS.TYPE_t=5
                        see: {*5.*}
                    end
                else
                    cons.CONS.TYPE_t=6
                    see: {*6.*}
                end
            end
        end
    end
end
```

Ad. see: {*1.*} & {*2.*}

for *the only indvidual that left* **do**

```
|   if dec.ind.LABOR.STATUS = 5 then
|   |   Go to Inheritance of deposits & loans & firms (29a)
|   else
|   |   Go to Inheritance of only deposits and housing and nonhousing loans (29b)
|   end
end
```

Ad. see: {*3.*} & {*4.*}& {*5.*}& {*6.*}

for *the eldest individual* **do**

```
|   if dec.ind.LABOR.STATUS = 5 then
|   |   Go to Inheritance of deposits & loans & firms (29a)
|   else
|   |   Go to Inheritance of only deposits and housing and nonhousing loans (29b)
|   end
end
```

Ad. see: *Adoption*

Look for a new household for the child(ren) composed of two individuals with ind.STATUS.CIVIL = 2

(if no couple found, then a single individual)

check how many properties have the couple

if *they have 0* **then**

```
|   properties that the children inherited goes to the new parents
else
|   if they have one then
|   |   sum up all properties of couple and children and mark any property more than 2 as for sale (prop.PROP.TO.BE.SOLD = 1)
|   else
|   |   /*already have 2*/
|   |   mark all more than 2 as for sale
|   end
end
```

if *the old parent(s) had a firm* **then**

```
|   pick one individual at random and he or she is a new owner
|   mark the firm as for sale
|   firm.FIRM.TO.BE.SOLD = 1
else
|   no firm is inherited
end
```

Go to ***Education level updating (32)***

Data: BZGD, GUS
Result: Inheritance of deposits & loans & firms (29a)

/*update deposits and then firms and then move to (30) to properties*/

if $dec.ind.DEPOSITS_t - dec.ind.PENDING.TO.BE.PAID.RE.H.LOANS_t - dec.ind.PENDING.TO.BE.PAID.RE.NH.LOANS_t > 0$ **then**

- inh.ind.DEPOSITS$_t$ + =
- $(1-\beta_{21})\times$ (dec.ind.DEPOSITS$_t$ − dec.ind.PENDING.TO.BE.PAID.RE.H.LOANS$_t$ − dec.ind.PENDING.TO.BE.PAID.RE.NH.LOANS$_t$)
- **check** the bank that gave the consumer loan to deceased person and update non-performing consumer loans
- ind.DEFAULT.IND$_t$ = 1
- bank.NPL.CONS.LOANS$_t$ + = ind.(dec).PENDING.TO.BE.PAID.CONS.LOANS$_t$
- bank.NO.DEFAULT.IN.BANK$_t$ ++

else

- inh.ind.DEPOSITS$_t$ + = $(1-\beta_{21})\times$ dec.ind.DEPOSITS$_t$
- inh.ind.RE.H.LOANS$_t$ + = dec.ind.PENDING.TO.BE.PAID.RE.H.LOANS$_t$
- inh.ind.RE.H.LOANS.QUARTERLY$_t$ = dec.ind.RE.H.LOANS.QUARTERLY$_t$
- inh.ind.PENDING.TO.BE.PAID.RE.H.LOANS$_t$ = dec.ind.PENDING.TO.BE.PAID.RE.H.LOANS$_t$
- inh.ind.INTEREST.TO.BE.PAID.RE.H.LOANS$_t$ = dec.ind.INTEREST.TO.BE.PAID.RE.H.LOANS$_t$
- inh.ind.INTEREST.TO.BE.PAID.RE.H.QUARTERLY$_t$ = dec.ind.INTEREST.TO.BE.PAID.RE.H.LOANS.QUARTERLY$_t$
- inh.ind.RE.NH.LOANS$_t$ + = dec.ind.PENDING.TO.BE.PAID.RE.NH.LOANS$_t$
- inh.ind.RE.NH.LOANS.QUARTERLY$_t$ = dec.ind.RE.NH.LOANS.QUARTERLY$_t$
- inh.ind.PENDING.TO.BE.PAID.RE.NH.LOANS$_t$ = dec.ind.PENDING.TO.BE.PAID.RE.NH.LOANS$_t$
- inh.ind.INTEREST.TO.BE.PAID.RE.NH.LOANS$_t$ = dec.ind.INTEREST.TO.BE.PAID.RE.NH.LOANS$_t$
- inh.ind.INTEREST.TO.BE.PAID.RE.NH.QUARTERLY$_t$ = dec.ind.INTEREST.TO.BE.PAID.RE.NH.LOANS.QUARTERLY$_t$
- **check** the bank that gave the consumer loan to deceased person and update non-performing consumer loans
- ind.DEFAULT.IND$_t$ = 1
- bank.NPL.CONS.LOANS$_t$ + = ind.(dec).PENDING.TO.BE.PAID.CONS.LOANS$_t$
- bank.NO.DEFAULT.IN.BANK$_t$ ++

end

if $inh.ind.WAGE_t + inh.ind.SUBSIDY_t < rndm(0,1) \times dec.ind.WAGE_t$ **then**

- inh.ind.ENTREPRENEUR$_t$ = 2
- inh.ind.LABOR.STATUS$_t$ = 5
- don't create new establishments
- inh.ind.LABOR.PERIODS$_t$ = 0
- inh.ind.SUBSIDY$_t$ = 0
- inh.ind.ESTABLISH.ID = ESTABLISH.ID of deceased person
- inh.ind.firm.INDIVIDUAL.ID = dec.ind.firm.INDIVIDUAL.ID
- inh.ind.FIRM.INV.LOANS$_t$ + = dec.ind.PENDING.TO.BE.PAID.FIRM.INV.LOANS$_t$
  inh.ind.FIRM.INV.LOANS.QUARTERLY$_t$ = dec.ind.FIRM.INV.LOANS.QUARTERLY$_t$
  inh.ind.PENDING.TO.BE.PAID.FIRM.INV.LOANS$_t$ = dec.ind.PENDING.TO.BE.PAID.FIRM.INV.LOANS$_t$
  inh.ind.INTEREST.TO.BE.PAID.FIRM.INV.LOANS$_t$ = dec.ind.INTEREST.TO.BE.PAID.FIRM.INV.LOANS$_t$
  inh.ind.INTEREST.TO.BE.PAID.FIRM.INV.LOANS.QUARTERLY$_t$ = dec.ind.INTEREST.TO.BE.PAID.FIRM.INV.LOANS.QUARTERLY$_t$
- **Go** to ***Inheritance: Properties (30)***

else

- reject the inheritance
- inh.ind.ESTABLISHMENT.ID = ESTABLISHMENT.ID of deceased person
- inh.ind.firm.INDIVIDUAL.ID = dec.ind.firm.INDIVIDUAL.ID
- dec.ind.firm.FIRM.TO.BE.SOLD$_t$ = 1
- ind.ENTREPRENEUR$_t$= 2
  ind.LABOR.STATUS$_t$ = 5
- **check** which bank was the granter of the investment loan for a firm
- ind.DEFAULT.IND$_t$ = 1
- bank.NPL.FIRM.INV.LOANS$_t$ + = ind.(dec.).PENDING.TO.BE.PAID.FIRM.INV.LOANS$_t$
- bank.NO.DEFAULT.IN.BANK$_t$ ++
- **Go** to ***Inheritance: Properties (30)***

end

Result: Inheritance of only deposits and housing and nonhousing loans (29b)

if $dec.ind.DEPOSITS_t - dec.ind.PENDING.TO.BE.PAID.RE.H.LOANS_t - dec.ind.PENDING.TO.BE.PAID.RE.NH.LOANS_t > 0$ **then**

- inh.ind.DEPOSITS$_t$ + =
- $(1-\beta_{21})\times$ (dec.ind.DEPOSITS$_t$ − dec.ind.PENDING.TO.BE.PAID.RE.H.LOANS$_t$ − dec.ind.PENDING.TO.BE.PAID.RE.NH.LOANS$_t$)
- **check** the bank that gave the consumer loan to deceased person and update non-performing consumer loans
- ind.DEFAULT.IND$_t$ = 1
- bank.NPL.CONS.LOANS$_t$ + = ind.(dec).PENDING.TO.BE.PAID.CONS.LOANS$_t$
- bank.NO.DEFAULT.IN.BANK$_t$ ++
- **Go** to ***Inheritance: Properties (30)***

else

- inh.ind.DEPOSITS$_t$ + = $(1-\beta_{21})\times$ dec.ind.DEPOSITS$_t$
- inh.ind.RE.H.LOANS$_t$ + = dec.ind.PENDING.TO.BE.PAID.RE.H.LOANS$_t$
- inh.ind.RE.H.LOANS.QUARTERLY$_t$ = dec.ind.RE.H.LOANS.QUARTERLY$_t$
- inh.ind.PENDING.TO.BE.PAID.RE.H.LOANS$_t$ = dec.ind.PENDING.TO.BE.PAID.RE.H.LOANS$_t$
- inh.ind.INTEREST.TO.BE.PAID.RE.H.LOANS$_t$ = dec.ind.INTEREST.TO.BE.PAID.RE.H.LOANS$_t$
- inh.ind.INTEREST.TO.BE.PAID.RE.H.QUARTERLY$_t$ = dec.ind.INTEREST.TO.BE.PAID.RE.H.LOANS.QUARTERLY$_t$
- inh.ind.RE.NH.LOANS$_t$ + = dec.ind.PENDING.TO.BE.PAID.RE.NH.LOANS$_t$
- inh.ind.RE.NH.LOANS.QUARTERLY$_t$ = dec.ind.RE.NH.LOANS.QUARTERLY$_t$
- inh.ind.PENDING.TO.BE.PAID.RE.NH.LOANS$_t$ = dec.ind.PENDING.TO.BE.PAID.RE.NH.LOANS$_t$
- inh.ind.INTEREST.TO.BE.PAID.RE.NH.LOANS$_t$ = dec.ind.INTEREST.TO.BE.PAID.RE.NH.LOANS$_t$
- inh.ind.INTEREST.TO.BE.PAID.RE.NH.QUARTERLY$_t$ = dec.ind.INTEREST.TO.BE.PAID.RE.NH.LOANS.QUARTERLY$_t$
- **check** the bank that gave the consumer loan to deceased person and update non-performing consumer loans
- ind.DEFAULT.IND$_t$ = 1
- bank.NPL.CONS.LOANS$_t$ + = ind.(dec).PENDING.TO.BE.PAID.CONS.LOANS$_t$
- bank.NO.DEFAULT.IN.BANK$_t$ ++
- **Go** to ***Inheritance: Properties (30)***

end

Data: BZGD, GUS
Result: Inheritance of deposits & loans & firms (29aa)
/*update deposits and then firms and then move to (30) to properties*/
inh.ind.DEPOSITS$_t$ + =(1 − β_{21})× (dec.ind.DEPOSITS$_t$)
check the bank that gave the consumer loan to deceased person and update non-performing consumer loans
ind.DEFAULT.IND$_t$ = 1
bank.NPL.CONS.LOANS$_t$ + = ind.(dec).PENDING.TO.BE.PAID.CONS.LOANS$_t$
bank.NO.DEFAULT.IN.BANK$_t$ ++

if *inh.ind.WAGE$_t$ + inh.ind.SUBSIDY$_t$ < rndm(0,1) × dec.ind.WAGE$_t$* **then**
    inh.ind.ENTREPRENEUR$_t$ = 2
    inh.ind.LABOR.STATUS$_t$ = 5
    don't create new establishments
    inh.ind.LABOR.PERIODS$_t$ = 0
    inh.ind.SUBSIDY$_t$ = 0
    inh.ind.ESTABLISH.ID = ESTABLISH.ID of deceased person
    inh.ind.firm.INDIVIDUAL.ID = dec.ind.firm.INDIVIDUAL.ID
    inh.ind.FIRM.INV.LOANS$_t$ += dec.ind.PENDING.TO.BE.PAID.FIRM.INV.LOANS$_t$
    inh.ind.FIRM.INV.LOANS.QUARTERLY$_t$ = dec.ind.FIRM.INV.LOANS.QUARTERLY$_t$
    inh.ind.PENDING.TO.BE.PAID.FIRM.INV.LOANS$_t$ = dec.ind.PENDING.TO.BE.PAID.FIRM.INV.LOANS$_t$
    inh.ind.INTEREST.TO.BE.PAID.FIRM.INV.LOANS$_t$ = dec.ind.INTEREST.TO.BE.PAID.FIRM.INV.LOANS$_t$
    inh.ind.INTEREST.TO.BE.PAID.FIRM.INV.LOANS.QUARTERLY$_t$ = dec.ind.INTEREST.TO.BE.PAID.FIRM.INV.LOANS.QUARTERLY$_t$
    Go to ***Inheritance: Properties (30)***
else
    reject the inheritance
    inh.ind.ESTABLISHMENT.ID = ESTABLISHMENT.ID of deceased person
    inh.ind.firm.INDIVIDUAL.ID = dec.ind.firm.INDIVIDUAL.ID
    dec.ind.firm.FIRM.TO.BE.SOLD$_t$ = 1
    ind.ENTREPRENEUR$_t$= 2
    ind.LABOR.STATUS$_t$ = 5
    check which bank was the granter of the investment loan for a firm
    ind.DEFAULT.IND$_t$ = 1
    bank.NPL.FIRM.INV.LOANS$_t$ + = ind.(dec.).PENDING.TO.BE.PAID.FIRM.INV.LOANS$_t$
    bank.NO.DEFAULT.IN.BANK$_t$ ++
    Go to ***Inheritance: Properties (30)***
end

Result: Inheritance of only deposits and loans (29bb)
/*update deposits and then firms and then move to (30) to properties*/
inh.ind.DEPOSITS$_t$ + =(1 − β_{21})× (dec.ind.DEPOSITS$_t$)
check the bank that gave the consumer loan to deceased person and update non-performing consumer loans
ind.DEFAULT.IND$_t$ = 1
bank.NPL.CONS.LOANS$_t$ + = ind.(dec).PENDING.TO.BE.PAID.CONS.LOANS$_t$
bank.NO.DEFAULT.IN.BANK$_t$ ++
Go to ***Inheritance: Properties (30)***

```
Result: Inheritance: Properties (30)
for selected household of dec individual do
    check how many adults in the household of dec.person
    if there was only 1 adult that is the deceased person then
        check the hh.ST.OWNER_t
        if hh.ST.OWNER_t=2 then
            we have already deleted an individual from the system, now we delete records where he lives (in which property)
            he lived on rent
            update prop.NO.HHS.RENT − −
        else
            if hh.ST.OWNER_t=1 && ind.PENDING.TO.BE.PAID.RE.H.LOANS_t > 0 then
                deceased person has a housing loan
                do not delete property from the system
                bank gets the property and tries to sale it
                look for households that would like to buy it
                for all households with no more than 2 adults (cons.CONS.TYPE =!6) do
                    temp.DEP=(ind1&ind2).DEPOSITS_t
                    check list of households with temp.DEP ≥ prop.PROP.PRICE_t
                    if found at least one then
                        pick at random the buyer and update
                        bank.NPL.RE.H.LOANS + = dec.ind.PENDING.TO.BE.PAID.RE.H.LOANS
                        bank.NPL.RE.NH.LOANS + = dec.ind.PENDING.TO.BE.PAID.RE.NH.LOANS
                        bank.REV.RE.H.LOANS_t + = (1−β_22)× prop.PROP.PRICE_t
                        if ind(buy.hh).STATUS.CIVIL_t=2 then
                            ind1.(buy).DEPOSITS_t−=0.5 × (1−β_22)× prop.PROP.PRICE_t
                            ind2.(buy).DEPOSITS_t−=0.5 × (1−β_22)× prop.PROP.PRICE_t
                        else
                            ind.(buy).DEPOSITS_t−=(1−β_22)× prop.PROP.PRICE_t
                        end
                    else
                        mark the property to sell
                        prop.PROP.TO.BE.SOLD_t=1
                        prop.PROP.PRICE_t=0.95× (1−β_22)× prop.PROP.PRICE_t
                    end
                end
            else
                deceased person was living on his house without mortgage
                set prop.PROP.TO.BE.SOLD_t=1
                delete individual from the system
            end
        end
    else
        at lease one more adult in the family of deceased person
        property stays in the same household and is paying the housing and non-housing loans
    end
end
```

Data: BZGD
Result: Consumer type updating (31)
for *each individual that survived* **do**
  check ind.AGE$_t$ and cons.CONS.TYPE$_t$
  if *ind.AGE$_t$=67* **then**
    if *cons.CONS.TYPE$_t$=2* **then**
      cons.CONS.TYPE$_t$=1
    else
      if *cons.CONS.TYPE$_t$=4* **then**
        cons.CONS.TYPE$_t$=3
      else
        do not update consumer type
      end
    end
  else
    if *ind.AGE$_t$=16* **then**
      create new household for that individual (new hh.HOUSEHOLD.ID)
      cons.CONS.TYPE$_t$=2
      hh.TOTAL.INC.FAM$_t$=ind.WAGE$_t$+ind.SUBSIDY$_t$+bank.IR.DEPOSITS$_t$× ind.DEPOSITS$_t$
      prop.PROPERTY.ID=PROPERTY.ID of previous household (he lives with his parents)
      hh.ACCOM.COST$_t$=0
      Go to ***Education***
    else
      do not update consumer type
    end
  end
end

Data: BZGD, GUS
Result: Education level updating (32)
for *all survivors* **do**
  if *ind.EDUC$_t$ = {0 || 1} && 0 < ind.PERIODS.EDU$_t$ < 24* **then**
    ind.EDUC.LEVEL$_t$ = 1
  else if *ind.EDUC$_t$ = 1 && ind.PERIODS.EDU$_t$ ≥ 24* **then**
    ind.EDUC.LEVEL$_t$ = 2
  else if *ind.EDUC$_t$ = 2 && ind.PERIODS.EDU$_t$ ≥ 36* **then**
    ind.EDUC.LEVEL$_t$ = 3
  else if *ind.EDUC$_t$ = 3 && ind.PERIODS.EDU$_t$ ≥ 48* **then**
    ind.EDUC.LEVEL$_t$ = 4
  else if *ind.EDUC$_t$ = 4 && ind.PERIODS.EDU$_t$ ≥ 60* **then**
    ind.EDUC.LEVEL$_t$ = 5
  else if *ind.EDUC$_t$ = 5 && ind.PERIODS.EDU$_t$ ≥ 68* **then**
    ind.EDUC.LEVEL$_t$ = 6
  else if *ind.EDUC$_t$ = 6 && ind.PERIODS.EDU$_t$ ≥ 76* **then**
    ind.EDUC.LEVEL$_t$ = 7
  else if *ind.EDUC$_t$ = 7 && ind.PERIODS.EDU$_t$ ≥ 88* **then**
    ind.EDUC.LEVEL$_t$ = 8
  end
end
.

