ICEACE Reference Manual

Author names to add

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Contents

1 ICEACE FLAME Implementation

1.1 firm

Table 1: **List of memory variables for firm agent.**

Name	Description
int id	Agent ID.
int bank_id	Primary bank of a firm.
int firmtype	Identifies the firm type. 0 regular firm, 1 constructor firm, 2 export firm
int day_of_month_to_act	The day of the month to act at production and labour.
int isinsolvent	The variable indicates if the firm is a replacement of an insolvent producer.
int it_no	Current iteration. Incremented daily bais.
int day_of_week_to_act	Day of the week to act for consumption.
double average_goods_price	Average goods price in the market.
int_array employees	Holds employee ids
double wage_offer	Monthly wage offer.
double average_wage	Average wage in the market.
int no_employees	Number of employees
int vacancies	Number of vacancies
int employees_needed	Number of workers a firm needs for next production
int day_of_month_wages_paid	The day of the month wages paid.
int day_of_month_production_completed	The day of the month amount of production is computed.
double labour_productivity	Productivity of a unit labour.
int production_current	Total number of goods produced in current month.
int expected_sales	An estimate of production for incoming period.
int production_plan	Production plan for next month.
double unit_goods_price	Price of a unit of goods produced by a firm.
double unit_house_price	Unit price of an house.
double unit_cost	Unit production cost of a consumption good.
int capital_goods	Capital goods in units.
double capital_productivity	Capital productivity of firms.
int projects	Holds projects under construction. Indices denote number of months left for completion.

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Name	Description
double loans_interest_rate	Rate of interest paid by firms to banks for the loans.
double debt	Total debt of the firm.
int inventory	Unsold inventory from previous month.
int sales	Total number of sales within a month.
double revenues	Total revenue from sales. It is offset quarterly.
double total_assets	Total assets of a firm.
double operating_costs	Total operation costs.
double labour_costs	Total labour costs.
double total_interest_payments	Total ineterests paid on a quarterly basis for the bank loans.
double dividends_paid	Amount of dividends paid to share holders via Equity Fund.
double dividends_to_be_paid	Amount of dividends to be paid based on previous quarter operation.
double retained_earnings	Amount of dividends retained by the firm.
double net_earnings	Quarterly profit after ineterest payments.
double ebit	Firm earnings before ineterest and taxes.
double equity	Firm equity.
double liquidity	Liquidity.
int isliquidshort	The variable holds wheather a firm had any liquidity need in the latest quarter.
int hasloan	The variable holds wheather a firm been credited by a bank for the loan that was requested.
int hasinvestment	The variable holds wheather a firm has recieved investment from the fund for its liquidity need.
int isilliquid	Flag 0 or 1. Tells whether the firm ended up in illiquidity bankruptcy.
double planned_investment_costs	Amount of investment to be made.
double liquidity_need	The variable holds wheather a firm needs liquidity to pay debt and dividends.
loan loan_list	Holds loans owed to each bank.
double labour_tax_rate	Tax rate to be used to pay labour tax.
double delta_housing_price	Monthly change on average housing prices.
double exchange_rate	Foreign currency exchange rate
double unit_xgoods_price	Export unit goods price
double unit_raw_price	Raw material unit goods price

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Table 1 – continued from previous page

Name	Description
double unit_cgoods_price	Unit capital goods price
int capital_goods_investment	Units of investment in capital goods
double cgoods_costs	Value of capital goods investment
double rawmaterial_costs	Value of raw material imports
double depreciation_rate	Capital goods monthly depreciation rate.

Table 2: **List of functions for firm agent.**

Name	Description
idle	Agent initilialization.
idle	Proceeding with regular agent loop.
firm_init_post_id	Firm posts its Id for employment initilialization.
firm_init_employment	Firm recieves its list of employees.
firm_init_balancesheet	Synchronizing the mortgage debt and deposit with respective banks.
firm_iterate	Resumes with its regular iteration loop.
idle	Skip the bank account updates.
firm_update_bank_account	Deposits/updates its liquidity to bank.
idle	Handles if the firm is not a regular firm.
idle	Works when the firm is a constructor.
idle	It is not the day of the week to sell.
firm_consumption_supply	A firm ships its goods to malls.
firm_consumption_receive_sales	A firm recieves goods unsold and sales liquidity from the mall.
firm_consumption_update_market_price	Firm checks goods prices.
idle	Labour hiring is not active.
firm_labour_workforce_needed	The firm computes required number of employees needed for incoming month.
idle	Firm does nothing
firm_labour_fire	The firm decides to fire if employee needed is below number of employees it does have.
firm_labour_job_announcement_stage1	The agent posts available positions.
firm_labour_job_offer_stage1	The agent takes job matches done by jpoffice.

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Table 2 – continued from previous page

Name	Description
firm_labour_update	The agent updates labour status. In case of resignments.
firm_labour_job_announcement_stage2	The agent posts unfilled positions.
idle	The agent has no vacant positions
firm_labour_job_offer_stage2	The agent completes the job placement.
idle	Does nothing at the point when it is not last day of the month.
firm_labour_pay_wages	Pay wages and update liquidity.
firm_labour_trace_wages	Firm checks wage in the market and updates its wage offer.
idle	It is not the end of month or the first day of the month.
idle	The state serves to check the activity cases.
firm_production_skip	The firm is new entrant has initialized with an employee and an inventory.
idle	The firm is a new entrant due to insolvency of inherited firm.
idle	Sets a producer role.
idle	Set the constructor role.
idle	Set the exporter role.
firm_production_produce_goods	Firm audits number of items produced. Updates inventory accordingly.
firm_production_set_price	Firm sets price of goods produced.
firm_production_plan	Firm determines number of items to be produced for the next period.
firm_production_compute_labour_demand	Firm determines required number of labourers for current production plan.
firm_production_construct_houses	Firm releases number of items produced. Updates project status accordingly.
firm_production_construction_plan	Firm sets the construction project plan.
firm_production_construction_labour_demand	Firm determines required number of labourers for current construction plan.
firm_production_produce_export_goods	Firm ships export goods to foreign sector
firm_production_export_plan	Firm export plan.
firm_production_export_labour_demand	Firm determines required number of labourers for current export plan.
idle	It is not the start of a quarter.
firm_credit_compute_income_statement	computing firm balance sheet.

