# Overview

on considere une economie constituee de:

- 02 secteurs: rural et urbain

- 02 secteurs urbains: formel et informel

- 02 secteurs informels: avance et retarde

les formes de dualismes considerees sont:

- le dualisme geographique (urbain/rural)

- le dualisme technologique (avancee/retarde)

- le dualisme du marche du travail (formel/informel)

On a donc 04 secteurs $k$ dans lequel sont regroupes les entreprises:

- un secteur rural ($k = 1$)

- un secteur urbain formel ($k = 2$)

- un secteur urbain informel avancee ($k = 3$)

- un secteur urbain informel retardee ($k = 4$)

| | Secteur 1 | Secteur 2 | Secteur 3 | Secteur 4 |

| --- | --- | --- | --- | --- |

| Region | Rural | Urbain | Urbain | Urbain |

| Type de travail | Informel | Formel | Informel | Informel |

| Acces au credit | Non | Oui | Oui | Non |

| Biens produits | Agricoles | Manufacturees | Manufacturees | Intermediaires |

| Technologie | Retardee | Avancee | Avancee | Retardee |

On a egalement 06 categories $z$ de menages:

| Categorie | Secteur | Statut | Description |

|:-:| --- | --- | --- |

| 1 | rural | entrepreneur | paysans |

| 2 | urbain formel | entrepreneur | entrepreneurs formels |

| 3 | urbain informel | entrepreneur | entrepreneurs informels |

| 4 | urbain formel | salaries | salaries formels |

| 5 | urbain informel | salaries | salaries informels |

| 6 | urbain | \*aucun\* | chomeurs |

Une approche en termes d'informalite base sur le concept de degre d'informalite.

On regroupe des les normes qui sont les regles formelles que doivent resspecter une entreprise dans un cadre institutionnel donne. Distinguons alors deux normes:

- les normes du travail (regles formelles regissant la relation salariale)

- les normes de credit (regles formelles regissant l'acces au credit bancaire)

on peut alors segmenter le marche du travail en deux segments:

- le marche du travail formel (ou les participants respectent les normes du travail)

- le marche du travail informel (ou les participants respectent les normes du travail)

on peut egalement segmenter le marche du credit en deux segments:

- le marche du credit formel (ou les participants respectent les normes du credit)

- le marche du credit informel (ou les participants respectent les normes du credit)

les niveaux d'informalite sont alors:

| Niveaux | Respect des normes |

|---| ---|

|Informel (0)| Ne respecte aucune norme|

|Semi-formel (1)| Ne respecte qu'un groupe de normes |

|Formel (2) | Respecte toutes les normes |

si l'on note:

- $n$ le degre d'informalite

- $n^N$ le respect des normes du travail

- $n^L$ le respect des normes du credit

on a:

$$

n = n^N + n^L

$$

Pour l'emploi on peut donc definir une structure de l'emploi comme un repartition des emploi entre le secteur prive et public et le segment formel et informel du marche du travail:

| |Travail Formel|Travail Informel| $\Sigma$ |

|--- | :-: | :-: | :-: |

| Secteur Prive | $N\_{F1}$ | $N\_{F2}$ | $N\_{F}$ |

| Secteur Public | $N\_{G}$ | | $N\_{G}$ |

| $\Sigma$ | $N\_1$ | $N\_2$ | $N$ |

Pour l'informalite on peut egalement definir une repartition des firmes dans un secteur $k$ comme suit:

| |Travail Formel|Travail Informel| $\Sigma$ |

|--- | :-: | :-: | :-: |

|Credit Formel | $Z\_{Fk11}$ | $Z\_{Fk12}$ | $Z\_{Fk1.}$ |

|Credit Informel | $Z\_{Fk21}$ | $Z\_{Fk22}$ | $Z\_{Fk2.}$ |

| $\Sigma$ | $Z\_{Fk.1}$ | $Z\_{Fk.2}$ | $Z\_{Fk}$ |

## Purpose and Patterns

## Entities, State Variables, and Scales

## Process overview and scheduling

# Design Concepts

## Basic Principles

## Emergence

## Adaptation

## Objectives

## Learning

## Prediction

## Sensing

## Interaction

## Stochasticity

## Collectives

## Observation

# Details

## Initialization

we adopted the six-step strategy proposed by Caiani et al. [1]. This strategy involves:

1. creating an aggregate version of the agent-based model
2. constraining it to a real stationary state (SS) associated with a nominal steady growth of prices and wages 
3. numerically solving the constrained model with reasonable values of parameters to obtain initial values of stocks, flows and prices
4. distributing these initial values uniformly across agents created within each sector
5. determining the original amount, outstanding values, age of durable stocks
6. setting the initial network configuration by assigning randomly contractors or suppliers to agents

presenter les matrices de stocks et flux a obtenir

Ce modele s’inspire du modele GROWTH de Godley et Lavoie [2]. Dans ce modele on considere qu’il n’ya pas d’inventaires ou de capital fixe.