Data: GUS

Result: Continue education (33)

for *all individuals* **do**

if $ind.EDUC.LEVEL_t = 2$ && $(ind.LABOR.STATUS_t = 2$ && $ind.LABOR.PERIODS_t > 8$ && $rndm(0,1) < \beta_{23}$ || $ind.AGE_t < 16)$ **then**

$\text{ind.EDUC}_t = 2$ && $\text{ind.LABOR.STATUS}_t = 1$

ind.PERIODS.EDU ++

else if $(ind.GENDER_t = 1$ && $ind.EDUC.LEVEL_t = 3$ && $ind.AGE_t \leq 18$ && $ind.LABOR.STATUS_t = 2$ && $rndm(0,1) < \beta_{24})$ || $(ind.GENDER_t = 1$ && $ind.EDUC.LEVEL_t = 3$ && $ind.LABOR.STATUS_t = 2$ && $ind.LABOR.PERIODS_t > 8$ && $rndm(0,1) < \beta_{25})$ **then**

$\text{ind.EDUC}_t = 3$ && $\text{ind.LABOR.STATUS}_t = 1$

ind.PERIODS.EDU ++

else if $(ind.GENDER_t = 1$ && $ind.EDUC.LEVEL_t = 4$ && $ind.AGE_t \leq 20$ && $ind.LABOR.STATUS_t = 2$ && $rndm(0,1) < \beta_{26})$ || $(ind.GENDER_t = 1$ && $ind.EDUC.LEVEL_t = 4$ && $ind.LABOR.STATUS_t = 2$ && $ind.LABOR.PERIODS_t > 8$ && $rndm(0,1) < \beta_{27})$ **then**

$\text{ind.EDUC}_t = 4$ && $\text{ind.LABOR.STATUS}_t = 1$

ind.PERIODS.EDU ++

else if $(ind.GENDER_t = 0$ && $ind.EDUC.LEVEL_t = 3$ && $ind.AGE_t \leq 18$ && $ind.LABOR.STATUS_t = 2$ && $rndm(0,1) < \beta_{28})$ || $(ind.GENDER_t = 0$ && $ind.EDUC.LEVEL_t = 3$ && $ind.LABOR.STATUS_t = 2$ && $ind.LABOR.PERIODS_t > 8$ && $rndm(0,1) < \beta_{29})$ **then**

$\text{ind.EDUC}_t = 4$ && $\text{ind.LABOR.STATUS}_t = 1$

ind.PERIODS.EDU ++

else if $(ind.GENDER_t = 0$ && $ind.EDUC.LEVEL_t = 4$ && $ind.AGE_t \leq 20$ && $ind.LABOR.STATUS_t = 2$ && $rndm(0,1) < \beta_{30})$ || $(ind.GENDER_t = 0$ && $ind.EDUC.LEVEL_t = 4$ && $ind.LABOR.STATUS_t = 2$ && $ind.LABOR.PERIODS_t > 8$ && $rndm(0,1) < \beta_{31})$ **then**

$\text{ind.EDUC}_t = 4$ && $\text{ind.LABOR.STATUS}_t = 1$

ind.PERIODS.EDU ++

else if $(ind.EDUC.LEVEL_t = 5$ && $ind.AGE_t \leq 19$ && $ind.LABOR.STATUS_t = 2$ && $rndm(0,1) < \beta_{32})$ || $(ind.EDUC.LEVEL_t = 5$ && $ind.LABOR.STATUS_t = 2$ && $ind.LABOR.PERIODS_t > 8$ && $rndm(0,1) < \beta_{33})$ **then**

$\text{ind.EDUC}_t = 5$ && $\text{ind.LABOR.STATUS}_t = 1$

ind.PERIODS.EDU ++

else if $(ind.EDUC.LEVEL_t = 6$ && $ind.AGE_t \leq 26$ && $ind.LABOR.STATUS_t = 2$ && $rndm(0,1) < \beta_{34})$ || $(ind.EDUC.LEVEL_t = 6$ && $ind.LABOR.STATUS_t = 2$ && $ind.LABOR.PERIODS_t > 8$ && $rndm(0,1) < \beta_{35})$ **then**

$\text{ind.EDUC}_t = 6$ && $\text{ind.LABOR.STATUS}_t = 1$

ind.PERIODS.EDU ++

else if $(ind.EDUC.LEVEL_t = 7$ && $ind.AGE_t < 20$ && $ind.LABOR.STATUS_t = 2$ && $rndm(0,1) < \beta_{36})$ || $(ind.EDUC.LEVEL_t = 7$ && $ind.LABOR.STATUS_t = 2$ && $ind.LABOR.PERIODS_t > 8$ && $rndm(0,1) < \beta_{37})$ **then**

$\text{ind.EDUC}_t = 7$ && $\text{ind.LABOR.STATUS}_t = 1$

ind.PERIODS.EDU ++

else if $(ind.EDUC.LEVEL_t = 7$ && $ind.LABOR.STATUS_t = 2$ && $ind.LABOR.PERIODS_t > 8$ && $rndm(0,1) < \beta_{38})$ **then**

$\text{ind.EDUC}_t = 8$ && $\text{ind.LABOR.STATUS}_t = 1$

ind.PERIODS.EDU ++

end

Go to ***Divorces (34)***

end

Data: GUS

Result: Divorces (34)

for *ind.STATUS.CIVIL$_t$ = 2* **do**

Check to which household the individual belongs to

temp.ADULTS.COUNTER=0

for *all individuals in this household with ind.AGE>18* **do**

temp.ADULTS.COUNTER++

end

Go to ***Births*** & then follow

if *ind.STATUS.CIVIL$_t$ = 2 && rndm(0,1) < $\beta_{40.age}$ && temp.ADULTS.COUNTER <3* **then**

ind1.STATUS.CIVIL$_t$ = 4

check with whom was married & change to ind2.STATUS.CIVIL$_t$ = 2

check ind1.GENDER$_t$ && ind2.GENDER$_t$

for *ind.GENDER $_t$= 1* **do**

ind2.STATUS.CIVIL$_t$ = 4

check ind.AGE$_t$ of ex husband

if *ind.AGE$_t$ < 67* **then**

change cons.(ex-husb).CONS.TYPE$_t$ = 2

else

change cons.(ex-husb).CONS.TYPE$_t$ = 1

end

create new household for ex husband

hh.(new).TOTAL.INC.FAM$_t$ = ind.(ex husband).INCOME$_t$

hh.(new).ACCOM.COST$_t$ = 0.5 × hh.(old).ACCOM.COST$_t$

check how much properties they had

{* **if** *they had two* **then**

each stay in one of them

hh(exwife).ST.OWNER=1

hh(exwife).PRINC.HOUSING=1

prop.(wife).PROPERTY.ID = one.of.old.hh.PROPERTY.ID

hh.(exhusband).ST.OWNER=1

hh(exhusband).PRINC.HOUSING=1

prop.(husband).PROPERTY.ID = one.of.old.hh.PROPERTY.ID

else

//*only one property*//

ex–wife stays in the property and is the owner

hh(exwife).ST.OWNER$_t$=1

hh(exwife).PRINC.HOUSING$_t$=1

ex-housband stays temporarly in the property as a renter

hh.(exhusband).ST.OWNER$_t$=2

hh(exhusband).PRINC.HOUSING$_t$=1

prop.NO.HHS.RENT ++

re.h.loans and re.nh loans are related to property so needs to be linked to ex–wife

ind.(husband).PENDING.TO.BE.PAID.RE.H.LOANS$_t$ = 0

ind.(wife).PENDING.TO.BE.PAID.RE.H.LOANS$_t$ + = ind.(mąż).PENDING.TO.BE.PAID.RE.H.LOANS$_t$

ind.(husband).PENDING.TO.BE.PAID.RE.H.LOANS$_t$ = 0

ind.(wife).PENDING.TO.BE.PAID.RE.H.LOANS$_t$ + = ind.(mąż).PENDING.TO.BE.PAID.RE.H.LOANS$_t$

ind.(husband).PENDING.TO.BE.PAID.RE.NH.LOANS$_t$ = 0

ind.(wife).PENDING.TO.BE.PAID.RE.NH.LOANS$_t$ + = ind.(mąż).PENDING.TO.BE.PAID.RE.NH.LOANS$_t$

ind.(husband).PENDING.TO.BE.PAID.RE.NH.LOANS$_t$ = 0

ind.(wife).PENDING.TO.BE.PAID.RE.NH.LOANS$_t$ + = ind.(mąż).PENDING.TO.BE.PAID.RE.NH.LOANS$_t$

ind.(husband).RE.H.LOANS$_t$ = 0

ind.(wife).RE.H.LOANS$_t$ + = ind.(husband).RE.H.LOANS$_t$

ind.(husband).RE.H.LOANS.QUARTERLY$_t$ = 0

ind.(wife).RE.H.LOANS.QUARTERLY$_t$ + = ind.(husband).RE.H.LOANS.QUARTERLY$_t$

ind.(husband).INTEREST.TO.BE.PAID.RE.H.LOANS.QUARTERLY$_t$=0

ind.(wife).INTEREST.TO.BE.PAID.RE.H.LOANS.QUARTERLY$_t$+=
ind.(husband).INTEREST.TO.BE.PAID.RE.H.LOANS.QUARTERLY$_t$

ind.(husband).INTEREST.TO.BE.PAID.RE.H.LOANS$_t$=0

ind.(wife).INTEREST.TO.BE.PAID.RE.H.LOANS$_t$+= ind.(husband).INTEREST.TO.BE.PAID.RE.H.LOANS$_t$

ind.(husband).RE.NH.LOANS$_t$ = 0

ind.(wife).RE.H.LOANS$_t$ + = ind.(husband).RE.NH.LOANS$_t$

ind.(husband).RE.NH.LOANS.QUARTERLY$_t$ = 0

ind.(wife).RE.NH.LOANS.QUARTERLY$_t$ + = ind.(husband).RE.NH.LOANS.QUARTERLY$_t$

ind.(husband).INTEREST.TO.BE.PAID.RE.NH.LOANS.QUARTERLY$_t$=0

ind.(wife).INTEREST.TO.BE.PAID.RE.NH.LOANS.QUARTERLY$_t$+=
ind.(husband).INTEREST.TO.BE.PAID.RE.NH.LOANS.QUARTERLY$_t$

ind.(husband).INTEREST.TO.BE.PAID.RE.NH.LOANS$_t$=0

ind.(wife).INTEREST.TO.BE.PAID.RE.NH.LOANS$_t$+= ind.(husband).INTEREST.TO.BE.PAID.RE.NH.LOANS$_t$ *}

end

end

for *ind.GENDER$_t$ = 0* **do**

create new household for wife

check ind.AGE$_t$ and number of children to update cons.CONS.TYPE$_t$

temp.NO.CHILDREN = 0

for *each children in old household of ind.1- and ind.2- (exwife and exhusband)* **do**

temp.NO.CHILDREN + +

end

if *temp. NO.CHILDREN = 0* **then**

check ind. AGE$_t$

if *cons.(exwife).AGE$_t$ < 67* **then**

change cons.(exwife).CONS.TYPE$_t$ = 2

else

change cons.(exhusband).CONS.TYPE$_t$ = 1

end

else

change cons.(ex-wife).CONS.TYPE$_t$ = 5

end

hh.(ex-wife).DONATIONS$_t$ + = β_{39} × ind.(ex-husband).WAGE$_t$ × temp.NO.CHILDREN$_t$

hh.(ex-husband).DONATIONS$_t$ − = β_{39} × ind.(ex-husband).WAGE$_t$ × temp.NO.CHILDREN$_t$

create new household for ex-wife

all children have the same HOUSEHOLD.ID that the mother

hh.(new).TOTAL.INC.FAM$_t$ = ind.(ex-wife).INCOME$_t$

hh.(new).ACCOM.COST$_t$ = 0.5 × hh.(old).ACCOM.COST$_t$

check how much properties they had

do if statement as above {* *}

end

else

they do not divorce

end

Go to ***Marriages (35)***

end

Data: GUS

Result: Marriages (35)

for *individuals from households with temp.ADULTS.COUNTER<3 && ind.GENDER*$_t$ *=0 && ind.AGE*$_t \geq 16$ *&& ind.STATUS.CIVIL*$_t$*!=2 && rndm(0,1)* $<\beta_{41.age}\times$ *(1 if ind.STATUS.CIVIL*$_t$*=1)* $+\beta_{42.age}\times$ *(1 if ind.STATUS.CIVIL*$_t$*=3)+* $\beta_{43.age}\times$ *(1 if ind.STATUS.CIVIL*$_t$*=4)* **do**

- ind.STATUS.CIVIL$_t$=2
- look for other individual (husband) with ind.GENDER$_t$=1 && ind.STATUS.CIVIL$_t$!=2 && ind.AGE$_t \geq 16$ && |ind1.AGE$_t$–ind2.AGE$_t$| $\leq$ 10
- **if** *at least one found* **then**
  - pick one at random and update
  - ind2.(new.husband).STATUS.CIVIL$_t$=2
  - change the household of husband for a household of wife and potentially children (HOUSEHOLD.ID of wife)
  - **check** how many properites in total had wife & husband
  - temp.PROPERTIES.TOTAL = 0
  - **for** *her and his properties (for all their prop.PROPERTY.ID* **do**
    - **if** *prop.ST.OWNER*$_t$ *= 1* **then**
      - temp.PROPERTIES.TOTAL ++
    - **else**
      - temp.PROPETIES.TOTAL does not change
    - **end**
  - **end**
  - **if** *temp.PROPERTIES.TOTAL>2* **then**
    - sell temp.PROPERTIES.TOTAL more than 2 properties that are not prop.PRINC.HOUSING$_t$ = 1
    - **for** *all properties that they own more than 2 and not principal housing* **do**
      - prop.PROP.TO.BE.SOLD$_t$ = 1
      - look for a buyer (hh) with temp.DEP.FOR.RE (from (24)) > prop.PROP.PRICE$_t$
      - **if** *at least found* **then**
        - choose one at random
        - **if** *household is one adult (single or single with children)* **then**
          - ind.(buyer).DEPOSITS$_t$ – = prop.PROP.PRICE$_t$
          - update spatial codes of individual to the ones of property
        - **else**
          - ind.1(buyer).DEPOSITS$_t$ – = 0.5 × prop.PROP.PRICE$_t$
          - ind.2(buyer).DEPOSITS$_t$ – = 0.5 × prop.PROP.PRICE$_t$
          - update spatial codes of members of household to the ones of the property
        - **end**
      - **else**
        - decrease price if you cannot find a buyer
        - prop.PROP.PRICE$_t$ = 0.9 × prop.PROP.PRICE$_t$
        - decrease price even more that is repeat the procedure when needed
        - update spatial codes of individuals members of the household that bought the property
      - **end**
    - **end**
    - temp.SUM.OF.PROPERTIES.PRICES = 0
    - temp.HALF.OF.SUM.OF.PROPERTIES.PRICES = 0
    - **for** *all properties that they owned more than 2 and not principal housing that have been sold (we found a buyer)* **do**
      - temp.SUM.OF.PROPERTIES.PRICES + = prop.PROP.PRICE$_t$
    - **end**
    - temp.HALF.OF.SUM.OF.PROPERTIES.PRICES = 0.5 × temp.SUM.OF.PROPERTIES.PRICES
    - **for** *both adults in the marriage (wife and husband)* **do**
      - use temp.HALF.OF.SUM.OF.PROPERTIES.PRICES to pay back real estate housing and non-housing loans
      - and/or updating deposits
      - **if** *ind.PENDING.TO.BE.PAID.RE.H.LOANS*$_t \geq$ *temp.HALF.OF.SUM.OF.PROPERTIES.PRICES* **then**
        - ind.PENDING.TO.BE.PAID.RE.H.LOANS$_t$ – = temp.HALF.OF.SUM.OF.PROPERTIES.PRICES
      - **else**
        - **if** *ind.PENDING.TO.BE.PAID.RE.NH.LOANS*$_t \geq$ *(temp.HALF.OF.SUM.OF.PROPERTIES.PRICES – ind.PENDING.TO.BE.PAID.RE.H.LOANS*$_t$*)* **then**
          - ind.PENDING.TO.BE.PAID.RE.NH.LOANS$_t$ – = temp.HALF.OF.SUM.OF.PROPERTIES.PRICES – ind.PENDING.TO.BE.PAID.RE.H.LOANS$_t$
          - ind.PENDING.TO.BE.PAID.RE.H.LOANS$_t$ = 0
        - **else**
          - ind.DEPOSITS$_t$ + = temp.HALF.OF.SUM.OF.PROPERTIES.PRICES – ind.PENDING.TO.BE.PAID.RE.H.LOANS$_t$ – ind.PENDING.TO.BE.PAID.RE.NH.LOANS$_t$
          - ind.PENDING.TO.BE.PAID.RE.H.LOANS$_t$ = 0
          - ind.PENDING.TO.BE.PAID.RE.NH.LOANS$_t$ = 0
        - **end**
      - **end**
    - **end**
  - **else**
    - they have both in total one or two properties
    - assign to the wife's property prop.PRINC.HOUSING$_t$ = 1
    - assign to the husband's property prop.PRINC.HOUSING$_t$= 0