Table 2 – continued from previous page

Name	Description
firm_credit_investment_decisions	computing firm balance sheet.
firm_credit_compute_dividends	computing dividends to be paid.
firm_credit_check_liquidity_need	Firm checks if it needs liquidity to pay loans and dividends.
idle	Firm does not need loans.
firm_credit_demand_loans_1	Firm computes loan demand and places a demand if it needs and if it is allowed to do so.
firm_credit_borrow_loans_1	Firm checks whether first loan request is accepted. When not, places another request to another bank.
idle	The firm has gotten loan.
firm_credit_borrow_loans_2	Firm checks weather second loan request is accepted.
idle	The firm has gotten loan in the second trial.
firm_credit_request_equityfund_investment	The firm checks its illiquidity state. It places a request for investment from Equity Fund.
idle	The firm checks for decision by Equity Fund.
firm_credit_check_equityfund_investment	The firm checks for decision by Equity Fund.
idle	The firm has the investment goes paying loans.
firm_credit_illiquidity_bankrupt	Firm cannot recieve fund goes illiquidity.
firm_credit_pay_interest_on_loans	Each quarter firm sends out intterest on the loans it has.
firm_credit_pay_dividends	At the end of a quarter, a firm sends net profit to the equity fund.
firm_credit_do_balance_sheet	Updating the balance sheet.
idle	Firm is not insolvent. Keeps it regular activities.
firm_credit_insolvency_bankruptcy	The firm checks its illiquidity state, checking the deal with Equity Fund.
idle	It is not time to act.
firm_credit_check_interest_rate	Firm checks quarterly interest rate.
firm_credit_check_tax_rate	Firm checks quarterly tax rate.
idle	Handles if the firm is not a constructor.
idle	Works when the firm is a constructor.
idle	It is not the first day of the month.
firm_housing_enter_market	Firm goes to market when it has housing units to sell.
firm_housing_collect_sale_revenues	Firm collects sale revenues.

Table 2 – continued from previous page

Name	Description
firm_housing_update_market_price	Firm checks housing prices.
idle	It is not the last day of the month.
firm_export_import_rawmaterials	Firm imports raw materials
firm_export_import_capitalgoods	Firm imports capital goods
idle	Handles if the firm is not an export firm.
idle	Works when the firm is an export firm.
idle	It is not the day of the month to sell.
firm_export_sell	A firm ships its goods to foreign sector.
firm_export_receive_sales	A firm recieves sales revenues through the central bank.
firm_export_check_pricesandrates	Firm receives exchange rate from Central bank and prices from foreign sector.
idle	Not the last day of the month

1.2 household

Table 3: **List of memory variables for household agent.**

Name	Description
int id	Agent ID.
int bank_id	The ID of the bank an household has. Household applies to her bank for mortgage and deposits.
int it_no	Current iteration. Incremented daily bais.
int day_of_week_to_act	Day of the week to act for consumption.
double weekly_consumption_budget	Regualr weekly consumption budget computed for the quarter.
double mall_budget	Consumption budget that can be spent for the week.
int my_employer_id	Employer ID of an household. A 0 means unemployed.
double wage	Current wage earned.
double government_benefits	General benefit plus unemployment benefit recieved from the government.
int day_of_month_to_act	The day of the month to act for seeking a job.
int day_of_month_wage_recieved	The day of the month to wage recieved.
double mortgages_interest_rate	Rate of interest set by the central bank.

Table 3 – continued from previous page

Name	Description
double labour_tax_rate	Rate of tax set by the government.
mortgage_array mortgages_list	List of mortgages debted by households.
double mortgages	Total mortgage.
double housing_payment	Holds total mortgage payment done within the last quarter.
double equity	Household equity.
double housing_price	Market value of a unit housing.
int housing_units	Number of housing units owned by a household.
int n_shares	Number of shares an household owns.
double liquidity	Liquidity.
double capital_income	Equity fund shares recieved quarterly.
double previous_wages	Holds wages earned in three previous months.
double previous_benefits	Holds benefits from the govenment in three previous months.
double labour_income	Labour income for last 3 months.
double total_assets	Total assets owned by an household.
double housing_value	Monetary value of housing units owned by an household.
double expected_housing_payment	It keeps payment amount for the incoming quarter.
int hmarket_role	The variable sets households market role.
double equity_ratio	Current equity ratio of an household
double minimum_equity_ratio	Minimum equity ratio required for a household to apply for mortgage.
double mortgage_costs	Holds mortgage costs, principal plus ineterests paid for last three months.
double delta_housing_value	Value change on housing value on a monthly basis.

Table 4: **List of functions for household agent.**

Name	Description
idle	Agent initilialization.
idle	Proceeding with regular agent loop.
household_init_post_id	Household posts its Id for employment initilialization.
household_init_employment	Household recieves agent Id of his employer.
household_init_balancesheet	Synchronizing the mortgage debt and deposit with respective banks.

