

Deliverable reference number and Title
D5.3: Software module of the agent based models of
goods,labour and credit markets

Simon Coakley
Mariam Kiran

August 19, 2008

Abstract

This report presents the deliverable D5.3 accounting for the software descriptions of the models for the markets - goods and labour and credit markets. This deliverable acts as part of the work package 5 which comprises of agent based computational models of goods, labour and credit markets required for the project EURACE.

Contents

1	Executive Summary	iv
2	Introduction	v
2.1	Report Structure	v
3	Labour Market Implementation	vi
4	Credit Market Implementation	vii
4.1	Description of the Credit Market	vii
4.2	Implementation Details	vii
4.2.1	Agents	vii
4.2.2	State dependency diagram	vii
4.3	Results	viii
A	XMML Schema	xi
A.1	Labour market	xi
A.2	Credit market	xi
A.2.1	Firm Agent	xi
A.2.2	Bank Agent	xii
A.2.3	Messages being Used	xv

List of Figures

4.1 State Dependency Diagram.	ix
---------------------------------------	----

List of Tables

Chapter 1

Executive Summary

Chapter 2

Introduction

2.1 Report Structure

Chapter 3

Labour Market Implementation

Chapter 4

Credit Market Implementation

4.1 Description of the Credit Market

This model was adapted from the proposed model of the credit market by the Ancona Unit [?]. Here we present a description of how the model was implemented.

4.2 Implementation Details

The credit market involves the interaction of the credit function with the financial management functions of the Firm Agent.

4.2.1 Agents

The agents involved in the implementation are listed below:

- Bank Agent - reads loans requests and approves loans.
- Firm Agent - requests for loans if needed.
- Dummy Agent - to handle message of orders and household functions.