    - nothing changes with re.h.loans and re.nh.loans
  - **end**
  - /*see a part of pseudocode on the next page*/
- **else**
  - no husband found
  - no marriage
  - **Go** to ***Births (36)***
- **end**

end

```
/*part of the pseudocode from the last page*/
check if wife had children
temp.NO.CHILDREN2=0
for each individual in her household do
    if ind.AGE_t < 16 then
        temp.NO.CHILDREN2++
    else
        temp.NO.CHILDREN2=0
    end
end
if temp.NO.CHILDREN2 >0 then
    cons.(new.hh).CONS.TYPE_t=5
else
    check ind1.AGE_t && ind2.AGE_t
    temp.NO.OLDS=0
    for each individual in the household do
        if ind.AGE_t > 67 then
            temp.NO.OLDS++
        else
            temp.NO.OLDS=0
        end
    end
    if temp.NO.OLDS > 0 then
        cons.(new.hh).CONS.TYPE_t=3
    else
        Go to Births (36)
    end
end
```

Data: GUS
Result: Births (36)
for *all individuals from households with temp.ADULTS.COUNTER <3* **do**
  if *rndm(0,1) <* $\beta_{44.age}\times$ *(1 if ind.STATUS.CIVIL*$_t$ *!=2) +* $\beta_{45.age}\times$ *(1 if ind.STATUS.CIVIL*$_t$ *= 2)* **then**
    Create new individual
    new INDIVIDUAL.ID
    ind.HOUSEHOLD.ID = mother.HOUSEHOLD.ID
    ind.ESTABLISH.ID = 0
    ind.AGE$_t$=0
    ind.BANK.ID1=choose at random
    ind.BANK.ID2=choose at random
    ind.BANK.ID3=0
    ind.BANK.ID4=0
    ind.BANK.ID5=0
    ind.CONS.LOANS$_t$ =0
    ind.CONS.LOANS.MAT$_t$ = 0
    ind.CONS.LOANS.QUARTERLY$_t$ = 0
    ind.DEFAULT.IND$_t$ = 0
    ind.DEPOSITS$_t$=0
    ind.EDUC$_t$ = 1
    ind.EDUC.LEVEL$_t$=1
    ind.ENTREP.PAST$_t$ = 0
    ind.ENTREPRENEUR$_t$ = 0
    ind.ENTREP.SPIRIT$_t$ = rndm(0,1)
    ind.FIRM.INV.LOANS$_t$ = 0
    ind.FIRM.INV.LOANS.MAT$_t$ = 0
    ind.FIRM.INV.LOANS.QUARTERLY$_t$ = 0
    if *rndm(0,1) < 0.5* **then**
      ind.GENDER$_t$ = 0
    else
      ind.GENDER$_t$ = 1
    end
    ind.INCOME$_t$ = 0
    ind.INTEREST.TO.BE.PAID.CONS.LOANS$_t$ = 0
    ind.INTEREST.TO.BE.PAID.CONS.LOANS.QUARTERLY$_t$=0
    ind.INTEREST.TO.BE.PAID.FIRM.INV.LOANS$_t$=0
    ind.INTEREST.TO.BE.PAID.FIRM.INV.LOANS.QUARTERLY$_t$=0
    ind.INTEREST.TO.BE.PAID.RE.H.LOANS$_t$=0
    ind.INTEREST.TO.BE.PAID.RE.H.QUARTERLY$_t$=0
    ind.INTEREST.TO.BE.PAID.RE.NH.LOANS$_t$=0
    ind.INTEREST.TO.BE.PAID.RE.NH.QUARTERLY$_t$=0
    ind.LABOR.PERIODS$_t$=0
    ind.LABOR.STATUS$_t$=1
    ind.NO.CONS.LOANS$_t$=0
    ind.PERC$_t$=0
    ind.PERC.PERC$_t$=0
    ind.PENDING.TO.BE.PAID.CONS.LOANS$_t$=0
    ind.PENDING.TO.BE.PAID.FIRM.INV.LOANS$_t$=0
    ind.PENDING.TO.BE.PAID.RE.H.LOANS$_t$=0
    ind.PENDING.TO.BE.PAID.RE.NH.LOANS$_t$=0
    ind.PERIODS.EDU$_t$=0
    ind.RE.H.LOANS$_t$=0
    ind.RE.H.LOANS.MAT$_t$=0
    ind.RE.H.LOANS.QUARTERLY$_t$=0
    ind.RE.NH.LOANS$_t$=0
    ind.RE.NH.LOANS.MAT$_t$=0
    ind.RE.NH.LOANS.QUARTERLY$_t$=0
    ind.SHARES$_t$=0
    ind.SPATIAL.CODE1$_t$=0
    ind.SPATIAL.CODE2$_t$=0
    ind.SPATIAL.CODE3$_t$=0
    ind.SPATIAL.CODE4$_t$=0
    ind.STATUS.CIVIL$_t$=1
    ind.SUBSIDY$_t$=0
    ind.WAGE$_t$=0
    ind.WORKER.SKILLS$_t$=0
    if *hh.(child).CONS.TYPE*$_t$ *! = 5* **then**
      hh.(child).CONS.TYPE$_t$ = 5
    else
      do not change consumer type
    end
  else
    no individual (child) is created!
  end
  Go to ***Entrepreneurs*** **(37)**
end

Data: GUS

Result: Individuals updating – Entrepreneurs (37)

Check status in the labor market and compute ind.ENTREP.SPIRIT$_t$

if *ind.LABOR.STATUS$_t$ = 2 && ind.AGE$_t$ > 16* **then**

ind.ENTREP.SPIRIT$_t$ = $max\{min$ (1, ind.ENTREP.SPIRIT$_t$× (β_{46} × ind.GENDER$_t$+β_{47}× ind.EDUC.LEVEL$_t$+β_{48}× ind.ENTREP.PAST$_t$+β_{49}× ind.AGE$_t$-β_{50}× ind.LABOR.PERIODS$_t$)), $\beta_{51}\}$

else if *ind.LABOR.STATUS$_t$ = 3* **then**

ind.ENTREP.SPIRIT$_t$ = $max\{min$ (1, ind.ENTREP.SPIRIT$_t$× (β_{52}× ind.GENDER$_t$ + β_{53}× ind.EDUC.LEVEL$_t$+β_{54}× ind.ENTREP.PAST$_t$+β_{55}× ind.AGE$_t$+β_{56}× ind.LABOR.PERIODS$_t$)), $\beta_{57}\}$

else if *ind.LABOR.STATUS$_t$=4* **then**

ind.ENTREP.SPIRIT$_t$ = $max\{min$ (1, ind.ENTREP.SPIRIT$_t$× (β_{58}× ind.GENDER$_t$+β_{59}× ind.EDUC.LEVEL$_t$+β_{60}× ind.ENTREP.PAST$_t$+β_{61}× ind.AGE$_t$-β_{62}× ind.LABOR.PERIODS$_t$)), $\beta_{63}\}$

else if *ind.LABOR.STATUS$_t$=5* **then**

ind.ENTREP.SPIRIT$_t$ = $max\{min$ (1, ind.ENTREP.SPIRIT$_t$× (β_{64}× ind.GENDER+β_{65}× ind.EDUC.LEVEL$_t$+β_{66}× ind.ENTREP.PAST$_t$+β_{67}× ind.AGE$_t$+β_{68}× ind.LABOR.PERIODS$_t$)), $\beta_{69}\}$

end

if *rndm(0,1)* × ι_1 + ι_2 < *ind.ENTREP.SPIRIT$_t$* **then**

ind.ENTREPRENEUR$_t$=2

Go to ***Firm Demography (Pseudocodes 38–46) sequentially***

else

ind.ENTREPRENEUR$_t$=1

Go to ***Individuals labor status updating (47)*****end**

end

Data: GUS

Result: Probability of opening a new firm (38)

for *all individuals who ind.ENTREPRENEUR$_t$=2* **do**

if *(ind.ENTREPRENEUR$_t$ = 2 && firm.FIRM.PROFIT$_t$ > γ_1× temp.HI.SECT.EXPECT) || (ind.ENTREPRENEUR$_t$ = 2 && rndm(0.1) < γ_0)* **then**

continue and compute

temp1 = γ_2 + γ_3× ind.ENTREP.PAST$_t$+γ_4× ind.EDUC.LEVEL$_t$ + γ_5 ×(ind.AGE$_t$ + γ_6)

temp2 = γ_7 + γ_8 × ind.ENTREP.PAST$_t$+γ_9 × ind.EDUC.LEVEL$_t$ + γ_{10} ×(ind.AGE$_t$ + γ_{11})

create new firm object with INDIVIDUAL.ID=current individual

create one establishment

if *rndm(0,1) < temp1* **then**

est.SECTOR.ID=sector with highest expected profit per firm

else if *rndm(0,1)< temp1 + temp2* **then**

est.SECTOR.ID = sector with second highest expected profit per firm

else

choose one sector randomly and create new firm and establishment in this sector

end

else

do not continue

end

end

Data: GUS

Result: New license (39)

for *selected individuals – continuation from* ***Probability of opening a new firm*** – **do**

choose temp.SIZE from $\mathcal{N}$(γ_{13}×sector.AVE.SECT.WF.EST$_t$, γ_{14} × sector.SECT.SD.FIRM.SIZE$_t$)

If sector is not empty (at least one establishment is already there)

temp.INIT.SIZE= max{min(γ_{12}×sector.AVE.SECT.WF.EST$_t$, temp.SIZE), 0}

else

temp.INIT.SIZE = max(0, temp.SIZE)

end

if γ_{15}×*sector.LICENSE.EASINESS$_t$*× $\frac{sector.AVE.SECT.WF.EST_t}{temp.INIT.SIZE}$ < *rndm(0,1)* **then**

If sector is empty

do not delete with probability 0.5

else

delete new firm

end

else

do not delete this firm

end

end

Data: GUS
Result: Funding new firm creation (40)
for *selected individuals – continuation from* ***New license*** – **do**
temp.COST.NEW.FIRM = temp.INIT.SIZE × sector.AVE.WAGE.SECT$_t$ × γ_{16} + $\gamma_{17.s}$
if *ind.DEPOSITS$_t$ > temp.COST.NEW.FIRM* **then**
entrepreneur could fund it on his own
assume temp.1.FIX.CAP.FIRM = ind.DEPOSITS$_t$
ind.DEPOSITS$_t$ − = temp.COST.NEW.FIRM
firm.FIRM.ID = assign new one
firm.INDIVIDUAL.ID = ind.INDIVIDUAL.ID of one individual from the list and assign him as the primary owner
firm.DEFAULT.FIRM$_t$ = 0
firm.FINANCIAL.RISK$_t$ = rndm(0,1)
firm.FIRM.AGE$_t$=1
firm.FIRM.DEBT$_t$ = temp.COST.NEW.FIRM
firm.FIRM.MARKET.VALUE$_t$ = γ_{18}×(temp.COST.NEW.FIRM+temp1.FIX.CAP.FIRM)
firm.FIRM.PROFIT$_t$ = 0
firm.FIRM.TO.BE.SOLD$_t$ = 0
firm.FIX.CAP.FIRM$_t$ = temp.1.FIX.CAP.FIRM
firm.LIQ.ASSETS.FIRM$_t$ = γ_{19}× temp.COST.NEW.FIRM
firm.NO.ESTABLISH.OF.FIRM$_t$ = 1
firm.SECTOR.ID$_t$ = assign according to the selection in previous modules
firm.TAX.PROFITS$_t$ = 0
firm.WF.FIRM$_t$ = round(temp.INIT.SIZE)
Create one establishment for this firm with all records
ESTABLISH.ID = next number available on the list of IDs
BANK.Q.BUY.EST.ID = choose at random
est.COST$_t$=0
est.COST$_{t-1}$=0
est.DEFAULT.EST$_t$=0
est.DEMAND$_t$= 1
est.EST.NEW$_t$=1
est.EXP.DEM$_t$=1
est.EXP.IMP$_t$= at random from set {0,1,2,3}
est.FIRM.ID=assign the firm.FIRM.ID
est.FIX.CAP.EST$_t$=firm.FIX.CAP.FIRM
est.INPUTS$_t$=0
est.INTEREST.TO.BE.PAID.Q.BUY$_t$=0
est.INTEREST.TO.BE.PAID.Q.BUY.QUARTERLY$_t$=0
est.KNOW.HOW$_t$=rndm(0,1)
est.LIQ.ASSETS.EST$_t$=firm.LIQ.ASSETS.FIRM$_t$
est.PRICE$_t$=1
est.PRICE$_{t-1}$=1
est.PROD$_t$=0
est.PERC$_t$=0
est.PERC.PERC$_t$=0
est.Q.BUY.EST$_t$=0
est.Q.BUY.EST.LOANS$_t$=0
est.Q.BUY.EST.LOANS.QUARTERLY$_t$=0
est.QUALITY$_t$=rndm(0,1)
est.QUALITY.TMINUS1$_t$=rndm(0,1)
est.SALES.EMPLOYEE$_t$=0
est.SALES.MONET$_t$=0
est.SECTOR.ID=sector of the firm
est.SPATIAL.CODE1= ind.SPATIAL.CODE1
est.SPATIAL.CODE2= ind.SPATIAL.CODE2
est.SPATIAL.CODE3= ind.SPATIAL.CODE3
est.SPATIAL.CODE4= ind.SPATIAL.CODE4
est.STOCK$_t$=1
est.STOCK.OPT$_t$=1
est.TAX.PROP$_t$=0
est.WAGES.EST$_t$=0
est.WF.EST$_t$=0
est.WF.FIRED$_t$=0
est.WF.HIRED$_t$=0
est.WF.PROD$_t$=0
est.WORK.PROD$_t$=0
else
check whether entrepreneur will fund the firm creation by debt or equity
if *temp.INIT.SIZE* < γ_{20} **then**
Go to ***Bank firm creation funding***
else
Go to ***Shares***
end
end
end

Data: GUS
Result: Bank firm creation funding (41.1)
Do a list of bank, choose with the lowest interest rate bank.IR.FIRM.INV.LOANS$_t$
check whether has that quantity
bank.SUPPLY.FIRM.INV.LOANS$_t$ $\geq$ temp.COST.NEW.FIRM
check whether there is no excessive sectorial exposure: temp.COST.NEW.FIRM $\leq \gamma_{21}$
if *yes* **then**
    check firm loan admissibility
    assume temp.FIX.CAP.FIRM = max{0, ind.DEPOSITS$_t$}
    temp.FINANCIAL.RISK = rndm(0,1)
    if *check leverage ratio:*
    if *temp.FIX.CAP.FIRM !=0* **then**
        $\frac{temp.COST.NEW.FIRM}{temp.FIX.CAP.FIRM} < \gamma_{22.b}$
    else
        $temp.COST.NEW.FIRM < \gamma_{22.b}$
    end
    && *check financial risk of funding this firm:*
    $temp.FINANCIAL.RISK < \gamma_{23.b}$ &&
    check size of company relative to average size of establishments in the sector:
    $temp.INIT.SIZE < \gamma_{24.b} \times sector.AVE.SECT.WF.EST_t \times (1 \text{ if } sector.AVE.SECT.WF.EST_t > 0) + \gamma_{24.b} \times (1 \text{ if } sector.AVE.SECT.WF.EST_t = 0)$
    check the risk of sector:
    $sector.AVE.FINANCIAL.RISK_t < \gamma_{25.b}$ &&
    check entrepreneur history:
    $ind.DEFAULT.IND_t < \gamma_{26.b}$ **then**
        bank gives funds
        Go to ***New firm creation***
    else
        look for another bank from the list taking into account interest rate
        if *any found* **then**
            check admissibility
            if *passed the conditions* **then**
                bank gives funding
                Go to ***New firm creation***
                create all new records
            else
                firm is not created
            end
        else
            firm is not created
        end
    end
else
    firm is not created
end

Data: GUS

Result: New firm creation (41.1.1)

$\text{ind.FIRM.INV.LOANS}_t \; += \text{temp.COST.NEW.FIRM}$

$\text{ind.PENDING.TO.BE.PAID.FIRM.INV.LOANS}_t \; += \text{temp.COST.NEW.FIRM}$

$\text{bank.SUPPLY.FIRM.INV.LOANS}_t \; -= \text{temp.COST.NEW.FIRM}$

if $\textit{temp.COST.NEW.FIRM} > \gamma_{27}$ **then**

  $\text{ind.FIRM.INV.LOANS.MAT}_t = \gamma_{28}$

else if $\textit{temp.COST.NEW.FIRM} > \gamma_{29}$ **then**

  $\text{ind.FIRM.INV.LOANS.MAT}_t = \gamma_{30}$

else if $\textit{temp.COST.NEW.FIRM} > \gamma_{31}$ **then**

  $\text{ind.FIRM.INV.LOANS.MAT}_t = \gamma_{32}$

else

  $\text{ind.FIRM.INV.LOANS.MAT}_t = \gamma_{33}$

end

$$\text{ind.FIRM.INV.LOANS.QUARTERLY}_t = \frac{\text{temp.COST.NEW.FIRM}}{\text{ind.FIRM.INV.LOANS.MAT}_t}$$