Table . Balance sheet of Dual Monetary Economy

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Households | Firms | Banks | Government | Central bank |  |
| HP Money |  |  |  |  |  |  |
| Cash Advances |  |  |  |  |  |  |
| Deposits |  |  |  |  |  |  |
| Bonds |  |  |  |  |  |  |
| Loans |  |  |  |  |  |  |
| Equities |  |  |  |  |  |  |
| Balance |  |  |  |  |  |  |
|  |  |  |  |  |  |  |

On suppose qu’il n’y a pas de changement dans la valeur des fonds propres (on suppose que les marches financiers sont inexistants)

Table 2. Transactions matrix of Dual Monetary Economy

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Households | Firms | Banks | Government | C. bank |  |
| Consumption |  |  |  |  |  |  |
| Wages |  |  |  |  |  |  |
| Transfers |  |  |  |  |  |  |
| Taxes |  |  |  |  |  |  |
| Interests on advances |  |  |  |  |  |  |
| Interests on bonds |  |  |  |  |  |  |
| Interests on loans |  |  |  |  |  |  |
| Interests on deposits |  |  |  |  |  |  |
| Entrepreneurial profits |  |  |  |  |  |  |
| Central Bank profits |  |  |  |  |  |  |
| Change in advances |  |  |  |  |  |  |
| Change in bonds |  |  |  |  |  |  |
| Change in HP Money |  |  |  |  |  |  |
| Change in loans |  |  |  |  |  |  |
| Change in deposits |  |  |  |  |  |  |
| Change in equities |  |  |  |  |  |  |
| Loan defaults |  |  |  |  |  |  |
|  |  |  |  |  |  |  |

### Computation of initial stocks, flows and prices

We divided the SS system of equations of the aggregated model in four sub-systems or block. Description de la methode de resolution

#### Firms stationary state equations

The first block contains the equations which refer to firms.

mesurer la mise en oeuvre d’une politique public a travers le concept d’intensite de l’instrument

let x be the variation and y the rate, such that:





For example, let’s consider  a deposit, we can write:





For each category of firms :













for firms of modern sector















for firms of rural or urban traditional sectors :











#### Banks stationary state equations

the third refers to banks and the public sector (government and central bank).





















#### Households stationary state equations

the second presents the set of equations related to households and rural households















urban households:



















With bank equities computed we can now calculate hosueholds equities:





#### Public sector stationary state equations

the third refers to banks and the public sector (government and central bank).

















### Creation of agents, networks and environment

presentation des agents, de la méthode de creation des networks, du placement des agents dans l’environment.

## Input Data

parametres

|  |  |  |
| --- | --- | --- |
| **Symbol** | **Code** | **Description** |
|  | g\_ss | Grow rate of prices and wages in stationary state |
|  | N\_E1 | Number of entrepreneurs in sector 1 |
|  | N\_E2 | Number of entrepreneurs in sector 2 |
|  | N\_E3 | Number of entrepreneurs in sector 3 |
|  | N\_W1 | Number of employees in sector 1 |
|  | N\_W2 | Number of employees in sector 2 |
|  | N\_W3 | Number of employees in sector 3 |
|  | N\_WG | Number of employees in public sector |
|  | N\_U | Number of unemployed |
|  | phi1 | Productivity in sector 1 |
|  | phi2 | Productivity in sector 2 |
|  | phi3 | Productivity in sector 3 |
|  | w1 | Initial wage in sector 1 |
|  | w2 | Initial wage in sector 2 |
|  | w3 | Initial wage in sector 3 |
|  | w\_G | Initial wage in public sector |
|  | w\_min | Minimum wage |
|  | tau | Tax rate |
|  | rho | Dividend policy |
|  | m | Markup rate |
|  | alpha\_b1 | Propension to consume goods 1 in urban region |
|  | alpha\_a2 | Propension to consume goods 2 in rural region |
|  | theta\_W | Desired liquidity share of wage bill |
|  | theta\_E | Initial equity share of banks assets |
|  | theta\_M | Initial bank liquidity ratio |
|  | theta\_Zbar | Reglementary portion of minimum wage dedicated to dole |
|  | r\_D | Interest rate on deposits |
|  | r\_L | Interest rate on loans |
|  | r\_B | Interest rate on bonds |
|  | r\_A | Interest rate on cash advances |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

## Submodels

**References**