Table 4 – continued from previous page

Name	Description
household_iterate	Resumes its regular iteration.
idle	Skip the bank account updates.
household_update_bank_account	Deposits/updates its liquidity to bank.
idle	It is not the first day of the month to compute monthly consumption.
household_consumption_compute_budget	It is the first day of the month, time to compute monthly consumption.
idle	It is not the day of the week to shop.
household_consumption_demand	A household demands a consumption amounted to the available budget he/she has.
household_consumption_recieve_goods	A household recieves goods bought from the mall.
idle	Job searching is not active.
household_labour_check_fired	Household checks layout status.
household_labour_reemployment_application	Stage 01 of job applications. Already employed households apply with a turnover probability
idle	Stage 01 of job applications. Unemployed households skip this stage
household_labour_turnover	A job turnover.
household_labour_employment_application	Stage 02 of job market. Unemployed households apply.
household_labour_employment	A new employment.
idle	Does nothing at the point when it is not last day of the month.
household_labour_receive_wage	Receives payment and update wage history.
household_labour_report_status	Sends out its employment status.
idle	It is not the start of a quarter.
idle	It is the start of a quarter.
idle	The household does not own any shares of firms.
household_credit_collect_shares	At the end of a quarter household recieves shares from the firms via Equity Fund.
household_credit_do_balance_sheet	Computing the balance sheet.
idle	It is not the end of the month.
household_credit_collect_benefits	Collect general transfer benefits and/or unemployment benefit from the government.
idle	It is not the end of a quarter.

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Table 4 – continued from previous page

Name	Description
household_credit_check_interest_rate	Households check the interest rate which is set by CB.
household_credit_update_mortgage_rates	Households updates annuity, principal and interest payment amounts.
household_credit_check_tax_rate	Households check the tax rate which is set by government.
idle	It is not the first day of the month.
household_housing_market_role	Sets the households market role in real estate for the current month.
idle	Household is not active at the market.
household_housing_check_wealth	Households attempts to the market with regular buyer role.
household_housing_sell	Households enters the market with regular seller role.
household_housing_fire_sell	Household enters the market with a fire seller role.
household_housing_collect_sale_revenue	Household collects sale revenue and if he is a fire seller pays mortgage with it.
idle	Household does not have enough equity to buy.
household_housing_enter_market	Household goes to the market.
household_housing_buy	Household updates her assets based on the result he gets from housing market.
household_housing_update_market_price	Household checks new avg housing market price.
household_housing_pay_mortgages	Household sends out mortgage payments.
household_housing_debt_writeoff	When debt of household drops below a certain threshold its earnings, the debt is written off.

1.3 equityfund

Table 5: **List of memory variables for equityfund agent.**

Name	Description
int id	Agent ID.
int it_no	Current iteration. Incremented daily bais.
int day_of_month_to_act	Activation day for the shareholder audition.
int day_of_month_wages_paid	Activation day for the shareholder audition.
double share_firms	Shares owned by regular firms.

Table 5 – continued from previous page

Name	Description
double share_construction_firms	Shares owned by constructor firms.
double share_banks	Shares owned by banks.
double equity	Firm equity.
double liquidity	Liquidity.
int n_shares	Number of households(shares) to recieve liquid shares from firm net income.
double dividends_recieved	Total amount dividends recieved from firms and banks
double dividends_retained	Total amount of dividends retained.
double dividends_paid	Total amount of dividends distributed to shareholders.
double firm_investment	Total amount of liquidity used for firms with liquidity needs.
double capital_tax_rate	Tax rate used at determining amount of tax on dividends.

Table 6: **List of functions for equityfund agent.**

Name	Description
equityfund_init	Agent initilialization.
idle	Proceeding with regular agent loop.
equityfund_iterate	Notifies its id.
idle	It is not the start of a month.
equityfund_audit_dividends	Makes a sensus on size of dividends.
idle	It is not the start of a quarter.
equityfund_credit_invest_illiquids	The equity fund invests certain firms to resolve their liquidity problem.
equityfund_credit_collect_bank_shares	At the end of a quarter collect net income from the banks in the market.
equityfund_credit_collect_firm_shares	At the end of a quarter collect net income from the firms in the market.
equityfund_credit_distribute_shares	At the end of a quarter net income per household is distributed.
idle	It is not the end of a quarter.
equityfund_credit_compute_income_statement	Equity Fund computes the income statement.
equityfund_credit_do_balance_sheet	Equity fund balance sheet accounting activities.
equityfund_credit_check_tax_rate	Equity fund checks quarterly tax rate.

1.4 bank

Table 7: **List of memory variables for bank agent.**

Name	Description
int id	Agent ID.
int day_of_month_to_act	Activation day.
int day_of_week_to_act	Day of the week to act.
int it_no	Current iteration. Incremented daily bais.
double total_assets	Total assets of the banks.
double loans	Loans to firms.
double loans_start	Loans to firms at the start of the quarter.
double mortgages	Mortgages to households.
double deposits	Deposits recieved from private sector.
double centralbank_debt	Debt to central bank.
double equity	Firm equity.
double liquidity	Liquidity.
double revenues	Revenues of the bank.
double total_writeoffs	Total of writeoff loss a bank has.
double interest_rate	Rate of interest set by central bank.
double interests_accrued	Total interest a bank has collected from loans and mortgages.
double interests_paid	Total interest a bank has paid to for its central bank debts.
double dividends_paid	Amount of dividends paid to share holders via Equity Fund.
double total_dividends	Amount of dividends banks have to distribute.
double retained_earnings	Retained earnings in the case of capital inadequecy.
double net_earnings	Earnings from interests minus costs.
double total_costs	Total costs of banks. It is interest paid to CB and writeoffs recieved.

