

ICEACE Reference Manual

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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 constructor firm or not. |
| int day_of_month_to_act | The day of the month to act at production and labour. |
| 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 construction capital in housing. |
| int projects | Holds projects under construction. Indices denote number of months left for completion. |
| double debt | Total debt of the firm. |
| int inventory | Unsold inventory from previous month. |
| int sales | Total number of sales within a month. |
| double revenue | Total revenue from sales. It is offset quarterly. |
| double costs | Total production and operation costs. |

Continued on next page

Table 1 – continued from previous page

| Name | Description |
|----------------------------|--|
| double equity | Firm equity. |
| double liquidity | Liquidity. |
| double capital_goods | Capital Goods. |
| double loans_interest_rate | Rate of interest paid by firms to banks for the loans. |

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. |
| 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 differentiate regular and constructor firms. |
| idle | Sets a producer role. |
| idle | Set the constructor role. |

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Table 2 – continued from previous page

| Name | Description |
|--|--|
| 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 end/start of a quarter. |
| firm_accounting_distribute_net_profit | At the end of a quarter, a firm sends net profit to the equity fund. |
| firm_accounting_do_balance_sheet | Updating the balance sheet. |
| idle | It is not the start of a quarter. |
| firm_credit_check_interest_rate | Firm checks quarterly interest rate. |
| idle | Firm stays idle 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. |
| firm_credit_borrow_loans_2 | Firm checks whether second loan request is accepted. |
| 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 | 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. |
| double mortgages_interest_rate | Rate of interest set by central bank. |
| mortgage_array mortgages_list | List of mortgages debted by households. |
| int isseller | The variable sets households market role. |
| double equity_ratio | Current equity ratio of an household |

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. |

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Table 4 – continued from previous page

| Name | Description |
|---|---|
| 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_recieve_wage | Recieves payment and update wage history. |
| idle | It is not the start of a new quarter. |
| idle | It is the start of a new quarter. |
| idle | The household does not own any shares of firms. |
| household_accounting_collect_shares | At the end of a quarter household recieves shares from the firms via Equity Fund. |
| household_accounting_do_balance_sheet | Computing the balance sheet. |
| idle | It is not the start of a quarter. |
| household_credit_check_interest_rate | Households check the interest rate which set by CB. |
| household_credit_update_mortgage_rates | Households updates annuity, principal and interest payment amounts. |
| 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. |
| household_housing_buy | Households enters 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. |
| household_housing_compute_equity_ratio | Household checks her equity ratio. |

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Table 4 – continued from previous page

| Name | Description |
|---------------------------------------|---|
| idle | Household does not have enough equity to buy. |
| household_housing_check_market | Household goes to the market. |
| household_housing_bargain | 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. |

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 receive 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 end/start of a quarter. |
| equityfund_accounting_collect_firm_shares | At the end of a quarter collect net income from the firms in the market. |
| equityfund_accounting_distribute_shares | At the end of a quarter net income per household is distributed. |
| equityfund_accounting_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 end/start of a quarter. |
| bank_accounting_do_balance_sheet | Bank balance sheet accounting activities. |
| 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. |
| 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 mortgage requests from real estate agency. |
| bank_housing_recieve_fire_sale_payments | Bank collects mortgage debt payments from households. |

1.5 government

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

| Name | Description |
|--------|-------------|
| int id | Agent ID. |

Continued on next page

Table 9 – continued from previous page

| Name | Description |
|------------------|-----------------------|
| double debt | Debt to central bank. |
| double equity | Government equity. |
| double liquidity | Government liquidity. |

Table 10: List of functions for government agent.

| Name | Description |
|--|---|
| government_init | Notifies its id. |
| idle | It is not the end/start of a quarter. |
| government_accounting_do_balance_sheet | Government balance sheet accounting activities. |

1.6 centralbank

Table 11: List of memory variables for centralbank agent.

| Name | Description |
|-----------------------------|---------------------------------------|
| int id | Agent ID. |
| 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 interest_rate | Rate of interest set by central bank. |

Table 12: List of functions for centralbank agent.

| Name | Description |
|------------------|---------------------------------------|
| centralbank_init | Notifies its id. |
| idle | It is not the end/start of a quarter. |

Continued on next page

Table 12 – continued from previous page

| Name | Description |
|---|---|
| centralbank_accounting_do_balance_sheet | Central Bank balance sheet accounting activities. |
| idle | It is not the start of a quarter. |
| centralbank_credit_set_interest_rate | Central bank sets the interest rate. |

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 month 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. |

Table 16: List of functions for mall agent.

| Name | Description |
|-----------|------------------|
| mall_init | Notifies its id. |

Continued on next page

Table 16 – continued from previous page

| Name | Description |
|---------------------------|---|
| idle | It is not the day of the week to shop. |
| mall_consumption_shopping | Mall collecting supplies from the firms, demands from the households. |

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. |

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_process | The agent collects requests and does the matchings. |

1.10 Messages

See Table 19.

Table 19: List of messages.

| Name | Description |
|-----------------------|--|
| 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. |

Continued on next page

Table 19 – continued from previous page

| Name | Description |
|------------------------|---|
| int id | Firm agent ID. |
| int unsold_quantities | Number of unsold quantities. |
| 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 notify joffice |
| 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 agent 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. |
| firm_net_profit | Net income sent 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. |
| interest_rate | The interest rate sent by central bank. |
| double rate | The rate. |
| 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. |

Continued on next page

Table 19 – continued from previous page

| Name | Description |
|--------------------------------|--|
| int firm_id | The firm. |
| int bank_id | The bank. |
| double amount | The amount. |
| loan_acknowledge_1 | The loan acknowledged by a firm. |
| 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. |
| 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 of 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. |
| sold_housing | Sent either by a constructor firm or an household. |
| int seller_id | Agent ID of the seller. |
| int quantity_sold | Quantity of housing units that has been sold. |
| 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 mortgage_given | Amount of mortgage given out by the bank. |

Continued on next page

Table 19 – continued from previous page

| Name | Description |
|----------------------------|---|
| mortgage_payment_fire_sale | Amount of 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. |

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. |
| double turnover_probability | Used by Household agents. 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_persistence | A parameter holding to what extent firms previous sale history play on final production decision. |
| 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 risky_assets_ratio | Percent of risky assets of banks to be compared to banks' equity. |
| double minimum_equity_ratio | Minimum equity ratio required for a household to apply for mortgage. |
| 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. |

1.12 Datatypes

Table 21: List of attributes for ADTs.

| Name | Description |
|-----------------------|---------------------------------|
| buyer | Consumer data. |
| int id | Id of the household agent. |
| double budget | Consumption budget to go. |
| 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. |

Continued on next page

Table 21 – continued from previous page

| Name | Description |
|----------------------------|--|
| 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 the current quarter. |
| double quarterly_principal | Amount of principal to be repaid within the current quarter. |