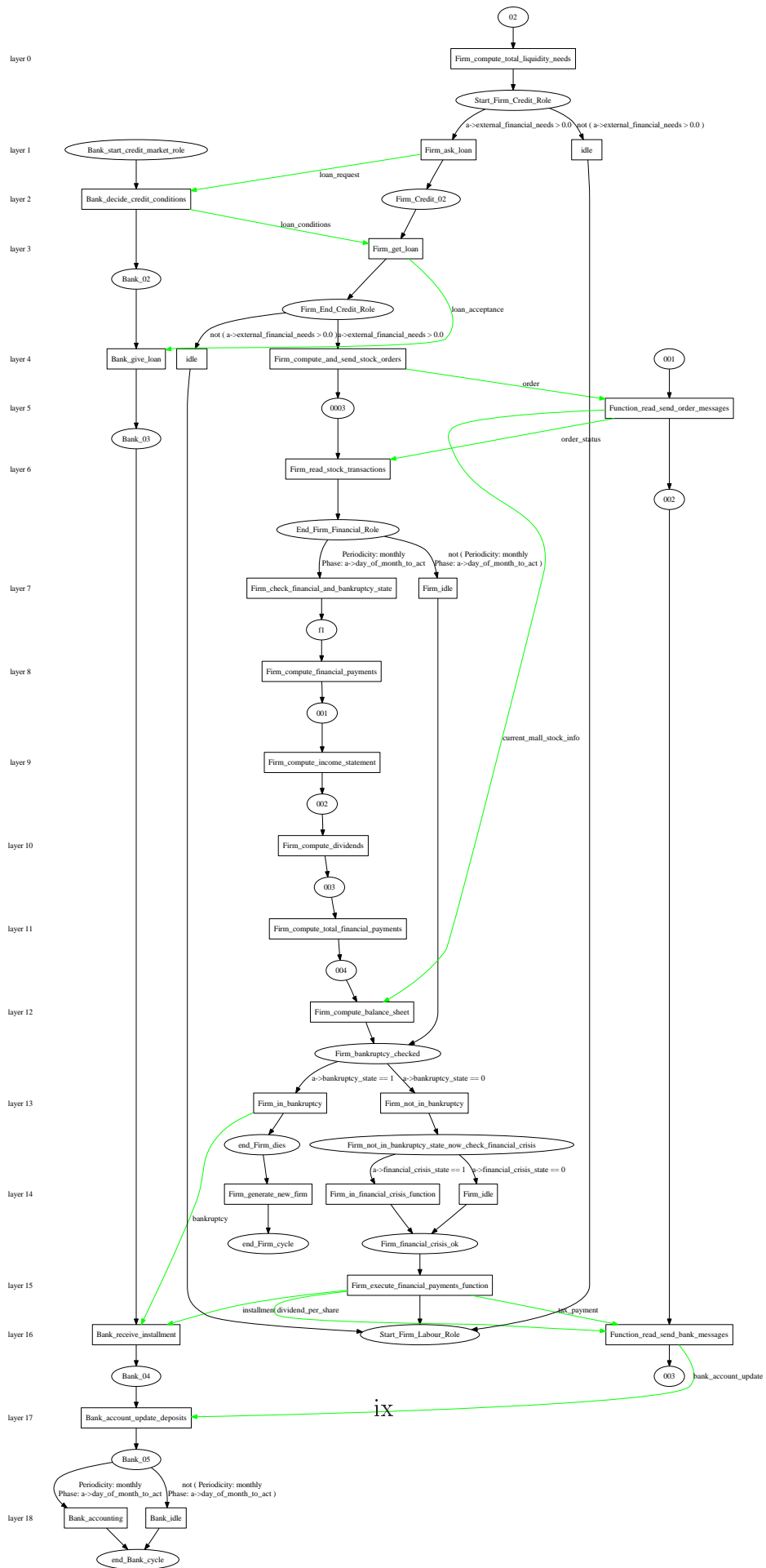
4.2.2 State dependency diagram

The state dependency diagram 4.1 shows the flow of activity in the model. The details of the functions of the agents can be found in the report presented by the Ancona Unit [?].

The xmml file for the credit market can be found in the Chapter A.

4.3 Results

Graphs



Bibliography

Appendix A

XMML Schema

A.1 Labour market

A.2 Credit market

A.2.1 Firm Agent

Abstract from memory:

```
<memory>
<variable><type>int</type><name>dmarketmatrix[10]</name>
<description></description></variable>
<variable><type>residual_var_datatype</type><name>residual_var[10]</name>
<description></description></variable>
</memory>
```

Function Descriptions:

```
<function>
<name>Firm_ask_loan</name>
<description></description>
<currentState>Start_Firm_Credit_Role</currentState>
<nextState>Firm_Credit_02</nextState>
<condition><lhs><value>a.external_financial_needs</value></lhs><op>GT</op>
<rhs><value>0.0</value></rhs></condition>
<outputs>
<output><messageName>loan_request</messageName></output>
</outputs>
```

```

</function>

<function>
<name>Firm_get_loan</name>
<description></description>
<currentState>Firm_Credit_02</currentState>
<nextState>Firm_End_Credit_Role</nextState>

<inputs>
<input> <messageName>loan_conditions</messageName>
<filter>
  <lhs><value>a.id</value></lhs>
  <op>EQ</op>
  <rhs><value>m.firm_id</value></rhs>
</filter>
</input> </inputs>
<outputs>
<output><messageName>loan_acceptance</messageName></output>
</outputs>
</function>

```

A.2.2 Bank Agent

Memory of the Agent:

```

<variable><type>double</type><name>cash</name><description></description></variable>
<variable><type>double</type><name>total_credit</name><description></description></variable>
<variable><type>double</type><name>equity</name><description></description></variable>
<variable><type>double</type><name>bce_debt</name><description></description></variable>
<variable><type>double</type><name>alfa</name><description></description></variable>
<variable><type>double</type><name>value_at_risk</name><description></description></variable>
<variable><type>double</type><name>min_interest</name><description></description></variable>
<variable><type>double</type><name>bank_gamma[2]</name><description></description></variable>
<variable><type>double</type><name>profits[2]</name><description></description></variable>
<variable><type>double</type><name>bank_lambda</name><description></description></variable>
<variable><type>double</type><name>bce_interest</name><description></description></variable>
<variable><type>double</type><name>bank_dividend_rate</name><description></description></variable>
<variable><type>double</type><name>tax_rate_corporate</name><description></description></variable>
<variable><type>int</type><name>number_of_shares</name><description></description></variable>
<variable><type>double</type><name>debt_period</name><description></description></variable>
<variable><type>int</type><name>loan_request_message_found</name><description></description></variable>
<variable><type>int</type><name>day_of_month_to_act</name><description>Day