Table 8: **List of functions for bank agent.**

Name	Description
idle	Agent initilialization.
idle	Proceeding with regular agent loop.
bank_init_loans	Gathers loans from firms.

Table 8 – continued from previous page

Name	Description
bank_init_mortgages	Gather mortgages from households.
bank_init_deposits	Gather deposits from firms and households.
bank_init_balancesheet	Bank initializes total assets, equity, debt to central bank and liquidity.
bank_iterate	Bank resumes its iterative functions.
idle	Skip the bank account updates.
bank_update_deposits	Deposits/updates its liquidity to bank.
idle	It is not the start of a quarter.
bank_credit_compute_income_statement	Bank computes income statement.
bank_credit_compute_dividends	Bank evaluates loan requests firstly.
bank_credit_do_balance_sheet	Bank balance sheet accounting activities.
bank_credit_process_loan_requests_1	Bank evaluates first loan requests.
bank_credit_process_loan_requests_2	Bank evaluates first loan requests.
bank_credit_recieve_loan_writeoffs	Bank updates its loss.
bank_credit_recieve_new_entrant_loan_requests	Bank recieve request for new entrant requests.
bank_credit_collect_loan_interests	Bank evaluates first loan requests.
idle	It is not time to act.
bank_credit_check_interest_rate	Bank checks centralbank ineterest rate.
idle	It is not the first day of the month.
bank_housing_compute_capital_status	Bank computes its crediting status.
bank_housing_deliver_mortages	Bank collects mortage requests from real estate agency.
bank_housing_recieve_mortgage_principals	Bank collects mortage debt principal payments from households.
bank_housing_recieve_mortgages	Bank collects regular mortgage payments from households.
bank_housing_debt_writeoff	Bank recieves mortgage written off.

1.5 government

Table 9: **List of memory variables for government agent.**

Name	Description
int id	Agent ID.
int it_no	Current iteration. Incremented daily bais.
double average_wage	Average wage for employed households.
double unemployment_rate	The unemployment rate
int population_size	Number of households.
double debt	Debt to central bank.
double equity	Government equity.
double liquidity	Government liquidity.
int day_of_month_to_act	Day of the month to act.
int day_of_month_wages_paid	The day of month wages paid. It is the end of month.
double capital_tax_rate	Government rate on capital income.
double labour_tax_rate	Government rate on labour income.
double labour_tax_income	Collected amount of labour tax.
double capital_tax_income	Collected amount of capital tax.
double gov_general_benefit_rate	Rate of general benefits to distribute to all housholds.
double gov_unemployment_rate	Rate of unemployment benefit with respect to average wage.
double general_benefits	Amount of general benefits distributed to households.
double unemployment_benefits	Amount of unemployment benefits distributed by the government.
double earnings	Government earnings from taxes.
double centralbank_income	Quarterly collected amount of profits from centralbank.
double expenditures	Government expenditures on unemployment and general benefit payments.

Table 10: **List of functions for government agent.**

Name	Description
government_init	Agent runtime initilialization.
idle	Proceeding with regular agent loop.
government_iterate	Regular loop start point.
government_trace_unemployment_status	Makes a sensus on employment status.

Continued on next page

Table 10 – continued from previous page

Name	Description
idle	It is not the start of a quarter.
government_collect_capital_tax	It is the start of the quarter.
idle	It is not the end of a month.
government_distribute_general_benefits	It distributes general benefits.
government_distribute_unemployment_benefits	It distributes unemployment benefits.
government_collect_labour_tax	Labour tax is collected
idle	It is not the end of a quarter.
government_collect_centralbank_profit	The government collects net profit from the centralbank.
government_compute_income_statement	Government computes its income statement.
government_do_balance_sheet	Government balance sheet accounting activities.
government_update_fiscal_policy	Government sets tax rate, general benefits and unemployment benefits

1.6 centralbank

Table 11: **List of memory variables for centralbank agent.**

Name	Description
int id	Agent ID.
int day_of_month_to_act	Day of the month to act.
int day_of_month_to_import	Day of the month to import.
int day_of_month_to_export	Day of the month to export.
double unemployment_rate	Unemployment rate. It is updated monthly.
double inflation_rate	inflation rate. It is updated quarterly.
double consumption_goods_prices	Unemployment rate. It is updated monthly
int it_no	Current iteration. Incremented daily bais.
int day_of_week_to_act	Day of the week to act.
transaction goods	Weakly transaction summary at the market.
double weekly_price_averages	Weakly price averages at the market.
int day_of_month_wages_paid	The day of the month wages paid.

Table 11 – continued from previous page

Name	Description
double interest_rate	Rate of interest set by central bank.
double liquidity	Central Bank liquidity
double loans_banks	loans to firms.
double loans_government	loans to the government.
double fiat_money	Outstanding fiat money.
double equity	Firm equity.
double liquidity_banks	Liquidity kept for banks.
double liquidity_government	Liquidity kept for the government.
double liquidity_equityfund	Liquidity kept for the fund.
double total_assets	Central Bank total assets.
double total_writeoffs	Central Bank loss due to bank bailouts.
double interests_accrued	Amount of interest collected from banks and government.
double revenues	Central Bank revenues.
double net_earnings	Central Bank net earnings.
double total_costs	Central Bank total costs.
double exchange_rate	Foreign currency exchange rate
double fx_liquidity	Foreign currency reserve of the centralbank.
transaction houses	Monthly transaction summary at the market.
double monthly_export_revenues	Value of monthly exports
double monthly_import_costs	Value of monthly imports

Table 12: **List of functions for centralbank agent.**

Name	Description
idle	Agent initilialization.
idle	Proceeding with regular agent loop.
centralbank_init_balancesheet	Synchronizing the bank debts.
centralbank_iterate	Resumes its regular iteration.
idle	It is not the day of the week to act.
centralbank_trace_goods_exported	Centralbank traces goods exported by regular firms to foreign sector.
centralbank_trace_goods_prices	It is the day of the week to act.

