

# A Macroeconomic Agent-Based Model

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## 1 Introduction

In this paper, I replicate ([lengnick?](#))’s macroeconomic agent-based model in Python with the Mesa library. The original model is written in Java not open-source.

why abm

why lengnick

- baseline

contributions

- java
- open-source
- baseline
- clarify the model
- dashboard functionality

The paper is structured as follows. In Section 2, I will first review the key components in the ([lengnick?](#)) MABM. In **?@sec-implment**, I discuss issues I encountered when implementing the model, including ambiguities in ([lengick?](#)) and assumptions I have to make in response. **?@sec-output** compares the output of my model to the original model. **?@sec-discuss** discusses further issues with the model.

## 2 Model

The ([lengick?](#)) MABM consists of two agent types—households and firms—interacting in two markets—that for consumer goods and labor. The model is best described from (i) how it is initialized and (ii) what a full step comprises.

### 2.1 Initialization

Each step represents a day. One month (denoted as  $t$ ) elapses after every 21 days.

$H$  **singleton** households (indexed  $h$ ) are first initialized,<sup>1</sup> and then  $F$  firms (indexed  $f$ ). Each household forms a network of  $n$  firms, from which the household will buy consumption goods when the model runs. Here I should note that all households and firms are permanent; there is no births or deaths for households, or entries or exits for firms.

Each household has a (monthly) reservation wage  $w_{ht}$  that changes with time. This refers to the wage that households must be offered to take a job. For clarity, it is **not** an amount that households receive for being unemployed. The reservation wage is initially  $w_{h0}$ .

Households are endowed with money  $m_{ht}|_{t=0} = m_{h0}$ . Each firm initially sets per-good price  $m_{f0}$ . and monthly wage  $w_{f0}$ .

## 2.2 One full step

At the start of each month (i.e., on day  $s$  where  $s \% 21 = 1$ ), the following actions are taken:

- If firms had a vacancy in the previous month, it adjusts wages upwards. Conversely, if it has had **no** vacancies for the previous six months. The adjustment is:

$$w_{ft} = w_{f,t-1}(1 \pm \mu)$$

$$\mu \sim U_{0,\delta}.$$

Table 1: Known parameters.

Parameter	Description	Value
$H$	Number of households.	1000
$F$	Number of firms.	$H/10$
$n$	Number of firms that household maintains in sellers network.	7
$\delta$	Upper-bound of wage adjustment.	0.019

Table: Unknown parameters. {#tbl-unknown} | Parameter | Description | Value | |:———  
|:———|———| |  $w_{h0}$  | Initial reservation wage (monthly).  
| NA |

## 3 Implementation Issues

- $w_h, m_{h0}, m_{f0}, w_{f0}$  is never defined.
- Some steps are skipped in the first instance.

<sup>1</sup>All households are singleton. They are called households throughout ([lengnick?](#)). I adopt the same language.