$$\text{ind.INTEREST.TO.BE.PAID.FIRM.INV.LOANS}_t \; += \frac{1}{\kappa_4} \times$$

$$(\text{temp.COST.NEW.FIRM} \times (1 + 0.25 \times \text{bank.IR.FIRM.INV.LOANS}_t)^{\text{ind.FIRM.INV.LOANS.MAT}_t} - \text{temp.COST.NEW.FIRM})$$

$$\text{ind.INTEREST.TO.BE.PAID.FIRM.INV.LOANS.QUARTERLY}_t = \frac{\text{ind.INTEREST.TO.BE.PAID.FIRM.INV.LOANS}_t}{\text{ind.FIRM.INV.LOANS.MAT}_t}$$

$$\text{bank.REV.FIRM.INV.LOANS}_t \; += \frac{\text{ind.INTEREST.TO.BE.PAID.FIRM.INV.LOANS}_t}{\text{ind.FIRM.INV.LOANS.MAT}_t}$$

Create records for a new firm

firm.FIRM.ID = assign new one

$\text{firm.INDIVIDUAL.ID}$ = ind.INDIVIDUAL.ID of the primary owner

$\text{firm.DEFAULT.FIRM}_t = 0$

$\text{firm.FINANCIAL.RISK}_t = \text{temp.FINANCIAL.RISK}$

$\text{firm.FIRM.AGE}_t = 1$

$\text{firm.FIRM.DEBT}_t = \text{temp.COST.NEW.FIRM}$

$\text{firm.FIRM.MARKET.VALUE}_t = \gamma_{18} \times (\text{temp.COST.NEW.FIRM} + \text{temp.FIX.CAP.FIRM})$

$\text{firm.FIRM.PROFIT}_t = 0$

$\text{firm.FIRM.TO.BE.SOLD}_t = 0$

$\text{firm.FIX.CAP.FIRM}_t = \text{temp.FIX.CAP.FIRM}$

$\text{firm.LIQ.ASSETS.FIRM}_t = \gamma_{19} \times \text{temp.COST.NEW.FIRM}$

$\text{firm.NO.ESTABLISH.OF.FIRM}_t = 1$

firm.SECTOR.ID = assign according to the selection in previous modules

$\text{firm.TAX.PROFITS}_t = 0$

$\text{firm.WF.FIRM}_t = \text{round}(\text{temp.INIT.SIZE})$

Create records for one establishment (the same records as in ***Funding new firm creation*** (40)).

Data: GUS

Result: Shares (41.2)

/*Firm too big to be funded by the deposits of the owner and the bank funding, we look for equity funding*/

check ind.DEPOSITS and find the list of n individuals that $\sum_{i=1}^{n}(\gamma_{8000} \times \text{ind.DEPOSITS}_t) = \text{temp.COST.NEW.FIRM}$

if *the list of individuals in the system found* **then**

  for *all those individuals from the list* **do**

    $\text{ind.SHARES}_t + = \gamma_{34} \times \text{ind.DEPOSITS}_t$

    $\text{ind.DEPOSITS}_t - = \gamma_{34} \times \text{ind.DEPOSITS}_t$

  end

  Create records for a new firm

  assume $\text{temp1.FIX.CAP.FIRM} = \sum_{i=1}^{n} \text{ind.DEPOSITS}$

  firm.FIRM.ID = assign new one

  firm.INDIVIDUAL.ID = ind.INDIVIDUAL.ID of one individual from the list and assign him as the primary owner

  $\text{firm.DEFAULT.FIRM}_t = 0$

  $\text{firm.FINANCIAL.RISK}_t = \text{rndm(0,1)}$

  $\text{firm.FIRM.AGE}_t = 1$

  $\text{firm.FIRM.DEBT}_t = \text{temp.COST.NEW.FIRM}$

  $\text{firm.FIRM.MARKET.VALUE}_t = \gamma_{18} \times (\text{temp.COST.NEW.FIRM} + \text{temp1.FIX.CAP.FIRM})$

  $\text{firm.FIRM.PROFIT}_t = 0$

  $\text{firm.FIRM.TO.BE.SOLD}_t = 0$

  $\text{firm.FIX.CAP.FIRM}_t = \text{temp1.FIX.CAP.FIRM}$

  $\text{firm.LIQ.ASSETS.FIRM}_t = \gamma_{19} \times \text{temp.COST.NEW.FIRM}$

  $\text{firm.NO.ESTABLISH.OF.FIRM}_t = 1$

  firm.SECTOR.ID = assign according to the selection in previous modules

  $\text{firm.TAX.PROFITS}_t = 0$

  $\text{firm.WF.FIRM}_t = \text{round(temp.INIT.SIZE)}$

  Create records for one establishment (the same records as in ***Funding new firm creation*** (40)).

else

  firm is not created in this iteration

end

Data: GUS

Result: Firm market value updating (42)

for *all firms & all sectors in which establishments of these firms operate* **do**

  for *all sectors in which the firm operates* **do**

    if *sector.PROFIT.SECT$_t$!=0* **then**

      $\text{temp.AVE.SECT.SIZE.TO.PROFITS} = \frac{(\text{sector.SECT.AVE.SIZE}_t+1)}{\text{sector.PROFIT.SECT}_t}$ *

    else

      $\text{temp.AVE.SECT.SIZE.TO.PROFITS} = (\text{sector.SECT.AVE.SIZE}_t+1)$*

    end

    /*if the firm operates in more than one sector compute the average*/

  end

  $\text{temp.REL.PROF} = \frac{\text{firm.FIRM.PROFIT}_t}{(\text{firm.WF.FIRM}_t+1)} \times \text{temp.AVE.SECT.SIZE.TO.PROFITS}$

  if *sector.AVE.FINANCIAL.RISK$_t$!=0* **then**

    $\text{temp.REL.RISK} = \frac{\text{firm.FINANCIAL.RISK}_t}{\text{sector.AVE.FINANCIAL.RISK}_t}$

  else

    $\text{temp.REL.RISK} = \frac{\text{firm.FINANCIAL.RISK}_t}{0.5}$

  end

  $\text{temp.DIFF.PROF} = \text{firm.FIRM.PROFIT}_t - \text{sector.PROFIT.SECT}_t$

  $\text{temp.DIFF.RISK} = \text{firm.FINANCIAL.RISK}_t - \text{sector.AVE.FINANCIAL.RISK}_t$

  if *temp.DIFF.PROF* ≥ 0 *&& temp.DIFF.RISK* ≥ 0 **then**

    $\text{temp.MARKET.VALUE} = \gamma_{35} \times \sqrt{\text{firm.FIRM.AGE}_t} + \gamma_{36} \times \text{temp.REL.PROF} + \gamma_{37} \times \text{temp.REL.RISK}$

  else if *temp.DIFF.PROF* ≥ 0 *&& temp.DIFF.RISK* < 0 **then**

    $\text{temp.MARKET.VALUE} = \gamma_{38} \times \sqrt{\text{firm.FIRM.AGE}_t} + \gamma_{39} \times \text{temp.REL.PROF} + \gamma_{40} \times \text{temp.REL.RISK}$

  else if *temp.DIFF.PROF$_t$* < 0 *&& temp.DIFF.RISK* ≥ 0 **then**

    $\text{temp.MARKET.VALUE} = \gamma_{41} \times \sqrt{\text{firm.FIRM.AGE}_t} + \gamma_{42} \times \text{temp.REL.PROF} + \gamma_{43} \times \text{temp.REL.RISK}$

  else

    $\text{temp.MARKET.VALUE} = \gamma_{44} \times \sqrt{\text{firm.FIRM.AGE}_t} + \gamma_{45} \times \text{temp.REL.PROF} + \gamma_{46} \times \text{temp.REL.RISK}$

  end

  requirement to not to increase the market value too much and too fast:

  if *temp.MARKET.VALUE > rndm(0,1)/2 + 0.5* **then**

    $\text{firm.FIRM.MARKET.VALUE}_t = \text{rndm}(0,1)/2 + 0.5$

  else

    Go to ***Firm closure*** for this firm

    Go to the next firm

  end /*if firm is not going to be closed then you proceed to **Mergers & Acquisitions***/

end

Data: GUS

Results: Mergers (43)

for *each firm* **do**

  $\text{temp.NO.OF.ESTABLISH.SECT1} = 0$

  $\text{temp.NO.OF.ESTABLISH.SECT2} = 0$

  for *each establishment of the firm in the first sector in which the firm operates* **do**

    $\text{temp.NO.OF.ESTABLISH.SECT1}$ ++

  end

  for *each establishment of the firm in the second sector in which the firm operates* **do**

    $\text{temp.NO.OF.ESTABLISH.SECT2}$ ++

  end

  $\text{temp.SECTOR1.PROFITS.FIRM} = \frac{\text{temp.NO.OF.ESTABLISH.SECT1}}{\text{firm.NO.OF.ESTABLISH.FIRM}_t} \times \text{firm.FIRM.PROFIT}_t$

  $\text{temp.SECTOR2.PROFITS.FIRM} = \frac{\text{temp.NO.OF.ESTABLISH.SECT2}}{\text{firm.NO.OF.ESTABLISH.FIRM}_t} \times \text{firm.FIRM.PROFIT}_t$

  if *temp.SECTOR1.PROFITS.FIRM > temp.SECTOR2.PROFITS.FIRM* **then**

    the merger is planned in sector 1

  else

    the merger is planned in sector 2

  end

  if *firm.FIRM.DEBT$_t$* $< \gamma_{47}$ $\times$ *firm.FIRM.PROFIT$_t$ && firm.FIRM.TO.BE.SOLD$_t$ = 0 &&*
  firm.FIRM.DEBT$_t$ $< \gamma_{48}$ $\times$ *(firm.LIQ.ASSETS.FIRM$_t$ + firm.FIX.CAP.FIRM$_t$) && firm.FIRM.MARKET.VALUE$_t$* $> \gamma_{49}$ **then**

    get randomly γ_{50} firms from the selected sector

    choose one at random

    if *(merged.firm.LIQ.ASSETS.FIRM$_t$ + merged.firm.FIX.CAP.FIRM$_t$) < (firm.LIQ.ASSETS.FIRM$_t$ + firm.FIX.CAP.FIRM$_t$) && merged.WF.FIRM$_t$* $\leq$
    firm.WF.FIRM$_t$ && merged.FIRM.MARKET.VALUE$_t$ $> \gamma_{51}$ *&& merged.FIRM.TO.BE.SOLD$_t$=0* **then**

      change merged.FIRM.ID in merged firm's establishments to firm.FIRM.ID
      change the owner of a "new" firm (after merger)
      firm.FIRM.DEBT_t + = $\text{merged.FIRM.DEBT}_t + \gamma_{52} \times \text{merged.FIRM.MARKET.VALUE}_t \times (\text{merged.LIQ.ASSETS.FIRM}_t + \text{merged.FIX.CAP.FIRM}_t)$

      $\text{firm.NO.ESTABLISH.OF.FIRM}_t$ + = $\text{merged.NO.ESTABLISH.OF.FIRM}_t$
      $\text{firm.FIX.CAP.FIRM}_t$ + = $\text{merged.FIX.CAP.FIRM}_t$

      $\text{firm.LIQ.ASSETS.FIRM}_t$ + = $\text{merged.LIQ.ASSETS.FIRM}_t$

      firm.WF.FIRM_t + = merged.WF.FIRM_t

      for the"old" owner of merged firm:

      ind.DEPOSITS_t + = $\gamma_{53} \times \text{merged.FIRM.MARKET.VALUE}_t \times (\text{merged.LIQ.ASSETS.FIRM}_t + \text{merged.FIX.CAP.FIRM}_t)$

      check whether he has another firm

      if *not* **then**

        $\text{ind.ENTREPRENEUR}_t = 1$

        $\text{ind.ENTREP.PAST}_t = 1$

        $\text{ind.LABOR.STATUS}_t = 2$

        $\text{ind.LABOR.PERIODS}_t = 0$

      else

        do not update

      end

      delete merged firm

    else

      check another from γ_{54} firms

      if *found* **then**

        update records as above

      else

        do not merge

      end

    end

  else

    do not look for a company to merge

    nothing has to be updated

  end

end

Data: GUS

Result: Acquisitions (44)

for *each firm* **do**

temp.NO.OF.ESTABLISH.SECT1 = 0

temp.NO.OF.ESTABLISH.SECT2 = 0

for *each establishment of the firm in the first sector in which the firm operates* **do**

temp.NO.OF.ESTABLISH.SECT1 ++

end

for *each establishment of the firm in the second sector in which the firm operates* **do**

temp.NO.OF.ESTABLISH.SECT2 ++

end

$$\text{temp.SECTOR1.PROFITS.FIRM} = \frac{\text{temp.NO.OF.ESTABLISH.SECT1}}{\text{firm.NO.OF.ESTABLISH.FIRM}_t} \times \text{firm.FIRM.PROFIT}_t$$

$$\text{temp.SECTOR2.PROFITS.FIRM} = \frac{\text{temp.NO.OF.ESTABLISH.SECT2}}{\text{firm.NO.OF.ESTABLISH.FIRM}_t} \times \text{firm.FIRM.PROFIT}_t$$

if *temp.SECTOR1.PROFITS.FIRM > temp.SECTOR2.PROFITS.FIRM* **then**

the acquisition is planned in sector 1

else

the acquisition is planned in sector 2

end

if *firm.FINANCIAL.RISK*$_t$ *< sector.AVE.FINANCIAL.RISK*$_t$ *in the sector that the acquisition is planned && firm.FIRM.TO.BE.SOLD*$_t$ *= 0* **then**

look for a firm to be acquired (acq.-) such that

acq.SECTOR.ID = firm.SECTOR.ID ;

acq.WF.FIRM$_t$ $< \gamma_{55} \times$ firm.WF.FIRM$_t$;

acq.FIRM.DEBT$_t$ $< \gamma_{56} \times$ firm.FIRM.DEBT$_t$;

acq.FIRM.TO.BE.SOLD$_t$=1 ;

if *at least one find* **then**

choose one at random

change acq.FIRM.ID in acquired firm's establishments to firm.FIRM.ID

firm.FIRM.DEBT$_t$ + = acq.FIRM.DEBT$_t$ + acq.FIRM.MARKET.VALUE$_t \times$ (acq.LIQ.ASSETS.FIRM$_t$ +

acq.FIX.CAP.FIRM$_t$ − acq.FIRM.DEBT$_t$)$\times \sqrt{\text{rndm}(0,1)}$

firm.NO.ESTABLISH.OF.FIRM$_t$ + = acq.NO.ESTABLISH.OF.FIRM$_t$;

firm.FIX.CAP.FIRM$_t$ + = acq.FIX.CAP.FIRM$_t$;

firm.LIQ.ASSETS.FIRM$_t$ + = acq.LIQ.ASSETS.FIRM$_t$;

firm.WF.FIRM$_t$ + = acq.WF.FIRM$_t$;

delete acquired firm

else

Go to next firm

firm will not acquire any firm at this stage

end

else

Go to next firm

firm will not acquire any firm at this stage

end

end

end

Data: BZGD, GUS

Result: Individuals records updating when firm closure (45)

for *firms with firm.FIRM.AGE*$_t$ *> 6 && firm.NO.ESTABLISH.OF.FIRM*$_t$*=0* **do**

if *owner (firm.INDIVIDUAL.ID) does not have another firm* **then**

ind.ENTREPRENEUR$_t$=1

ind.ENTREP.PAST$_t$=1

ind.LABOR.STATUS$_t$=2

ind.LABOR.PERIODS$_t$=0

else

nothing changes

end

delete firm and start firm closure for next firm

end

Data: GUS

Result: New establishments creation (46)

for *each firm & each sector in which the firm conducts business activity* **do**

  if $firm.FINANCIAL.RISK_t < v_1 \times sector.AVE.FINANCIAL.RISK_t$ &&

  $\frac{firm.FIRM.PROFIT_t}{(firm.WF.FIRM_t+1)} > v_2 \times \frac{sector.PROFIT.SECTOR_t}{(sector.SECTOR.FIRMS_t+1)\times(sector.AVE.SECT.WF_t+1)}$) **then**

    Create new records for new establishment in the sector in which all conditions are fullfiled

    Create records for establishment (the same records as in ***Funding new firm creation*** (40)).

