ICEACE Reference Manual

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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 isconstructor	Identifies if the firm is a constractor firm or not.
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 day_of_week_to_act	Day of the week to act for consumption.
int_array employees	Holds employee ids
double wage_offer	Monthly wage offer.
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.
double labour_productivity	Productivity of a unit labour.
int production_current	Total number of goods produced in current month.
int production_estimate	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.
int day_of_month_production_ completed	The day of the month amount of production is computed.
double unit_house_price	Unit price of an house.
double labour_productivity_ construction	Productivity of a unit labour in construction sector.
double capital_productivity_ construction	Capital productivity in construction sector.
double capital_construction	Upper amount of constraction capital in housing.
int projects	Holds projects under construction. Indices denote number of months left for completion.
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.

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Name	Description
double revenue	Total revenue from sales. It is offset quarterly.
double costs	Total production and operation costs.
double equity	Firm equity.
double liquidity	Liquidity.
double capital_goods	Capital Goods.
int hasloan	The variable holds wheather a firm been credited by a bank for the loan that was requested.
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 delta_housing_price	Monthly change on average housing prices.

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

Name	Description
firm_init	Notifies its id.
idle	It is not the day of the week to sell.
firm_consumption_supply	A firm ships its goods to malls.
firm_consumption_recieve_sales	A firm recieves goods unsold and sales liquidity from the mall.
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.
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.

Table 2 – continued from previous page

Name	Description
firm_labour_pay_wages	Pay wages and update liquidity.
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.
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.
idle	It is not the start of a month.
firm_credit_check_interest_rate	Firm checks monthly interest rate.
idle	It is not the start of a quarter.
firm_credit_check_liquidity_need	Firm checks if it needs liquidity to pay loans and dividends.
idle	Firm does not need loans.
idle	Firm need loans.
idle	Firm is insolvent if it does not have a positive equity.
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.

Table 2 – continued from previous page

Name	Description
firm_credit_check_illiquidity	The firm checks its illiquidity state, checking the deal with Equity Fund.
firm_credit_exit_market	The firm checks its illiquidity state, checking the deal with Equity Fund.
firm_credit_distribute_net_profit	At the end of a quarter, a firm sends net profit to the equity fund.
firm_credit_pay_interest_on_loans	Each quarter firm sends out intterest on the loans it has.
firm_credit_do_balance_sheet	Updating the balance sheet.
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.
firm_housing_update_market_price	Firm checks housing prices.

1.2 household

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

Name	Description
int id	Agent ID.
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 consumption_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.
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.
double tax_rate	Rate of tax set by the government.
mortgage_array mortgages_list	List of mortgages debted by households.
int bank_id	The ID of the bank an household applies to a mortgage.

Table 3 – continued from previous page

Name	Description
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 dividends	Number of dividends an household owns.
double liquidity	Liquidity.
double fund_shares	Equity fund shares.
int previous_wages	Holds wages earned in three previous months.
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.

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

Name	Description
household_init	Notifies its id..
idle	It is not the first day of the month to compute monthly consumption.
household_consumption_monthly_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.

Table 4 – continued from previous page

Name	Description
household_labour_employment_application	Stage 02 of job market. Unemployed households apply.
household_labour_employment	A new employment.
household_labour_report_status	Sends out its employment status.
idle	Does nothing at the point when it is not last day of the month.
household_labour_recieve_wage	Recieves payment and update wage history.
idle	It is not the start of a quarter.
household_credit_check_tax_rate	Households check the tax rate which set by government.
household_credit_update_mortgage_rates	Households updates annuity, principal and interest payment amounts.
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_pay_capital_tax	Paying capital income tax.
household_credit_do_balance_sheet	Computing the balance sheet.
idle	It is not the start of the month.
household_credit_check_interest_rate	Households check the interest rate which is set by CB.
household_credit_collect_benefits	Collect general transfer benefits from the government.
household_credit_collect_unemployment	Collect unemployment transfer benefits from the government.
household_credit_pay_labour_tax	Paying labour income tax.
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.

Table 4 – continued from previous page

Name	Description
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.
double share_firms	Shares owned by regular firms.
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_dividends	Number of households to recieve liquid shares from firm net income.

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

Name	Description
equityfund_init	Notifies its id.
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_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.

Table 6 – continued from previous page

Name	Description
equityfund_credit_do_balance_sheet	Equity fund balance sheet accounting activities.

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.
double loans	loans to firms.
double mortgages	Mortgages to households.
double deposits	Deposits recieved from private sector.
double debt	Debt to central bank.
double equity	Firm equity.
double liquidity	Liquidity.