Table 12 – continued from previous page

Name	Description
idle	It is not the end of month.
centralbank_update_price_indices	The central bank computes monthly price average.
idle	It is not the day of the month to act.
centralbank_trace_unemployment_status	Makes a sensus on employment status.
idle	It is not time to act.
centralbank_collect_interest_payments	Central Bank collects interest payments from banks.
centralbank_process_debt_requests	Central Bank receives new debt requests from banks and collects debt payments from banks.
idle	It is not time to act.
centralbank_compute_income_statement	Central Bank computes income statement.
centralbank_process_government_requests	Central Bank processes loan requests and loan payments from the government.
centralbank_do_balance_sheet	Central Bank balance sheet accounting activities.
centralbank_set_interest_rate	Central bank sets the interest rate.
idle	It is not the day of the month to act.
centralbank_trace_housing_prices	It is the day of the month to act.
centralbank_import_transactions	Central bank updates foreign currency reserves due to imports
idle	It is not the end of month.
centralbank_export_transactions	Central bank processes fx transactions between foreign sector and export firms
idle	It is not the end of month.
centralbank_set_exchangerate	Central bank sets exchange rates
idle	Not the last day of the month

1.7   foreignsector

Table 13: **List of memory variables for foreignsector agent.**

Name	Description
int id	Agent ID.
int it_no	Current iteration. Incremented daily bais.

Continued on next page

Table 13 – continued from previous page

Name	Description
int day_of_month_to_export	Activation day.
int day_of_month_to_import	Activation day.
int day_of_week_to_act	Day of the week to act.
double unit_xgoods_price	Unit price of export goods
double unit_raw_price	Unit price of raw materials
double unit_cgoods_price	Unit price of capital goods.
xtransaction_array export_list	List of goods to be exported
double exports	total value of exports in fx currency
double imports	total value of imports in fx currency

Table 14: **List of functions for foreignsector agent.**

Name	Description
foreignsector_init	Agent runtime initilialization.
idle	Proceeding with regular agent loop.
foreignsector_iterate	Regular loop start point.
idle	It is not the day of the week to act.
foreignsector_consumption_buy_goods	Foreign sector consumption of locally produced goods.
idle	It is not the end of month.
foreignsector_export_sell_rawmaterials	Foreign sector sells raw materials to firms
foreignsector_export_sell_capitalgoods	Foreign sector sells capital goods to firms
foreignsector_export_buy	Firm sells export goods to foreign sector
idle	It is not the end of month.
foreignsector_export_pay	foreign sector payment for export goods from export firms to central bank
foreignsector_set_prices	Foreign sector sets prices
idle	Not the last day of the month

1.8   jpoffice

Table 15: **List of memory variables for jpoffice agent.**

Name	Description
int id	Agent ID.
int it_no	Current iteration. Incremented daily bais.
int day_of_month_to_act	The day of mont to perform job matching.

Table 16: **List of functions for jpoffice agent.**

Name	Description
idle	Agent initilialization.
idle	Proceeding with regular agent loop.
jpoffice_init_employment	Job placement office collects household and firm ids and forms network of initial employment.
jpoffice_iterate	Notifies its id.
idle	Job matching is not active.
jpoffice_labour_stage1	Collecting vacancies and job applications. Vacancies and turnover applications are matched.
jpoffice_labour_stage2	Second stage job matching.

1.9 badbank

Table 17: **List of memory variables for badbank agent.**

Name	Description
int id	Agent ID.
int it_no	Current iteration. Incremented daily bais.

Table 18: **List of functions for badbank agent.**

Name	Description
badbank_init	Initialization state.
idle	It is not the end of a quarter.
badbank_credit_requests	Bad bank activities.

1.10 mall

Table 19: **List of memory variables for mall agent.**

Name	Description
int id	Agent ID.
int it_no	Current iteration. Incremented daily bais.
int day_of_week_to_act	Day of the week to act for consumption.
transaction goods_transactions	Weakly transaction summary at the market.
double demand_tourism	Weekly consumption demand by foreign sector in foreign currency.

Table 20: **List of functions for mall agent.**

Name	Description
mall_init	Notifies its id.
idle	It is not the day of the week to shop.
mall_consumption_shopping	Mall collecting supplies from the firms, demands from the households.
mall_consumption_summary	The agent reports summary of transactions.

1.11 reagency

Table 21: **List of memory variables for reagency agent.**

Name	Description
int id	Agent ID.
int day_of_month_to_act	Activation day.
int it_no	Current iteration. Incremented daily bais.
double mortgages_interest_rate	Rate of interest set by central bank.
transaction housing_transactions	Monthly transaction summary at the market.

Table 22: **List of functions for reagency agent.**

Name	Description
reagency_init	Notifies its id.
idle	It is not the end of a quarter.
reagency_check_interest_rate	It checks interest rate.

Table 22 – continued from previous page

Name	Description
idle	It is not the first day of the month.
reagency_housing_process	The agent collects requests and does the matchings.
reagency_housing_summary	The agent reports summary of transactions.

1.12 Messages

See Table 23.