  else

    do not create new establishment

  end

end

Data: GUS

Result: Individuals labor status updating (47)

for *each individual* **do**

  if $(ind.LABOR.STATUS_t = 3 \;||\; ind.LABOR.STATUS_t = 5)$ && $ind.GENDER_t = 0$ && $ind.AGE_t \geq 55$ && $rndm(0,1) < \gamma_{57.age}$ && $ind.ENTREPRENEUR_t < 2$ **then**

    ind.LABOR.STATUS$_t$ = 2 ;
    ind.LABOR.PERIODS$_t$ = 0

  else if $(ind.LABOR.STATUS_t = 3 \;||\; ind.LABOR.STATUS_t = 5)$ && $ind.GENDER_t = 1$ && $ind.AGE_t \geq 55$ && $rndm(0,1) < \gamma_{58.age}$ && $ind.ENTREPRENEUR_t < 2$ **then**

    ind.LABOR.STATUS$_t$ = 2
    ind.LABOR.PERIODS$_t$ = 0

  else if $ind.LABOR.STATUS_t = 2$ && $ind.LABOR.PERIODS_t > 8$ && $ind.GENDER_t = 0$ && $rndm(0,1) < (\gamma_{59.age} \times \gamma_{60} + \gamma_{61} \times ind.LABOR.PERIODS_t)$ **then**

    ind.LABOR.STATUS$_t$ = 4
    ind.LABOR.PERIODS$_t$ = 0

  else if $ind.LABOR.STATUS_t = 2$ && $ind.LABOR.PERIODS_t > 8$ && $ind.GENDER_t = 1$ && $rndm(0,1) < (\gamma_{62.age} \times \gamma_{63} + \gamma_{64} \times ind.LABOR.PERIODS_t)$ **then**

    ind.LABOR.STATUS$_t$ = 4
    ind.LABOR.PERIODS$_t$ = 0

  else if $ind.LABOR.STATUS_t = 4$ && $ind.AGE_t \leq 55$ && $ind.(hh.)TOTAL.INC.FAM_t < \gamma_{65}$ **then**

    ind.LABOR.STATUS$_t$ = 2
    ind.LABOR.PERIODS$_t$ = 0

  else

    nothing changes, still the same status at the labor market

  end

end

Data: GUS

Result: Workers skills updating (48)

if *ind.LABOR.STATUS$_t$ = 1 || ind.LABOR.STATUS$_t$ = 4 || ind.LABOR.STATUS$_t$ = 5* **then**

  ind.WORKER.SKILLS$_t$ = 0

else

  ind.WORKER.SKILLS$_t$ = max{0, $\gamma_{66}\times$ ind.LABOR.PERIODS$_t$ + $\gamma_{67}\times$ ind.EDUC.LEVEL$_t$ + $\gamma_{68}\times$ ind.GENDER$_t$ + $\gamma_{69}\times$ ind.LABOR.STATUS$_t$ − − $\gamma_{70}\times$ ind.AGE$_t$}

end

Data: BZGD, GUS

Result: Hiring and firing (49)

for *all establishments that continue from* ***Firm growth*** **do**

  est.COST$_{t-1}$=est.COST$_t$

  est.COST$_t$=0

  if *est.WF.HIRED$_t$ ≤ est.WF.FIRED$_t$* **then**

    est.WF.FIRED$_t$ = min(est.WF.FIRED$_t$−est.WF.HIRED$_t$, est.WF.EST$_t$)

    est.WF.HIRED$_t$ = 0

    order individuals with ind.ESTABLISHMENT.ID = current establishment,

    according to ind.WORKER.SKILLS$_t$

    check how many people should be fired: est.WF.FIRED$_t$ − est.WF.HIRED$_t$ = k

    check their INDIVIDUAL.ID

    est.WF.FIRED$_t$ − = k

    est.WF.EST$_t$ − = k

    for *those k individuals who are to be fired* **do**

      ind.LABOR.STATUS$_t$ = 2

      ind.LABOR.PERIODS$_t$ = 0

      ind.ESTABLISH.ID = 0

    end

  else

    est.WF.HIRED$_t$ − est.WF.FIRED$_t$ = m

    est.WF.HIRED$_t$ − = est.WF.FIRED$_t$

    est.WF.FIRED$_t$ = 0

    look for new *m* employees, starting with the highest ind.WORKER.SKILLS$_t$,
    from the same SPATIAL.CODE4, SPATIAL.CODE1, SPATIAL.CODE3, SPATIAL.CODE2 and with ind.LABOR.STATUS=2:

    order individuals with ind.SPATIAL.CODE4=est.SPATIAL.CODE4 && ind.SPATIAL.CODE3=est.SPATIAL.CODE3 && ind.SPATIAL.CODE2=est.SPATIAL.CODE2 && ind.SPATIAL.CODE1=est.SPATIAL.CODE1 && ind.LABOR.STATUS$_t$=2
    decreasing by ind.WORKER.SKILLS$_t$

    temp.LIST.SIZE = no of individuals on the list

    if *temp.LIST.SIZE ≥ $\gamma_{72}\times$ est.WF.HIRED$_t$* **then**

      pick individuals and hire

      Go to ***Hiring***

    else

      remove the constrain ind.SPATIAL.CODE1=est.SPATIAL.CODE1

      if *found* **then**

        pick and hire

        Go to ***Hiring***

      else

        remove the constrain ind.SPATIAL.CODE1=est.SPATIAL.CODE1 && ind.SPATIAL.CODE2=est.SPATIAL.CODE2

        check whether the list is sufficient

        if *found* **then**

          Go to ***Hiring***

        else

          remove the constrain ind.SPATIAL.CODE1=est.SPATIAL.CODE1 && ind.SPATIAL.CODE2=est.SPATIAL.CODE2 && ind.SPATIAL.CODE3=est.SPATIAL.CODE3

          if *found* **then**

            Go to ***Hiring***

          else

            choose at random globally

          end

        end

      end

    ***Hiring*:**

    for *selected establishments and individuals* **do**

      est.WF.HIRED$_t$ − = m

      est.WF.PROD$_t$ + = m

      est.WORK.PROD$_t$ + = m

      est.WF.EST$_t$ + = m

      ind.LABOR.STATUS$_t$ = 3

      ind.LABOR.PERIODS$_t$ = 0

      ind.ESTABLISH.ID = current establishment

    end

  end

end

Data: BZGD, GUS

Result: Labor status & wage & subsidy updating (50)

for *each individual that comes from* ***Labour market (Pseudocodes 47–50)*** **do**

if $ind.LABOR.STATUS_t = 2$ && $ind.LABOR.PERIODS_t = 0$ **then**

$\text{ind.SUBSIDY}_t = \delta_1$

else if $ind.LABOR.STATUS_t = 2$ && $ind.LABOR.PERIODS_t > 1$ **then**

$\text{ind.SUBSIDY}_t = \delta_4$

else if $ind.LABOR.STATUS_t = 3$ **then**

$\text{ind.SUBSIDY}_t = 0$

$$\text{ind.WAGE}^*_t = \frac{\text{sector.AVE.WAGE.SECT}^*_t}{\text{sector.AVE.SECT.WF.EST}_t} \times(\delta_6 + \delta_7 \times \text{ ind.GENDER}_t)\times$$

$(\delta_8 + \delta_9 \times \text{ ind.AGE}_t)\times(\delta_{15} + \text{rndm}(0.04,0.06))$

/*in establishment and related sector in which the individual worked in Pseudocode 49*/

else if $ind.LABOR.STATUS_t = 4$ **then**

if $ind.AGE_t \geq 60$ && $ind.GENDER_t$=0 && $ind.LABOR.PERIODS_t = 0$ && $ind.WAGE_t > 0$ /*emerytura kobiet*/ **then**

$\text{ind.SUBSIDY}_t = \delta_{10} \times \text{ ind.WAGE}_t$

$\text{ind.WAGE}_t = 0$

else if $ind.AGE_t \geq 55$ /*wczesniejsza emerytura dla kobiet i mężczyzn*/ **then**

$\text{ind.SUBSIDY}_t = \delta_5$

else if $ind.AGE_t \geq 65$ && $ind.GENDER_t$ =1 && $ind.LABOR.PERIODS_t$=0 && $ind.WAGE_t$>0 /*emerytura mężczyzn*/ **then**

$\text{ind.SUBSIDY}_t = \delta_{13} \times \text{ind.WAGE}_t$

$\text{ind.WAGE}_t = 0$

else

if $hh.TOTAL.INC.FAM_t < \delta_3$ /*zapomoga*/ **then**

$\text{ind.SUBSIDY}_t = \delta_4$

do not change ind.WAGE_t

else

do not change ind.SUBSIDY_t

do not change ind.WAGE_t

end

else if $ind.LABOR.STATUS_t = 5$ && $ind.ENTREPRENEUR_t = 2$ **then**

temp.DIVIDEND = 0

for *each firm owned by this individual* **do**

if $firm.FIRM.PROFIT_t > 0$ **then**

$\text{temp.DIVIDEND} += \text{firm.FIRM.PROFIT}_t \times \delta_{14} \times \text{rand}(0.0000, 0.02)$

$\text{firm.FIRM.DEBT}_t +=$
$= \text{firm.FIRM.PROFIT}_t \times \delta_{14} \times \text{rand}(0.0000, 0.02)$

else

nothing changes

end

$\text{ind.WAGE}_t = \text{temp.DIVIDEND}$

$\text{ind.SUBSIDY}_t = 0$

end

end

end

Data: GUS

Result: Establishments & firms records updating (51)

for *all establishments* **do**

- $\text{est.LIQ.ASSETS.EST}_t$ − = est.WAGES.EST_t
- **if** $\textit{est.EST.NEW}_t > 0$ **then**
  - est.EST.NEW_t − −
  - $\text{est.WAGES.EST}_t = 0$
- **else**
  - $\text{est.WAGES.EST}_t = 0$
- **end**

end

.