```

of the month to act for bank accounting
function</description></variable>

Bank functions:

```
<function>
<name>Bank_decide_credit_conditions</name>
<description></description>
<currentState>Bank_start_credit_market_role</currentState>
<nextState>Bank_02</nextState> <inputs>
<input><messageName>loan_request</messageName> <filter>
  <lhs><value>a.id</value></lhs>
  <op>EQ</op>
  <rhs><value>m.bank_id</value></rhs>
</filter>
</input> </inputs>
<outputs>
<output><messageName>loan_conditions</messageName></output>
</outputs> </function>
```

```
<function>
<name>Bank_give_loan</name>
  <description></description>
<currentState>Bank_02</currentState> <nextState>Bank_03</nextState>
<inputs> <input> <messageName>loan_acceptance</messageName> <filter>
  <lhs><value>a.id</value></lhs>
  <op>EQ</op>
  <rhs><value>m.bank_id</value></rhs>
</filter> </input>
</inputs>
</function>
```

```
<function>
<name>Bank_receive_installment</name>
<description></description>
<currentState>Bank_03</currentState>
<nextState>Bank_04</nextState> <inputs> <input>
<messageName>installment</messageName> <filter>
  <lhs><value>a.id</value></lhs>
  <op>EQ</op>
```

```

    <rhs><value>m.bank_id</value></rhs>
</filter> </input> <input> <messageName>bankruptcy</messageName>
<filter>
    <lhs><value>a.id</value></lhs>
    <op>EQ</op>
    <rhs><value>m.bank_id</value></rhs>
</filter>
</input>
</inputs>
</function>

```

```

<function>
    <name>Bank_account_update_deposits</name>
<description></description>
<currentState>Bank_04</currentState>
<nextState>Bank_05</nextState>
    <inputs>
    <input>
<messageName>bank_account_update</messageName> <filter>
    <lhs><value>a.id</value></lhs>
    <op>EQ</op>
    <rhs><value>m.bank_id</value></rhs>
</filter>
</input>
    </inputs> <!--<outputs>
<output><messageName>central_bank_account_update</messageName></output>
</outputs>-->
</function>

```

```

<function>
<name>Bank_accounting</name>
<description></description>
<currentState>Bank_05</currentState>
<nextState>end_Bank_cycle</nextState> <condition>
    <time>
        <period>monthly</period>
        <phase>a.day_of_month_to_act</phase>
    </time>
</condition>
</function>

```



```

<function>
<name>Bank_idle</name>
<description></description>
<currentState>Bank_05</currentState>
<nextState>end_Bank_cycle</nextState> <condition>
    <not>
    <time>
    <period>monthly</period>
    <phase>a.day_of_month_to_act</phase>
    </time>
    </not>
</condition>
</function>

```

A.2.3 Messages being Used

```

<message>
<name>loan_request</name>

<description>Message added by firm to demand credit with bank_id,
with financial info of applying firm.</description>
<variables>
<variable><type>int</type><name>firm_id</name><description></description></variable>
<variable><type>int</type><name>bank_id</name><description></description></variable>
<variable><type>double</type><name>equity</name><description></description></variable>
<variable><type>double</type><name>total_debt</name><description></description></variable>
<variable><type>double</type><name>external_financial_needs</name><description></description></variable>
</variables>
</message>

<message>
<name>loan_conditions</name>
<description> Message added
by bank to offer credit; contains the interest rate, the amount of
offered credit, and the value_at_risk.</description>
<variables>
<variable><type>int</type><name>firm_id</name><description></description></variable>
<variable><type>int</type><name>bank_id</name><description></description></variable>
<variable><type>double</type><name>proposed_interest_rate</name><description></description></variable>
<variable><type>double</type><name>amount_offered_credit</name><description></description></variable>

```

```

<variable><type>double</type><name>value_at_risk</name><description></description></variable>
</variables>
</message>

```

```

<message>
<name>loan_acceptance</name>
<description>Message added by
firm to accept a loan with bank_id, for the amount credit_taken and
VAR. The bank does not need to know the firm_id.</description>
<variables>
<variable><type>int</type><name>bank_id</name><description></description></variable>
<variable><type>double</type><name>credit_amount_taken</name><description></description></variable>
<variable><type>double</type><name>loan_total_var</name><description></description></variable>
</variables>
</message>

```

```

<message>
<name>installment</name>
<description>Message added by
firm pays installment and interest to the bank.</description>
<variables>
<variable><type>int</type><name>bank_id</name><description></description></variable>
<variable><type>double</type><name>installment_amount</name><description>installment_amount
is 0 in case of bankruptcy, positive in case of
No_bankruptcy</description></variable>
<variable><type>double</type><name>interest_amount</name><description></description></variable>
<variable><type>double</type><name>var_per_installment</name><description></description></variable>
</variables>
</message>

```

```

<message>
<name>bankruptcy</name>
<description>Message added by firm
to bank to signal bankruptcy.</description> <variables>
<variable><type>int</type><name>bank_id</name><description></description></variable>
<variable><type>double</type><name>bad_debt</name><description></description></variable>
<variable><type>double</type><name>credit_refunded</name><description></description></variable>
<variable><type>double</type><name>residual_var</name><description></description></variable>
</variables>
</message>

```

```

<message>
<name>BCE_return</name>

```

```
<description></description>
<variables>
<variable><type>int</type><name>bce_debt</name><description></description></variable>
<variable><type>int</type><name>id</name><description></description></variable>
</variables>
</message>
```