Table 23: **List of messages.**

Name	Description
firm_bank_init_loans	Firm sends out its initialized loan info to bank.
int bank_id	The bank from which initial loan has gotten.
double amount	Amount of loan.
firm_bank_init_deposit	Firm sends out its liquid money to bank.
int bank_id	The bank where liquid money to be deposited.
double amount	Amount of liquid money to be deposited.
firm_bank_update_deposit	Firm sends out its liquid money to bank.
int bank_id	The bank where liquid money to be deposited.
double amount	Amount of liquid money to be deposited.
household_bank_init_mortgages	Household sends out its initialized amount of mortgage info to its bank.
int bank_id	The bank from which initial mortgage has been acquired.
double amount	Amount of mortgage.
household_bank_init_deposit	Household sends out its liquid money to bank.
int bank_id	The bank where liquid money to be deposited.
double amount	Amount of liquid money to be deposited.
household_bank_update_deposit	Household sends out its liquid money to bank.
int bank_id	The bank where liquid money to be deposited.
double amount	Amount of liquid money to be deposited.
bank_centralbank_init_debt	Bank informs its centralbank debt for initilialization.
int bank_id	The deptor bank id.
double amount	Amount of debt.
bank_centralbank_init_deposit	Bank sends out its liquid money to centralbank.
int bank_id	The depositor bank id.
double amount	Amount of liquid money to be deposited.
bank_centralbank_update_deposit	Bank sends out its liquid money to centralbank.
int bank_id	The depositor bank id.
double amount	Amount of liquid money to be deposited.
fund_centralbank_init_deposit	Fund sends out its liquid money to centralbank.

Table 23 – continued from previous page

Name	Description
double amount	Amount of liquid money to be deposited.
fund_centralbank_update_deposit	Fund sends out its liquid money to centralbank.
double amount	Amount of liquid money to be deposited.
gov_centralbank_init_deposit	Government sends out its liquid money to centralbank.
double amount	Amount of liquid money to be deposited.
gov_centralbank_update_deposit	Government sends out its liquid money to centralbank.
double amount	Amount of liquid money to be deposited.
interest_rate	The interest rate sent by the central bank.
double rate	The rate.
capital_tax_rate	Government tax rate on capital income.
double value	Rate of the tax.
labour_tax_rate	Government tax rate on labour income.
double value	Rate of the tax.
household_jpoffice_id	Household notifies his/her id.
int household_id	The agent id.
jpoffice_household_employer	Firm notifies its id.
int household_id	The agent id.
int employer_id	The agent id.
firm_jpoffice_id	Firm notifies its id.
int firm_id	The agent id.
int isconstructor	Firm type.
jpoffice_firm_employee	Firm notifies its id.
int firm_id	The agent id.
int employee_id	The agent id.
buy	Weekly household consumption information.
int id	Household agent ID.
double budget	Amount of liquid money to spend.
bought	Consumption summary.
int id	Household agent ID.
double money_spent	Amount of liquid money that was spent.
int received_quantity	Number of goods bought.
sell	Information on items to be sold at the mall.
int id	Firm agent ID.
double price	Unit price of goods to be sold.
int inventory	Number of items to be sold.
sold	Sales summary.
int id	Firm agent ID.
int sold_quantities	Number of sold quantities.

Table 23 – continued from previous page

Name	Description
goods_transactions_summary	Weakly sent out transaction summary.
int quantity	Number of goods sold out.
double avg_price	Weakly avg price.
mall_centralbank_goods	Total transaction volume of regular consumption goods sold to foreign market.
double volume	Transaction volume in local currency
centralbank_foreignsector_goods	Total transaction volume of regular consumption goods sold to foreign market in foreign currency.
double fx_revenues	Transaction volume in foreign currency
fired	Sent by a firm to notify an employee who is fired.
int employee_id	Employee ID who has been fired.
vacancy_stage1	Sent by a Firm to post a vacancy.
int employer_id	Firm agent ID who posts a new position.
double wage	Amount of salary to be offered.
job_application_stage2	Sent by an household to apply a posted vacancy.
int employee_id	Household agent ID who seeks employment.
job_application_stage1	Sent by an household to notifie jpoffice
int employee_id	Household agent ID who applies for a new job.
double wage	Current amount of wage earned by the applicant.
job_match_stage1	Sent by a firm informing a filled position.
int employer_id	Firm agent ID that has filled a post.
int employee_id	Household agent ID who has been offered a position.
double wage	Amount of salary that is offered.
job_change	Sent by a worker to notify a resigned position.
int employer_id	Firm agent ID of the position held.
int employee_id	Household aent ID who is changing the job.
vacancy_stage2	Sent by a Firm to post unfilled vacancy.
int employer_id	Firm agent ID who posts unfilled position.
double wage	Amount of salary to be offered.
job_match_stage2	Sent by a firm informing a filled position.
int employer_id	Firm agent ID that has filled a post.
int employee_id	Household agent ID who has been offered a position.
double wage	Amount of salary that is offered.
employment_status	Sent by a household to report his/her employment status.
int employer_id	The employer. O stands for unemployed case.
double wage	Current wage of an household.
int nshares	Number of shares one own.
firm_household_wage_payment	Posted by the firm agent.
int firm_id	The firm id.
double wage	Current wage offer by the firm.