for *all establishments (not only the new ones)* **do**

- **for** *each individual working in the related establishment* **do**
  - est.WAGES.EST_t + = ind.WAGE_t
- **end**
- est.COST_t + = δ_{16}×est.INPUTS_t + δ_{17} × $\frac{\text{firm.FIRM.DEBT}_t}{\text{firm.NO.ESTABLISH.OF.FIRM}_t}$ + est.TAX.PROP_t + $\delta_{18.s}$× est.PROD_t + $\delta_{19.s}$× est.WF.EST_t+ δ_{20}× est.WAGES.EST_t
- **if** $\textit{est.LIQ.ASSETS.EST}_t < v_3$ *(po skalibrowaniu będzie 0)* **then**
  - check whether this firm is able to provide sources from other establishments
  - **if** $\textit{firm.NO.ESTABLISH.OF.FIRM}_t > 1$ && $(\textit{firm.LIQ.ASSETS.FIRM}_t + \textit{est.LIQ.ASSETS.EST}_t) \geq 0$ **then**
    - $\text{firm.DEFAULT.FIRM}_t$ +=rndm(0,1)× $\frac{\text{WF.EST}_t}{(\text{WF.FIRM}_t+1)}$
    - $\text{firm.NO.ESTABLISH.OF.FIRM}_t$ − −
    - $\text{firm.LIQ.ASSETS.FIRM}_t$ + = $\text{est.LIQ.ASSETS.EST}_t$
    - delete establishment that defaulted due to liquidity problems
  - **else**
    - $\text{firm.DEFAULT.FIRM}_t$ =1
    - $\text{bank.NPL.FIRM.INV.LOANS}_t$ +=$\text{ind.PENDING.TO.BE.PAID.FIRM.INV.LOANS}_t$
    - delete establishment that defaulted due to liquidity problems
    - delete firm from the database with all associated records
    - **if** *owner (firm.INDIVIDUAL.ID) does not have another firm* **then**
      - $\text{ind.ENTREPRENEUR}_t$ = 1
      - ind.ENTREP.PAST_t = 2
      - $\text{ind.LABOR.STATUS}_t$ = 2
      - $\text{ind.LABOR.PERIODS}_t$ = 0
    - **else**
      - nothing changes
    - **end**
  - **end**
- **else**
  - do not delete the establishment
- **end**
- $\text{est.SALES.EMPLOYEE}_t$ = $\frac{\text{est.SALES.MONET}_t}{(\text{est.WF.EST}_t+1)}$
- **if** $\frac{\textit{firm.FIRM.PROFIT}_t}{(\textit{firm.WF.FIRM}_t+1)} > \delta_{21}$ **then**
  - $\text{est.LIQ.ASSETS.EST}_t$ + = $(\delta_{22}+\delta_{23})$×$\text{est.FIX.CAP.EST}_t$
  - est.FIX.CAP.EST_t = $(1+\delta_{24} - \delta_{23})$×$\text{est.FIX.CAP.EST}_t$
- **else**
  - est.FIX.CAP.EST_t = $(1\text{-}\delta_{23})$×est.FIX.CAP.EST_t
- **end**
- **if** $\textit{est.LIQ.ASSETS.EST}_t > \delta_{25.s}$×$\textit{est.WF.EST}_t$ **then**
  - **if** $\textit{firm.FIRM.DEBT}_t > \textit{est.LIQ.ASSETS.EST}_t - \delta_{25.s}$×$\textit{est.WF.EST}_t$ **then**
    - firm.FIRM.DEBT_t − = $\text{est.LIQ.ASSETS.EST}_t - \delta_{25.s}$×$\text{est.WF.EST}_t$
    - $\text{est.LIQ.ASSETS.EST}_t$= $\delta_{25.s}$×est.WF.EST_t
  - **else**
    - $\text{est.LIQ.ASSETS.EST}_t$ − = firm.FIRM.DEBT_t
    - firm.FIRM.DEBT_t = 0
  - **end**
- **else**
  - **if** $\textit{est.LIQ.ASSETS.EST}_t < \delta_{26.s}$×$\textit{est.WF.EST}_t$ − $\textit{est.LIQ.ASSETS.EST}_t$ **then**
    - firm.FIRM.DEBT_t + = $\delta_{26.s}$×est.WF.EST_t −$\text{est.LIQ.ASSETS.EST}_t$
    - $\text{est.LIQ.ASSETS.EST}_t$ = $\delta_{26.s}$×est.WF.EST_t
  - **else**
    - do not update debt
  - **end**
- **end**
- **if** $(\textit{est.SALES.MONET}_t < \delta_{27} || \textit{est.WF.EST}_t < 2)$ **then**
  - est.TAX.PROP_t=0
- **else**
  - est.TAX.PROP_t=δ_{28}×est.WF.EST_t
- **end**

end

Data: GUS

Result: Firm records updating (52)

for *each firm* **do**

  check in which sectors operates

  if in more than one, the firm.FINANCIAL.RISK is the average of financial risk in the sectors

  firm.FIRM.AGE_t ++

  if *firm.FIRM.DEBT$_t$!=0* **then**

    $\text{firm.FINANCIAL.RISK}_t = \delta_{29.s} + \delta_{30} \times \frac{1}{\text{firm.WF.FIRM}_t + 1} + \delta_{31.s} \times \frac{\text{firm.WF.FIRM}_t}{\text{firm.FIRM.DEBT}_t}$

  else

    $\text{firm.FINANCIAL.RISK}_t = \text{rndm}(0,\ 0.1)$

    $\text{firm.FIRM.DEBT}_t = (1 + \delta_{32} \times \text{firm.FINANCIAL.RISK}_t) \times \text{firm.FIRM.DEBT}_t$

  end

end

create 5 temporal variables:
temp1 = 0
temp2 = 0
temp3 = 0
temp4 = 0
temp5 = 0

for *each establishment of this firm* **do**

  temp1 + = est.FIX.CAP.EST_t

  temp2 + = $\text{est.LIQ.ASSETS.EST}_t$

  temp3 + = est.WF.EST_t

  temp4 + = $\text{est.SALES.MONET}_t - \text{est.COST}_t$

  temp5 + = est.SALES.MONET_t

end

$\text{firm.FIX.CAP.FIRM}_t$ = temp1

$\text{firm.LIQ.ASSETS.FIRM}_t$ = temp2

firm.WF.FIRM_t = temp3

$\text{firm.FIRM.PROFIT}_t$ = temp4

update firm.TAX.PROFIT_t according to generated profits and sales.monet of the firm (the sum of establishments of the firm)

if *temp5* $\leq$ *1200* **then**

  $\text{firm.TAX.PROFIT}_t = \max\{0,\ 0.15 \times \text{temp4}\}$

else

  $\text{firm.TAX.PROFIT}_t = \max\{0,\ 0.19 \times \text{temp4}\}$

end

$\text{firm.FIRM.DEBT}_t += \text{firm.TAX.PROFIT}_t$

Data: GUS

Result: Sectors records updating (53)

for *each sector* **do**

| sector.QUALITY.SECT$_{t-1}$=sector.QUALITY.SECT$_t$

| sector.PRICE.SECT$_{t-1}$=sector.PRICE.SECT$_t$

end

create 3 temporal variables

temp1=0
temp2=0

temp.FIRMCOUNT=0

for *each firm of the current sector*

*/*if there is no firms in this sector you do not do this,*
assign the values from the this iteration for the next iteration (values remain the same)/* **do**

| temp.FIRMCOUNT ++

| temp1 + = firm.FINANCIAL.RISK$_t$

| temp2 + = firm.FIRM.PROFIT$_t$

| sector.AVE.FINANCIAL.RISK$_t$ = $\frac{\text{temp1}}{\text{temp.FIRMCOUNT}}$

| sector.PROFIT.SECT$_t$ = temp2

| sector.SECTOR.FIRMS = temp.FIRMCOUNT

end

create following temporal variables
temp3=0
temp4=0
temp5=0
temp6=0
temp7=0
temp8=0
temp9=0
temp10=0
temp11=0
temp.ESTCOUNT = 0
temp.EMPLOYEES = 0

for *each establishment in the current sector* **do**

| temp.ESTCOUNT ++
| temp.EMPLOYEES += est.WF.EST$_t$
| temp3 += est.SALES.MONET$_t$
| temp6 += est.PRICE$_t$
| temp7 += est.QUALITY$_t$
| temp11 += est.WAGES.EST$_t$
| **if** *est.IMP.EXP$_t$=1* **then**
| | temp8++
| **else if** *est.IMP.EXP$_t$=2* **then**
| | temp9++
| **else if** *est.IMP.EXP$_t$=3* **then**
| | temp10++
| **end**

end

if *temp.EMPLOYEES > 0* **then**

| sector.AVE.SALES.FIRM.SECT$_t$=$\frac{\text{temp3}}{\text{temp.EMPLOYEES}}$

else

| sector.AVE.SALES.FIRM.SECT$_t$=temp3

end

if *temp.ESTCOUNT >0* **then**

| sector.PRICE.SECTOR$_t$=$\frac{\text{temp6}}{\text{temp.ESTCOUNT}}$

else

| sector.PRICE.SECTOR$_t$ = 1
| Set warning: 'No establishments in the sector, price was set to 1!'

end

if *temp.ESTCOUNT > 0* **then**

| sector.QUALITY.SECT$_t$=$\frac{\text{temp7}}{\text{temp.ESTCOUNT}}$

else

| do not update sector.QUALITY.SECT$_t$
| set the same from the database (if it was the first iteration) or from the last iteration.

end

if *temp.ESTCOUNT > 0* **then**

| sector.AVE.SECT.WF.EST$_t$ = $\frac{\text{temp.EMPLOYEES}}{\text{temp.ESTCOUNT}}$

else

| sector.AVE.SECT.WF.EST$_t$ =temp.EMPLOYEES

end

sector.SECTOR.AVE.SIZE$_t$ = sector.AVE.SECT.WF.EST$_t$ **if** *temp.ESTCOUNT >0* **then**

| sector.PERC.EST.EXP$_t$ = $\frac{\text{temp9+temp10}}{\text{temp.ESTCOUNT}}$

else

| sector.PERC.EST.EXP$_t$ =temp9+temp10

end

if *temp.ESTCOUNT >0* **then**

| sector.PERC.EST.IMP$_t$ = $\frac{\text{temp8+temp10}}{\text{temp.ESTCOUNT}}$

else

| sector.PERC.EST.IMP$_t$ =temp8+temp10

end

if *temp.EMPLOYEE >0* **then**

| sector.AVE.WAGE.SECT$_t$ = $\frac{\text{temp11}}{\text{temp.EMPLOYEE}}$

else

| sector.AVE.WAGE.SECT$_t$ = temp11

end

Data: Financial data

Result: Individuals' and establishments' paying back of loans (54)

for *each individual* **do**

  if $ind.CONS.LOANS_t > 0$ && $ind.PENDING.TO.BE.PAID.CONS.LOANS_t > 0$ **then**

    $ind.CONS.LOANS_t -= ind.CONS.LOANS.QUARTERLY_t$

    $ind.PENDING.TO.BE.PAID.CONS.LOANS_t -= ind.CONS.LOANS.QUARTERLY_t$

    $ind.INTEREST.TO.BE.PAID.CONS.LOANS_t -= ind.INTEREST.TO.BE.PAID.CONS.LOANS.QUARTERLY_t$

  else

    $ind.CONS.LOANS_t = 0$

    $ind.CONS.LOANS.QUARTERLY_t = 0$

    $ind.PENDING.TO.BE.PAID.CONS.LOANS_t = 0$

    $ind.INTEREST.TO.BE.PAID.CONS.LOANS_t = 0$

    $ind.INTEREST.TO.BE.PAID.CONS.LOANS.QUARTERLY_t = 0$

  end

  if $ind.CONS.LOANS_t < 0$ || $ind.PENDING.TO.BE.PAID.CONS.LOANS_t < 0$ || $ind.INTEREST.TO.BE.PAID.CONS.LOANS_t < 0$ || $ind.INTEREST.TO.BE.PAID.CONS.LOANS.QUARTERLY_t < 0$ || $ind.CONS.LOANS.QUARTERLY_t < 0$ **then**

    $ind.CONS.LOANS_t = 0$

    $ind.PENDING.TO.BE.PAID.CONS.LOANS_t = 0$

    $ind.INTEREST.TO.BE.PAID.CONS.LOANS_t = 0$

    $ind.INTEREST.TO.BE.PAID.CONS.LOANS.QUARTERLY_t = 0$

    $ind.CONS.LOANS.QUARTERLY_t = 0$

  else

    Nothing changes

  end

  if $ind.RE.H.LOANS_t > 0$ && $ind.PENDING.TO.BE.PAID.RE.H.LOANS_t > 0$ **then**

    $ind..RE.H.LOANS_t -= ind.RE.H.LOANS.QUARTERLY_t$

    $ind.PENDING.TO.BE.PAID.RE.H.LOANS_t -= ind.RE.H.LOANS.QUARTERLY_t$

    $ind.INTEREST.TO.BE.PAID.RE.H.LOANS_t -= ind.INTEREST.TO.BE.PAID.RE.H.LOANS.QUARTERLY_t$

  else

    $ind.RE.H.LOANS_t = 0$

    $ind.RE.H.LOANS.QUARTERLY_t = 0$

    $ind.PENDING.TO.BE.PAID.RE.H.LOANS_t = 0$

    $ind.INTEREST.TO.BE.PAID.RE.H.LOANS_t = 0$

    $ind.INTEREST.TO.BE.PAID.RE.H.LOANS.QUARTERLY_t = 0$

  end

  if $ind.RE.H.LOANS_t < 0$ || $ind.PENDING.TO.BE.PAID.RE.H.LOANS_t < 0$ || $ind.INTEREST.TO.BE.PAID.RE.H.LOANS_t < 0$ || $ind.INTEREST.TO.BE.PAID.RE.H.LOANS.QUARTERLY_t < 0$ || $ind.RE.H.LOANS.QUARTERLY_t < 0$ **then**

    $ind.RE.H.LOANS_t = 0$

    $ind.PENDING.TO.BE.PAID.RE.H.LOANS_t = 0$

    $ind.INTEREST.TO.BE.PAID.RE.H.LOANS_t = 0$

    $ind.INTEREST.TO.BE.PAID.RE.H.LOANS.QUARTERLY_t = 0$

    $ind.RE.H.LOANS.QUARTERLY_t = 0$

  else

    Nothing changes

  end

  if $ind.RE.NH.LOANS_t > 0$ && $ind.PENDING.TO.BE.PAID.RE.NH.LOANS_t > 0$ **then**

    $ind.RE.NH.LOANS_t -= ind.RE.NH.LOANS.QUARTERLY_t$

    $ind.PENDING.TO.BE.PAID.RE.NH.LOANS_t -= ind.RE.NH.LOANS.QUARTERLY_t$

    $ind.INTEREST.TO.BE.PAID.RE.NH.LOANS_t -= ind.INTEREST.TO.BE.PAID.RE.NH.LOANS.QUARTERLY_t$

  else

    $ind.RE.NH.LOANS_t = 0$

    $ind.RE.NH.LOANS.QUARTERLY_t = 0$

    $ind.PENDING.TO.BE.PAID.RE.NH.LOANS_t = 0$

    $ind.INTEREST.TO.BE.PAID.RE.NH.LOANS_t = 0$

    $ind.INTEREST.TO.BE.PAID.RE.NH.LOANS.QUARTERLY_t = 0$

  end

  if $ind.RE.NH.LOANS_t < 0$ || $ind.PENDING.TO.BE.PAID.RE.NH.LOANS_t < 0$ || $ind.INTEREST.TO.BE.PAID.RE.NH.LOANS_t < 0$ || $ind.INTEREST.TO.BE.PAID.RE.NH.LOANS.QUARTERLY_t < 0$ || $ind.RE.NH.LOANS.QUARTERLY_t < 0$ **then**

    $ind.RE.NH.LOANS_t = 0$

    $ind.PENDING.TO.BE.PAID.RE.NH.LOANS_t = 0$

    $ind.INTEREST.TO.BE.PAID.RE.NH.LOANS_t = 0$

    $ind.INTEREST.TO.BE.PAID.RE.NH.LOANS.QUARTERLY_t = 0$

    $ind.RE.NH.LOANS.QUARTERLY_t = 0$

  else

    Nothing changes

  end

  if $ind.FIRM.INV.LOANS_t > 0$ && $ind.PENDING.TO.BE.PAID.FIRM.INV.LOANS_t > 0$ **then**