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

Name	Description
bank_init	Notifies its id.
idle	It is not the start of a quarter.
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 evaluates first loan requests.
bank_credit_recieve_new_entrant_loan_requests	Bank recieve request for new entrant requests.
bank_credit_collect_loan_interests	Bank evaluates first loan requests.
bank_credit_do_balance_sheet	Bank balance sheet accounting activities.
idle	It is not the first day of the month.
bank_housing_compute_capital_status	Bank computes its crediting status.
bank_housing_deliver_mortgages	Bank collects mortage requests from real estate agency.

Table 8 – continued from previous page

Name	Description
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.
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.

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

Name	Description
government_init	Notifies its id.
idle	It is not the start of a quarter.
government_update_fiscal_policy	Government sets tax rate, general benefits and unemployment benefits
government_collect_capital_tax	It is the start of the quarter.
government_do_balance_sheet	Government balance sheet accounting activities.
idle	It is not the start 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

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_week_to_act	Day of the week to act.
transaction goods	Weakly transaction summary at the market.
double unemployment_rate	Monthly rate
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.
transaction houses	Monthly transaction summary at the market.

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

Name	Description
centralbank_init	Notifies its id.
idle	It is not the day of the week to act.
centralbank_trace_goods_prices	It is the day of the week to act.
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_set_interest_rate	Central bank sets the interest rate.
centralbank_do_balance_sheet	Central Bank balance sheet accounting activities.
idle	It is not the day of the month to act.
centralbank_trace_housing_prices	It is the day of the month to act.

1.7   jpoffice

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

Name	Description
int id	Agent ID.
int day_of_month_to_act	The day of mont to perform job matching.

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

Name	Description
jpoffice_init	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.

1.8 mall

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

Name	Description
int id	Agent ID.
int day_of_week_to_act	Day of the week to act for consumption.
transaction goods_transactions	Weakly transaction summary at the market.

Table 16: **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.

1.9 reagency

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

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

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

Name	Description
reagency_init	Notifies its id.
idle	It is not the first day of the month.
reagency_housing_check_interest_rate	It is 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.

1.10 Messages

See Table 19.

Table 19: **List of messages.**

Name	Description
interest_rate	The interest rate sent by the central bank.
double rate	The rate.
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_left	Amount of liquid money that was not spent.
int recieved_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.

Table 19 – continued from previous page

Name	Description
int unsold_quantities	Number of unsold quantities.
goods_transactions_summary	Weakly sent out transaction summary.
int quantity	Number of goods sold out.
double avg_price	Weakly avg price.
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.
loan_request_1	The loan requested by a firm.
int firm_id	The firm.
int bank_id	The bank.
double amount	The amount.
loan_request_2	The loan requested by a firm.
int firm_id	The firm.
int bank_id	The bank.
double amount	The amount.
loan_acknowledge_1	The loan acknowledged by a firm.

Table 19 – continued from previous page

Name	Description
int bank_id	The bank.
int firm_id	The firm.
double amount	The amount.
loan_acknowledge_2	The loan acknowledged by a firm.
int bank_id	The bank.
int firm_id	The firm.
double amount	The amount.
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.
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 househols.
unemployment_benefit	Total unemployment benefit sent to households.
double amount	
general_benefit	general benefit sent to households.
double amount	
tax_rate	Flat tax rate both for wage and capital earnings.
double value	Rate of the tax.
fund_request	Amount of the liquidity requested from Equity Fund.
double value	
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.
double amount	The amount.
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	
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.

Table 19 – continued from previous page

Name	Description
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.
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.
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.
mortgaging_capacity	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.

Name	Description
int quantity	Number of housing units sold out.
double avg_price	Monthly avg price..

1.11 Constants

Table 20: **List of constants.**

Name	Description
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.
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 risky_assets_ratio	Percent of risky assets of banks to be compared to banks' equity.
double ratio_debt_firm	Ratio of debt to be paid by a firm.
double ratio_capitalist_households	It is the rate of households owning firm shares.
double housing_market_entrance_prob	Entrance probability to be in active for the hoisehold agents.
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 bank_risky_assets_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

1.12 Datatypes

Table 21: **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.

Table 21 – continued from previous page

Name	Description
int recieved_quantity	Number of items bought.
seller	Seller data.
int id	Id of the firm agent.
double price	Unit price of goods to be sold.
int inventory	Number of items available for sale.
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.
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.
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.