Table 23 – continued from previous page

Name	Description
firm_bank_loan_request_1	The loan requested by a firm.
int firm_id	The firm.
int bank_id	The bank.
double amount	The amount.
firm_bank_loan_request_2	The loan requested by a firm.
int firm_id	The firm.
int bank_id	The bank.
double amount	The amount.
bank_firm_loan_acknowledge_1	The loan that is acknowledged by a firms's own bank.
int bank_id	The bank.
int firm_id	The firm.
double amount	The amount.
bank_firm_loan_acknowledge_2	The loan acknowledged for a firm by the other bank.
int bank_id	The bank.
int firm_id	The firm.
double amount	The amount.
bank_centralbank_debt_request	Debt request by bank from the central bank.
int bank_id	The bank id
double amount	amount requested
household_share	Shares are sent to households.
double amount	Share per household.
capital_tax	Tax on capital earnings of households.
double amount	Total capital tax sent by household.
labour_tax	Tax on wage earning of households.
double amount	Total wage taxes sent to government by households.
unemployment_benefit	Total unemployment benefit sent to households.
double amount	
general_benefit	general benefit sent to households.
double amount	
fund_request	Amount of the liquidity requested from Equity Fund.
int firm_id	
double amount	
fund_request_ack	Amount of the liquidity requested is confirmed by Equity Fund.
int firm_id	
double amount	
new_entrant_loan	The loan requested by the new entrant, that replaces the insolvent one.
int firm_id	The firm.
int bank_id	The bank.

Table 23 – continued from previous page

Name	Description
double amount	The amount.
firm_bank_interest_on_loan	Quarterly interest that is paid by a firm.
int bank_id	The bank.
double amount	The amount.
loan_writeoff	Amount of loan of a firm that is written off.
int bank_id	Agent ID of the bank to receive.
double amount	
firm_bank_insolvent_account	Acount maintainance in case of insolvency.
int bank_id	Bank ID of the account.
double liquidity	Amount of liquidity
firm_net_profit	Net income send to Equity Fund.
int id	Firm agent ID.
int isconstructor	Flag to label whether the income is recieved from a constructor firm.
double net_income	Net income to be distributed.
bank_net_profit	Net income send to Equity Fund.
int id	Bank Agent ID.
double net_income	Net income to be distributed.
bank_centralbank_interest_payment	Interest paid by bank to centralbank.
int id	Bank Agent ID.
double amount	Amount of interest payment.
bank_centralbank_debt_payment	Debt paid by bank to centralbank.
int id	Bank Agent ID.
double amount	Amount of debt paid back.
gov_centralbank_debt_request	Government requests debt from the centralbank.
double amount	Amount of liquidity needed.
gov_centralbank_debt_payment	Government pays debt to centralbank.
double amount	Amount of payment.
centralbank_government_profit	Amount of profit transfered to the government.
double amount	Amount of debt paid back.
housing_price	Sent real estate agency at the end of market.
double price	Average unit price of housing for the month.
buy_housing	Sent by a household.
int buyer_id	Household ID, the buyer.
int bank_id	Bank ID of the buyer. Used in case mortgage is needed.
double liquidity	Amount of liquidity an household have at the time to buy housing.
double quarterly_income	Quarterly net income, labour and capital, an household makes.
double quarterly_mortgage_paid	Quarterly mortgage payments being done by an household.

Table 23 – continued from previous page

Name	Description
sell_housing	Sent either by a constructor firm or an household.
int seller_id	Agent ID of the seller.
double price	Unit price of housing.
int quantity	Quantity of housing units to sell. Households are allowed to sell maximum of 1 unit.
int type	Seller Roles: 1 fire seller; 2 regular seller; 0 firm seller.
bought_housing	Sent to an household.
int buyer_id	Agent ID of the household who has bought one unit of housing.
double liquidity_spent	Amount of liquid money used to buy a unit of housing.
double mortgage_used	Amount of mortgage used from the bank.
double annuity	Annuity of the housing unit bought.
sold_housing	Sent either to a constructor firm or to an household.
int seller_id	Agent ID of the seller.
int quantity_sold	Quantity of housing units that has been sold.
double price_sold	Unit price of each sale.
bank_reagency_credibility	Posted by a bank. It shows total amount of mortgage a bank can provide for the market.
int bank_id	Agent ID of the bank.
double equity	Equity owned by bank.
double risky_assets	Amount of risky assets owned by the bank.
mortgage_requests	Posted by a bank. It shows total amount of mortgage a bank can provide for the market.
int bank_id	Agent ID of the bank.
double amount	Amount of mortgage given out by the bank.
mortgage_payment_from_sale	Amount of mortgage principal mortgage paid by a household to a bank after a fire sale.
int bank_id	Agent ID of the bank to receive.
double amount	Amount of mortgage paid to a bank by an household.
mortgage_payment	Regular mortage payments.
int bank_id	Agent ID of the bank to receive.
double interest	Amount of mortgage interest.
double principal	Amount of mortgage principal.
mortgage_writeoff	Amount of mortgage of a household that is written off.
int bank_id	Agent ID of the bank to receive.
double amount	Amount of mortgage interest.
housing_transactions_summary	Monthly transaction summary.
int quantity	Number of housing units sold out.
double avg_price	Monthly avg price..
centralbank_firm_exchangerate	Exchange rate.
double rate	Exchange rate
foreignsector_firm_prices	Prices.

Table 23 – continued from previous page

Name	Description
double xgoods	Xgoods price
double rawmaterial	Raw material price
double cgoods	Capital goods price
firm_foreignsector_xgoods	Amount of goods sold from export firm to foreign sector
int id	Export firm agent ID.
int amount	Amount of export goods.
firm_foreignsector_rawmaterials	Amount of raw material bought from foreign sector
int id	Importing firm agent ID.
int amount	Amount of raw materials.
firm_foreignsector_cgoods	Amount of capital goods bought from foreign sector
int id	Export firm agent ID.
int amount	Amount of capital goods.
foreignsector_centralbank_revenues	FX revenues from export sales
int id	Export firm agent ID.
double fx_revenues	Amount of FX revenues received from exports.
foreignsector_centralbank_rawcosts	FX costs of raw material imports
double fx_costs	Amount of FX costs due to raw material imports.
foreignsector_centralbank_cgoodscosts	FX costs of capital goods imports
double fx_costs	Amount of FX costs of capital goods imports.