    $ind.FIRM.INV.LOANS_t -= ind.FIRM.INV.LOANS.QUARTERLY_t$

    $ind.PENDING.TO.BE.PAID.FIRM.INV.LOANS_t -= ind.FIRM.INV.LOANS.QUARTERLY_t$

    $int.INTEREST.TO.BE.PAID.FIRM.INV.LOANS_t -= int.INTEREST.TO.BE.PAID.FIRM.INV.LOANS.QUARTERLY_t$

  else

    $ind.FIRM.INV.LOANS_t = 0$

    $ind.FIRM.INV.LOANS.QUARTERLY_t = 0$

    $ind.PENDING.TO.BE.PAID.FIRM.INV.LOANS_t = 0$

    $ind.INTEREST.TO.BE.PAID.FIRM.INV.LOANS_t = 0$

    $ind.INTEREST.TO.BE.PAID.FIRM.INV.LOANS.QUARTERLY_t = 0$

  end

  if $ind.FIRM.INV.LOANS_t < 0$ || $ind.PENDING.TO.BE.PAID.FIRM.INV.LOANS_t < 0$ || $ind.INTEREST.TO.BE.PAID.FIRM.INV.LOANS_t < 0$ || $ind.INTEREST.TO.BE.PAID.FIRM.INV.LOANS.QUARTERLY_t < 0$ || $ind.FIRM.INV.LOANS.QUARTERLY_t < 0$ **then**

    $ind.FIRM.INV.LOANS_t = 0$

    $ind.PENDING.TO.BE.PAID.FIRM.INV.LOANS_t = 0$

    $ind.INTEREST.TO.BE.PAID.FIRM.INV.LOANS_t = 0$

    $ind.INTEREST.TO.BE.PAID.FIRM.INV.LOANS.QUARTERLY_t = 0$

    $ind.FIRM.INV.LOANS.QUARTERLY_t = 0$

  else

    Nothing changes

  end

end

for *each establishment* **do**

  if $est.Q.BUY.EST.LOANS_t > 0$ && $temp.PENDING.TO.BE.PAID.Q.BUY > 0$ **then**

    $est.Q.BUY.EST..LOANS_t -= est.Q.BUY.EST.LOANS.QUARTERLY_t$

    $temp.PENDING.TO.BE.PAID.Q.BUY.EST.LOANS -= est.Q.BUY.EST.LOANS.QUARTERLY_t$

    $est.INTEREST.TO.BE.Q.BUY.EST.LOANS_t -= est.INTEREST.TO.BE.PAID.Q.BUY.EST.LOANS.QUARTERLY_t$

  else

    $est.Q.BUY.EST.LOANS_t = 0$

    $est.Q.BUY.EST.LOANS.QUARTERLY_t = 0$

    $temp.PENDING.TO.BE.PAID.Q.BUY.EST.LOANS = 0$

    $est.INTEREST.TO.BE.PAID.Q.BUY.EST.LOANS_t = 0$

    $est.INTEREST.TO.BE.PAID.Q.BUY.EST.LOANS.QUARTERLY_t = 0$

  end

  if $est.Q.BUY.EST.LOANS_t < 0$ || $temp.PENDING.TO.BE.PAID.Q.BUY.EST.LOANS < 0$ || $est.INTEREST.TO.BE.PAID.Q.BUY.EST.LOANS_t < 0$ || $est.INTEREST.TO.BE.PAID.Q.BUY.EST.LOANS.QUARTERLY_t < 0$ || $est.Q.BUY.EST.LOANS.QUARTERLY_t < 0$ **then**

    $est.Q.BUY.EST.LOANS_t = 0$

    $temp.PENDING.TO.BE.PAID.Q.BUY.EST.LOANS = 0$

    $est.INTEREST.TO.BE.PAID.Q.BUY.EST.LOANS_t = 0$

    $est.INTEREST.TO.BE.PAID.FIRM.Q.BUY.EST.QUARTERLY_t = 0$

    $est.Q.BUY.EST.LOANS.QUARTERLY_t = 0$

  else

    Nothing changes

  end

end

Data: BIS

Result: Bank's balance sheet positions with non-financial sector updating (55)

for *each bank* **do**

/*In ***Initialization*** we have computed:

temp.SUPPLY.CONS.LOANS = bank.SUPPLY.CONS.LOANS$_t$

temp.SUPPLY.RE.H.LOANS = bank.SUPPLY.RE.H.LOANS$_t$

temp.SUPPLY.RE.NH.LOANS = bank.SUPPLY.RE.NH.LOANS$_t$

temp.SUPPLY.FIRM.INV.LOANS = bank.SUPPLY.FIRM.INV.LOANS$_t$

temp.SUPPLY.Q.BUY.EST = bank.SUPPLY.Q.BUY.EST$_t$

and we use these temporal variables now*/

temp.CONS.LOANS.GRANTED = max{0, temp.SUPPLY.CONS.LOANS − bank.SUPPLY.CONS.LOANS$_t$}

temp.RE.H.LOANS.GRANTED = max{0, temp.SUPPLY.RE.H.LOANS − bank.SUPPLY.RE.H.LOANS$_t$}

temp.NH.LOANS.GRANTED = max{0, temp.SUPPLY.RE.NH.LOANS − bank.SUPPLY.RE.NH.LOANS$_t$}

temp.FIRM.INV.LOANS.GRANTED = max{0, temp.SUPPLY.FIRM.INV.LOANS − bank.SUPPLY.FIRM.INV.LOANS$_t$}

temp.Q.BUY.EST.LOANS.GRANTED = max{0, temp.SUPPLY.Q.BUY.EST − bank.SUPPLY.Q.BUY.EST$_t$}

/*compute the sum of all loans granted to individuals and small and medium firms as well as all size firms to buy inputs*/

temp.SUM.LOANS.GRANTED = temp.CONS.LOANS.GRANTED + temp.RE.H.LOANS.GRANTED + temp.NH.LOANS.GRANTED + temp.FIRM.INV.LOANS.GRANTED + temp.Q.BUY.EST.GRANTED

/*compute the sum of all non-performing loans and the sum of supply*/

temp.SUM.NPL= bank.NPL.Q.BUY.LOANS$_t$ + bank.NPL.FIRM.INV.LOANS$_t$ + bank.NPL.CONS.LOANS$_t$ + bank.NPL.RE.H.LOANS$_t$ + bank.NPL.RE.NH.LOANS$_t$

temp.SUPPLY.OF.ALL.LOANS
= bank.SUPPLY.Q.BUY.LOANS$_t$+bank.SUPPLY.FIRM.INV.LOANS$_t$+bank.SUPPLY.CONS.LOANS$_t$+bank.SUPPLY.RE.H.LOANS$_t$ + bank.SUPPLY.RE.NH.LOANS$_t$

/*sum all deposits that people have in this bank*/

for *all individuals who has ind.BANK.ID1 (bank of deposits) = bank.BANK.ID* **do**

temp.BANK.IND.DEPOSITS + = ind.DEPOSITS$_t$

check whether the individual owns the firm and if so, add the firm.LIQ.ASSETS.FIRM$_t$

temp.BANK.FIRM.DEPOSITS + = firm.LIQ.ASSETS.FIRM$_t$

end

bank.BANK.DEPOSITS$_t$ = temp.BANK.IND.DEPOSITS + temp.BANK.FIRM.DEPOSITS

/*sum all amounts that will be given back to banks */

for *all individuals who took a loan from this bank, that is ind.BANK.ID.2 (bank of loans) = bank.BANK.ID* **do**

temp.SUM.PENDING.TO.BE.PAID.CONS.LOANS + = ind.PENDING.TO.BE.PAID.CONS.LOANS$_t$

temp.SUM.PENDING.TO.BE.PAID.RE.H.LOANS + = ind.PENDING.TO.BE.PAID.RE.H.LOANS$_t$

temp.SUM.PENDING.TO.BE.PAID.RE.NH.LOANS + = ind.PENDING.TO.BE.PAID.RE.NH.LOANS$_t$

temp.SUM.PENDING.TO.BE.PAID.FIRM.INV.LOANS + = ind.PENDING.TO.BE.PAID.FIRM.INV.LOANS$_t$

end

for *all establishments that took a loan in this bank, that is est.BANK.Q.BUY.EST.ID = that bank* **do**

temp.SUM.PENDING.TO.BE.PAID.Q.BUY + = temp.PENDING.TO.BE.PAID.Q.BUY

end

temp.SUM.PENDING.TO.BE.PAID = temp.SUM.PENDING.TO.BE.PAID.CONS.LOANS + temp.PENDING.TO.BE.PAID.RE.H.LOANS + temp.PENDING.TO.BE.PAID.RE.NH.LOANS + temp.PENDING.TO.BE.PAID.FIRM.INV.LOANS + temp.PENDING.TO.BE.PAID.Q.BUY

end

/*compute the ratios of all non-performing loans to all loans of one type or the sum of loans*/

if *temp.SUM.PENDING.TO.BE.PAID >0* **then**

$$\text{temp.NPL.RATIO} = \frac{\text{temp.SUM.NPL}}{\text{temp.SUM.PENDING.TO.BE.PAID}}$$

else

temp.NPL.RATIO =0

end

if *temp.SUM.PENDING.TO.BE.PAID.Q.BUY > 0* **then**

$$\text{temp.NPL.RATIO.Q.BUY} = \frac{\text{bank.NPL.Q.BUY.LOANS}_t}{\text{temp.SUM.PENDING.TO.BE.PAID.Q.BUY}}$$

else

temp.NPL.RATIO.Q.BUY =0

end

if *temp.SUM.PENDING.TO.BE.PAID.FIRM.INV >0* **then**

$$\text{temp.NPL.RATIO.FIRM.INV} = \frac{\text{bank.NPL.FIRM.INV.LOANS}_t}{\text{temp.SUM.PENDING.TO.BE.PAID.FIRM.INV}}$$

else

temp.NPL.RATIO.FIRM.INV =0

end

if *temp.SUM.PENDING.TO.BE.PAID.CONS.LOANS >0* **then**

$$\text{temp.NPL.RATIO.CONS} = \frac{\text{bank.NPL.CONS.LOANS}_t}{\text{temp.SUM.PENDING.TO.BE.PAID.CONS.LOANS}}$$

else

temp.NPL.RATIO.CONS =0

end

if *temp.SUM.PENDING.TO.BE.PAID.RE.H.LOANS >0* **then**

$$\text{temp.NPL.RATIO.RE.H} = \frac{\text{bank.NPL.RE.H.LOANS}_t}{\text{temp.SUM.PENDING.TO.BE.PAID.RE.H.LOANS}}$$

else

temp.NPL.RATIO.RE.H =0

end

if *temp.SUM.PENDING.TO.BE.PAID.RE.NH.LOANS >0* **then**

$$\text{temp.NPL.RATIO.RE.NH} = \frac{\text{bank.NPL.RE.NH.LOANS}_t}{\text{temp.SUM.PENDING.TO.BE.PAID.RE.NH.LOANS}}$$

else

temp.NPL.RATIO.RE.NH =0

end

Data: BIS
Result: Bank's profits & costs & equity updating (56)
for *each bank* **do**
    /*compute the profit from interest from granted loans and update bank.EQUITY*/
    bank.BANK.COST_t = draw from $\mathcal{N}(\text{bank.BANKS.AVE.COSTS}_t, \text{bank.BANKS.ST.DEV.COSTS}_t)$
    compute the cost of interests that had to be paid by bank from deposits of individuals and liquid assets of firms
    in practice check which individuals and establishments (and associated firms)
    have this bank as matched and compute the sum of interests that was paid to them
    temp.INTERESTS.OF.DEPOSITS
    temp.INTERESTS.OF.DEPOSITS = 0
    temp.INTEREST.OF.DEPOSITS.OF.INDIVIDUALS = 0
    temp.INTEREST.OF.DEPOSITS.OF.ESTABLISHMENTS =0
    for *all individuals that have deposits in this bank* **do**
        check their ind.DEPOSITS_t
        check the interest rate of deposits in the bank
        $\text{temp.INTEREST.OF.DEPOSITS.OF.INDIVIDUALS} += \text{ind.DEPOSITS}_t \times \text{bank.IR.DEPOSITS}_t$
    end
    for *all establishments that have deposits in this bank in form of liquid assets* **do**
        check their $\text{est.LIQUID.ASSETS.EST}_t$
        check the interest rate of this kind of deposits in the bank
        $\text{temp.INTEREST.OF.DEPOSITS.OF.ESTABLISHMENTS} += \text{est.LIQUID.ASSETS.EST}_t \times \text{bank.IR.DEPOSITS}_t$
    end
    temp.INTERESTS.OF.DEPOSITS = temp.INTEREST.OF.DEPOSITS.OF.INDIVIDUALS +
    + temp.INTEREST.OF.DEPOSITS.OF.ESTABLISHMENTS
    $\text{temp.BANK.PROFIT.LOANS} = \text{bank.REV.CONS.LOANS}_t + \text{bank.REV.RE.H.LOANS}_t + \text{bank.REV.RE.NH.LOANS}_t +$
    $\text{bank.REV.FIRM.INV.LOANS}_t + \text{bank.REV.Q.BUY.EST}_t - \text{temp.INTEREST.OF.DEPOSITS}$
    $\text{bank.EQUITY}_t += \text{temp.BANK.PROFIT.LOANS} - \text{bank.BANK.COST}_t$
    $\text{temp.DEFAULT.OF.BANK} = \text{bank.EQUITY}_t + \text{bank.BANK.DEPOSITS}_t + \text{temp.BANK.PROFIT.LOANS} -$
    $- \text{temp.SUM.NPL}$
    if *temp.DEFAULT.OF.BANK < 0* **then**
        $\text{bank.BANK.DEFAULT}_t = 1$
        check bank.BANK.ID and to all individuals and firm that had ind.DEPOSITS_t & $\text{firm.LIQ.ASSETS.FIRM}_t$
        assign them banks at random (in practice, change their BANK.ID at random)
    else
        $\text{bank.BANK.DEFAULT}_t = 0$
    end
end

Data: BIS

Result: Supply side decisions for $t+1$ and regulatory requirements (57)
temp.APPOX.CASH = $\varphi_1 \times$ temp.PENDING.TO.BE.PAID.CONS.LOANS (from m. 55)
temp.SUM.LOANS.GRANTED.CORRECTED = temp.SUM.LOANS.GRANTED − temp.APPROX.CASH
temp.LIQ.DEM.TO.CB = $\varphi_{LCR.min} \times$ bank.BANK.DEPOSITS$_t$ − bank.BONDS$_t$ − bank.BANK.RESERVES$_t$ − $\varphi_3 \times$ temp.APPROX.CASH
temp.RISK.WEIGHTED.ASSETS = temp.SUM.PENDING.TO.BE.PAID (from m. 55) × RISK.WEIGHTS
temp.EQUITY.TIER.1 = bank.EQUITY$_t$
if *temp.RISK.WEIGHTED.ASSETS =!0* **then**
  temp.CAR.BASEL.III = $\frac{\text{temp.EQUITY.TIER.1}}{\text{temp.RISK.WEIGHTED.ASSETS}}$
else
  temp.CAR.BASEL.III = temp.EQUITY.TIER.1
end
temp=0
temp = (temp.SUM.LOANS.GRANTED.CORRECTED+bank.BONDS$_t$+ bank.BANK.RESERVES$_t$ + φ_3 × temp.APPROX.CASH$_t$)
if *temp.PENDING.TO.BE.PAID !=0* **then**
  temp.BANK.LR = $\frac{\text{temp.EQUITY.TIER1}}{\text{temp.PENDING.TO.BE.PAID (from m. 55)}}$
else
  temp.EQUITY.TIER1
end
temp.HQLA = bank.RESERVES$_t$ + temp.APPOX.CASH + min[0.85 × bank.BONDS$_t$; 0.75 × (bank.RESERVES$_t$+ temp.APPROX.CASH)]
temp.EXP.CASH.OUTFLOW = φ_4 + $\varphi_5 \times$bank.BANK.DEPOSITS$_t$ + $\varphi_6 \times$temp.LIQ.DEM.TO.CB
temp.EXP.CASH.INFLOW = $\varphi_7 - \varphi_8 + \varphi_9 \times$ temp.APPROX.CASH + $\varphi_{10} \times$ bank.BONDS$_t$ + φ_{11}
× bank.BANK.RESERVES$_t$
temp.NCOF = temp.EXP.CASH.OUTFLOW − temp.EXP.CASH.INFLOW
if *temp.NCOF>0* **then**
  temp.BANK.LCR = $\frac{\text{temp.HQLA}}{\text{temp.NCOF}}$
else
  temp.BANK.LCR =$\varphi_{LCR.min}$
  show the warning: 'temp.BANK.LCR set artificially to LCR.min, expected outflows are equal to expected inflows!'
end
/*Supply side decisions*/
compute supply taking into account the regulatory requirements
if $\varphi_{min.c.req.} > 0$ **then**
  if *temp.CAR.BASEL.III* $\geq \varphi_{min.c.req.}$ **then**
    temp.SUPPLY.TOTAL = $\frac{\text{bank.EQUITY}_t}{\varphi_{min.c.req.}}$ − temp.SUM.PENDING.TO.BE.PAID
  else
    temp.SUPPLY.TOTAL=0
    bank.BANK.DEFAULT$_t$ = 0.5
  end
else
  set the value of $\varphi_{min.c.req.}$ at random between (0.02; 0.04) and update temp.SUPPLY.TOTAL as in if statement above
end
check the liquidity requirement
if *temp.BANK.LCR* $< \varphi_{LCR.min} \times$ bank.BANK.DEPOSITS$_t$ **then**
  bank.DEPOSITS$_t$ + = temp.LIQUIDITY.DEMAND.CB
else
  nothing changes
end
check the laverage ratio requirement
if *temp.BANK.LR* $\leq \varphi_{13}$ **then**
  nothing changes
else
  temp.SUPPLY.TOTAL=0
  bank.BANK.DEFAULT$_t$ = 0.5
end
for *each bank* **do**
  if $\mu_1 > 0$ && $\mu_2 > 0$ && $\mu_3 > 0$ &&$\mu_4 > 0$ && $\mu_5 > 0$ **then**
    temp.SUM.FOR.RATIO.CONS.LOANS = bank.SUPPLY.CONS.LOANS$_t$ + bank.REV.CONS.LOANS$_t$ − temp.NPL.CONS.LOANS
    temp.SUM.FOR.RATIO.RE.H.LOANS = bank.SUPPLY.RE.H.LOANS$_t$ + bank.REV.RE.H.LOANS$_t$ − temp.NPL.RE.H
    temp.SUM.FOR.RATIO.RE.NH.LOANS = bank.SUPPLY.RE.NH.LOANS$_t$ + bank.REV.RE.NH.LOANS$_t$ − temp.NPL.RE.NH
    temp.SUM.FOR.RATIO.FIRM.INV.LOANS = bank.SUPPLY.FIRM.INV.LOANS$_t$ + bank.REV.FIRM.INV.LOANS$_t$ −
      temp.NPL.FIRM.INV
    temp.SUM.FOR.RATIO.Q.BUY.LOANS = bank.BANK.Q.BUY.LOANS$_t$ + bank.REV.Q.BUY.LOANS$_t$ − temp.NPL.Q.BUY
    if *bank.SUPPLY.CONS.LOANS$_t$>0* **then**
      temp.RATIO.(1).FOR.SUPPLY.CONS.LOANS = $\frac{\text{temp.SUM.FOR.RATIO.CONS.LOANS}}{\text{bank.SUPPLY.CONS.LOANS}_t}$
    else
      temp.RATIO.(1).FOR.SUPPLY.CONS.LOANS = temp.SUM.FOR.RATIO.CONS.LOANS
    end
    if *bank.SUPPLY.RE.H.LOANS$_t$* **then**
      temp.RATIO.(2).FOR.SUPPLY.RE.H.LOANS = $\frac{\text{temp.SUM.FOR.RATIO.RE.H.LOANS}}{\text{bank.SUPPLY.RE.H.LOANS}_t}$
    else
      temp.RATIO.(2).FOR.SUPPLY.RE.H.LOANS = temp.SUM.FOR.RATIO.RE.H.LOANS
    end
    if *bank.SUPPLY.RE.NH.LOANS$_t$>0* **then**
      temp.RATIO.(3).FOR.SUPPLY.RE.NH.LOANS = $\frac{\text{temp.SUM.FOR.RATIO.RE.NH.LOANS}}{\text{bank.SUPPLY.RE.NH.LOANS}_t}$
    else
      temp.RATIO.(3).FOR.SUPPLY.RE.NH.LOANS = temp.SUM.FOR.RATIO.RE.NH.LOANS
    end
    if *bank.SUPPLY.FIRM.INV.LOANS$_t$>0* **then**
      temp.RATIO.(4).FOR.SUPPLY.FIRM.INV.LOANS = $\frac{\text{temp.SUM.FOR.RATIO.FIRM.INV.LOANS}}{\text{bank.SUPPLY.FIRM.INV.LOANS}_t}$
    else
      temp.RATIO.(4).FOR.SUPPLY.FIRM.INV.LOANS = temp.SUM.FOR.RATIO.FIRM.INV.LOANS
    end
    if *bank.SUPPLY.Q.BUY.LOANS$_t$>0* **then**
      temp.RATIO.(5).FOR.SUPPLY.Q.BUY.LOANS = $\frac{\text{temp.SUM.FOR.RATIO.Q.BUY.LOANS}}{\text{bank.SUPPLY.Q.BUY.LOANS}_t}$
    else
      temp.RATIO.(5).FOR.SUPPLY.Q.BUY.LOANS = temp.SUM.FOR.RATIO.Q.BUY.LOANS
    end
    order types of loans from the most profitable to the less profitable
    assign the corresponding values of $\{\mu_1, \mu_2, \mu_3, \mu_4, \mu_5\}$
    temp.SUPPLY.PRIORITIES.i =μ_i × temp.SUPPLY.TOTAL
    temp.SUPPLY.PRIORITIES.j =μ_j × temp.SUPPLY.TOTAL
    temp.SUPPLY.PRIORITIES.k =μ_k × temp.SUPPLY.TOTAL
    temp.SUPPLY.PRIORITIES.l =μ_l × temp.SUPPLY.TOTAL
    temp.SUPPLY.PRIORITIES.m =μ_m × temp.SUPPLY.TOTAL
    bank.SUPPLY.CONS.LOANS$_t$ = temp.SUPPLY.PRIORITIES.i
    bank.SUPPLY.RE.H.LOANS$_t$= temp.SUPPLY.PRIORITIES.j
    bank.SUPPLY.RE.NH.LOANS$_t$ = temp.SUPPLY.PRIORITIES.k
    bank.SUPPLY.FIRM.INV.LOANS$_t$ = temp.SUPPLY.PRORITIES.l
    bank.SUPPLY.Q.BUY.LOANS$_t$ = temp.SUPPLY.PRORITIES.m
  else
    Go to ***Supply side decisions.v.2***
  end
end

Supply side decisions.v.2

temp.SUM.FOR.RATIO.CONS.LOANS = bank.SUPPLY.CONS.LOANS$_t$ + bank.REV.CONS.LOANS$_t$ − temp.NPL.CONS.LOANS

temp.SUM.FOR.RATIO.RE.H.LOANS = bank.SUPPLY.RE.H.LOANS$_t$ + bank.REV.RE.H.LOANS$_t$ − temp.NPL.RE.H

temp.SUM.FOR.RATIO.RE.NH.LOANS = bank.SUPPLY.RE.NH.LOANS$_t$ + bank.REV.RE.NH.LOANS$_t$ − temp.NPL.RE.NH

temp.SUM.FOR.RATIO.FIRM.INV.LOANS = bank.SUPPLY.FIRM.INV.LOANS$_t$ + bank.REV.FIRM.INV.LOANS$_t$ − temp.NPL.FIRM.INV

temp.SUM.FOR.RATIO.Q.BUY.LOANS = bank.BANK.Q.BUY.LOANS$_t$ + bank.REV.Q.BUY.LOANS$_t$ − temp.NPL.Q.BUY

if *bank.SUPPLY.CONS.LOANS$_t$>0* **then**

  temp.RATIO.1.FOR.SUPPLY.CONS.LOANS = $\frac{\text{temp.SUM.FOR.RATIO.CONS.LOANS}}{\text{bank.SUPPLY.CONS.LOANS}_t}$

else

  temp.RATIO.1.FOR.SUPPLY.CONS.LOANS = temp.SUM.FOR.RATIO.CONS.LOANS

end

if *bank.SUPPLY.RE.H.LOANS$_t$>0* **then**

  temp.RATIO.2.FOR.SUPPLY.RE.H.LOANS = $\frac{\text{temp.SUM.FOR.RATIO.RE.H.LOANS}}{\text{bank.SUPPLY.RE.H.LOANS}_t}$

else

  temp.RATIO.2.FOR.SUPPLY.RE.H.LOANS = temp.SUM.FOR.RATIO.RE.H.LOANS

end

if *bank.SUPPLY.RE.NH.LOANS$_t$>0* **then**

  temp.RATIO.3.FOR.SUPPLY.RE.NH.LOANS = $\frac{\text{temp.SUM.FOR.RATIO.RE.NH.LOANS}}{\text{bank.SUPPLY.RE.NH.LOANS}_t}$

else

  temp.RATIO.3.FOR.SUPPLY.RE.NH.LOANS =temp.SUM.FOR.RATIO.RE.NH.LOANS

end

if *bank.SUPPLY.FIRM.INV.LOANS$_t$>0* **then**

  temp.RATIO.4.FOR.SUPPLY.FIRM.INV.LOANS = $\frac{\text{temp.SUM.FOR.RATIO.FIRM.INV.LOANS}}{\text{bank.SUPPLY.FIRM.INV.LOANS}_t}$

else

  temp.RATIO.4.FOR.SUPPLY.FIRM.INV.LOANS = temp.SUM.FOR.RATIO.FIRM.INV.LOANS

end

if *bank.SUPPLY.Q.BUY.LOANS$_t$* **then**

  temp.RATIO.5.FOR.SUPPLY.Q.BUY.LOANS = $\frac{\text{temp.SUM.FOR.RATIO.Q.BUY.LOANS}}{\text{bank.SUPPLY.Q.BUY.LOANS}_t}$

else

  temp.RATIO.5.FOR.SUPPLY.Q.BUY.LOANS = temp.SUM.FOR.RATIO.Q.BUY.LOANS

end

order above temporal ratios (1–5) from the highest to the lowest

assign corresponding μ_i

assign the exact value of μ from the interval such that:

each $\mu_i \leq 35\%$ && $\mu_1 + \mu_2 + \mu_3 + \mu_4 + \mu_5 = 1$

&& $\mu_2 \in \langle 0.35, 0.3)$ &&

$\mu_3 \in (\mu_2, \mu_2 - 0.06)$ &&

$\mu_5 \in (\mu_3, \mu_3 - 0.06)$ &&

$\mu_1 \in (\mu_4, \mu_5)$ &&

$\mu_2 \in (0.30; 0.35]$ &&

$\mu_3 \in (\mu_2 - 0.06; \mu_2)$ &&

$\mu_5 \in (\mu_3 - 0.06; \mu_3)$ &&

$\mu_1 \in (\mu_5 - 0.06, \mu_5)$ &&

and μ_4 to fulfill the requirement:&&

$\mu_1 + \mu_2 + \mu_3 + \mu_4 + \mu_5 = 1$

/*see example in the explanation of pseudocodes*/

multiply each μ and temp.SUPPLY.TOTAL to obtain bank.SUPPLY.CONS.LOANS$_t$, bank.RE.H.LOANS$_t$, bank.RE.NH.LOANS$_t$, bank.FIRM.INV.LOANS$_t$, bank.Q.BUY.LOANS$_t$

Data: BIS

Result: Interest rates (58)

for *each bank* **do**

/*compute interest rates */

temp.NO.OF.INDIVIDUALS = 0
temp.PERC1.SUM = 0
temp.PERC2.SUM = 0
temp.PERC3.SUM = 0
temp.PERC4.SUM = 0
temp.PERC.PERC.SUM = 0
temp.PERC1.AVE = 0
temp.PERC2.AVE = 0
temp.PERC3.AVE = 0
temp.PERC4.AVE = 0
temp.PERC.PERC.AVE = 0
temp.ALL.DEPOSITS.IND = 0
temp.ALL.LIQ.ASSETS.EST = 0
temp.SCALING.PARAM = $\frac{\text{temp.ALL.DEPOSITS.IND}}{\text{(temp.ALL.DEPOSITS.IND+temp.ALL.LIQ.ASSETS.EST)}}$

for *all individuals* **do**

sum the number of individuals in the database

temp.NO.OF.INDIVIDUALS ++

sum all deposits of individuals

temp.ALL.DEPOSITS.IND + = ind.DEPOSITS$_t$

check the values of perception indicators ind.PERC.1$_t$, ind.PERC.2$_t$, ind.PERC.3$_t$, ind.PERC.4$_t$, ind.PERC.PERC$_t$
temp.PERC1.SUM + = ind.PERC.1$_t$
temp.PERC2.SUM + = ind.PERC.2$_t$
temp.PERC3.SUM + = ind.PERC.3$_t$
temp.PERC4.SUM + = ind.PERC.4$_t$
temp.PERC.PERC.SUM + = ind.PERC.PERC$_t$

end

if *all values of all indicators for all individuals are equal 0 (temp.PERC1.SUM=0, temp.PERC2.SUM=0, temp.PERC3.SUM = 0, temp.PERC4.SUM = 0, temp.PERC.PERC.SUM = 0)* **then**

interest rates bank.IR.FIRM.INV.LOANS$_t$, bank.IR.RE.H.LOANS$_t$, bank.IR.RE.NH.LOANS$_t$, bank.IR.CONS.LOANS$_t$

bank.IR.DEPOSITS$_t$ do not change, do not differ from the ones in the database

(program upload data about interest rates from the database)

else

compute new value of general perception on the market and sum up to bank.WIBID3M

if *temp.NO.OF.INDIVIDUALS>0* **then**

temp.PERC1.AVE = $\frac{\text{temp.PERC1.SUM}}{\text{temp.NO.OF.INDIVIDUALS}}$

temp.PERC2.AVE = $\frac{\text{temp.PERC2.SUM}}{\text{temp.NO.OF.INDIVIDUALS}}$

temp.PERC3.AVE = $\frac{\text{temp.PERC3.SUM}}{\text{temp.NO.OF.INDIVIDUALS}}$

temp.PERC4.AVE = $\frac{\text{temp.PERC4.SUM}}{\text{temp.NO.OF.INDIVIDUALS}}$

else

temp.PERC1.AVE=0, temp.PERC2.AVE =0, temp.PERC3.AVE=0, temp.PERC4.AVE =0

end

bank.IR.CONS.LOANS$_t$ = bank.WIBOR3M$_t$ + temp.PERC1.AVE
bank.IR.RE.H.LOANS$_t$ = bank.WIBOR3M$_t$ + temp.PERC2.AVE
bank.IR.RE.NH.LOANS$_t$ = bank.WIBOR3M$_t$ + temp.PERC3.AVE
bank.IR.FIRM.INV.LOANS$_t$ = bank.WIBOR3M$_t$ + temp.PERC4.AVE

for *all individuals* **do**

update the values of ind.PERC1$_t$, ind.PERC2$_t$, ind.PERC3$_t$, ind.PERC4$_t$, ind.PERC.PERC$_t$

ind.PERC1$_t$ = rndm(0.0001,0.001) + rndm(0.0001,0.001) × temp.NPL.RATIO.CONS $\times\psi_1$

ind.PERC2$_t$ = rndm(0.0001,0.001) + rndm(0.0001,0.001) × temp.NPL.RATIO.RE $\times\psi_2$

ind.PERC3$_t$ = rndm(0.0001,0.001) + rndm(0.0001,0.001) × temp.NPL.RATIO.RE.NH $\times\psi_3$

ind.PERC4$_t$ = rndm(0.0001,0.001) + rndm(0.0001,0.001) × temp.NPL.RATIO.FIRM.INV $\times\psi_4$

ind.PERC.PERC$_t$ = rndm(0.0001,0.001) + rndm(0.0001,0.001) × ind.DEFAULT.IND$_t$ $\times\psi_5$

end

end

temp.NO.OF.ESTABLISHMENTS = 0
temp.PERC.EST.SUM = 0
temp.PERC.PERC.EST.SUM =0
temp.PERC.EST.AVE = 0
temp.PERC.PERC.AVE = 0

for *all establishments* **do**

temp.NO.OF.ESTABLISHMENTS ++

check the values of perception indicators est.PERC.EST$_t$, est.PERC.PERC.EST$_t$

temp.PERC.EST.SUM + = est.PERC.EST$_t$

temp.PERC.PERC.EST.SUM + = est.PERC.PERC.EST$_t$

end

if *all values of all indicators for all establishments are equal 0 (temp.PERC.EST.SUM = 0, temp.PERC.PERC.EST.SUM = 0)* **then**

interest rates bank.IR.DEPOSITS$_t$, bank.Q.BUY.EST$_t$ do not change, do not differ from the ones in the database

else

if *temp.NO.OF.ESTABLISHMENTS>0* **then**

temp.PERC.EST.AVE = $\frac{\text{temp.PERC.EST.SUM}}{\text{temp.NO.OF.ESTABLISHMENTS}}$

temp.PERC.PERC.AVE = $\frac{\text{temp.PERC.PERC.EST.SUM}}{\text{temp.NO.OF.ESTABLISHMENTS}}$

else

temp.PERC.EST.AVE = 0
temp.PERC.PERC.AVE =0

end

bank.IR.Q.BUY.EST.LOANS$_t$ = bank.WIBOR3M$_t$ + temp.PERC.EST.AVE

bank.IR.DEPOSITS$_t$ = bank.WIBID3$_t$ + (1–temp.SCALING.PARAM) × temp.PERC.PERC.EST.AVE + temp.SCALING.PARAM ×

× temp.PERC.PERC.AVE

for *all establishments* **do**

update the values of est.PERC.EST$_t$ and est.PERC.PERC.EST$_t$

est.PERC.EST$_t$ = rndm(0.0001,0.001) + rndm(0.0001,0.001) × temp.NPL.RATIO.Q.BUY $\times\psi_6$

est.PERC.PERC.EST$_t$ = rndm(0.0001,0.001) + rndm(0.0001,0.001) × ind.DEFAULT.EST$_t$ $\times\psi_7$

end

end

end