1.13 Constants

Table 24: **List of constants.**

Name	Description
int resume_mode	Flag, 0 or 1. To re-start a simulation from a snapshot , it needs to be set to 1.
int print_debug_mode	Flag, 0 or 1. To record simulation process stages and selected states for debugging purposes, it needs to be set to 1.
int warning_mode	Flag, 0 or 1. To record unexpected states, this needs to be set to 1.
int data_collection_mode	Flag, 0 or 1. To record simulation data, it needs to be set to 1.
int collect_household_data	Flag, 0 or 1. To record household simulation data, it needs to be set to 1.
int collect_firm_data	Flag, 0 or 1. To record firm simulation data, it needs to be set to 1.
int n_exportfirms	Number of export firms
double exchange_rate_reference	Initial exchange rate
double ratio_liquidity	Ratio of liquidity to monthly disposable income.
double consumption_adjustment_speed	The consumption adjustment speed.
double wealth_effect	A rate of influence from housing market to regular economy. Used by Household agents.

Table 24 – continued from previous page

Name	Description
double firm_export_ratio	Ratio of regular goods exported by regular firms to foreign sector.
double export_growth_rate	Yearly growth rate of exports of regular consumption goods to foreign sector.
double turnover_probability	A probability of a uniform distribution that determines turnover rate.
double production_markup	Rate of increase in production by firms.
double price_markup	Rate of increase set by firms on prices.
double firm_memory_persistance	A parameter holding to what extend firms previous sale history play on final production decision.
double ratio_fiscal_policy	Ratio of tax vs benefits to balance government deficit.
double ratio_capitalist_households	It is the rate of households owning firm shares.
double inflation_target	It is used by central bank to compute monthly inflation.
double firms_minimum_equity_ratio	The paramter is used by funding agency to check equity requirement to invest in a firm.
double firm_startup_leverage	Firms' starting leverage'.
double household_startup_leverage	Households' starting leverage'.
double car_buffer_threshold	Allowable ratio of risky assets owned by bank for crediting.
double housing_market_entrance_prob	Entrance probability of an household agent. It determines the chance for an household to be active at housing market.
double fire_sale_threshold	The ratio of debt payments to income, which is inspected at a fire sale decision.
double household_budget_constraint	Budget constraint applied by banks for the mortgage applications.
double capital_adequecy_ratio	Allowable ratio of risky assets owned by bank for crediting.
double housing_price_up_rate	Allowable percentage increase in housing price.
double housing_price_down_rate	Allowable percentage decrease on a fire sale case by an household.
double household_mortgage_writeoff_high	Household budget threshold for mortgage write-off
double household_mortgage_writeoff_low	Household budget ratio for mortgage write-off
double export_price_change_rate	Rate of change allowed on export goods.

1.14 Datatypes

Table 25: **List of attributes for ADTs.**

Name	Description
transaction	A generic transaction data structure.
int quantity	Number of items within a period.
double avg_price	Average price on overall transactions.
buyer	Consumer data.
int id	Id of the household agent.
double budget	Consumption budget to go.
seller	Seller data.
int id	Id of the firm agent.
double price	Unit price of goods to be sold.

Table 25 – continued from previous page

Name	Description
int inventory	Number of items available for sale.
double inv_price	Inverse of price. It is used to decrease computation time at the mall.
vacancy	Firm vacancy information.
int id	Id of the firm agent.
double wage	Wage offered by the firm that holds the vacancy.
employee	Job applicant data.
int id	Id of the household agent.
double wage	Current wage of the job applicant.
mortgage	Household mortgage information.
int bank_id	Id of the bank from which mortgage is acquired.
double principal	Principal amount left
int quarters_left	Number of quarters left for the mortgage.
double quarterly_interest	Amount of interest to be paid within the current quarter.
double quarterly_principal	Amount of principal to be paid within the current quarter.
loan	Used by firm to hold loans they owe to each bank.
int bank_id	Id of the bank from which loan is acquired.
double amount	The amount requested so far.
double to_be_paid	The amount to be paid.
hbuyer	Buyer data at housing market.
int buyer_id	Household ID, the buyer.
int bank_id	Bank ID of the buyer. Used in case mortgage is needed.
double liquidity	Amount of liquidity an household have at the time to buy housing.
double quarterly_income	Quarterly net income, labour and capital, an household makes.
double quarterly_mortgage_paid	Quarterly mortgage payments being done by an household.
hseller	Seller data at housing market. Sent either by a constructor firm or an household.
int seller_id	Agent ID of the seller.
double price	Unit price of housing.
int quantity	Quantity of housing units to sell. Households are allowed to sell maximum of 1 unit.
int type	Seller Roles: 1 fire seller; 2 regular seller; 0 firm seller.
hbank	Mortgaging data regarding the banks at the housing market.
int id	Agent ID of the bank.
double equity	Equity owned by bank.
double risky_assets	Amount of risky assets owned by the bank.
double amount_mortgaged	Amount of mortgage given out by the bank.
xtransaction	Generic data type for foreign sector imports and exports

Continued on next page

Table 25 – continued from previous page

Name	Description
int id	Id of the import/export firm agent.
int amount	Amount of goods to be imported/exported.