**Modelling small open developing economies in a financialized world – Adaptation for Colombian economy.**

1. *Variation of expected sales*

1. *Aggregate demand*

1. *Inventories and real investment in inventories*
2. *Desired inventories*
3. *Desired investment in inventories*
4. *Production*
5. *Domestic production*
6. *Capital output ratio*
7. *Imports in real terms*
8. *Variation of import propensity*
9. *Targeted import propensity*
10. *Real exchange rate*
11. *Exports equation*

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1. *Autonomous exports growth rate.*
2. *Variation of exports propensity*
3. *Targeted exports propensity*
4. *Desired price level*
5. *Evolving markup*
6. *Variation of historical unit cost*
7. *Unit cost*
8. *Realized real investment.*
9. *Desired real investment.*
10. *Gross expected profits for firms*

1. *Net expected profits*
2. *Expected return per unit of capital*
3. *Total financing needs*
4. *Variation of desired level of loans in foreign exchange*

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1. *Variation of firms’ loans in foreign exchange*
2. *Variation of firms’ loans in domestic currency*
3. Target variation of firms’ debt currency allocation
4. Target fraction of firms’ debt in foreign currency

1. Arbitrage
2. *Variation of firms’ deposits in foreign exchange*
3. *Gross profits of firms*
4. *Net profits of firms*
5. *Return rate on capital*
6. *Firms’ dividends*

1. *Firms Dividends distributed to the rest of the world.*
2. *Firms Dividends distributed to the households.*
3. *Labour*
4. *Variation of output to labour ratio*
5. *Households net labour income*
6. *Households financial income.*
7. *Target desired consumption.*
8. *Marginal propensities to consume out of labour income*
9. *Marginal propensities to consume out of financial income*
10. *Marginal propensities to consume out of wealth*
11. *Desired consumption variation.*
12. *Effective consumption.*
13. *Desired demand for consumption credit.*
14. *Sensitivity parameter.*
15. *Burden of the Households (where rep is the average repayment ratio)*
16. *Effective demand of consumption credit (where is a credit rationing parameter determined by the financial system)*
17. *Households savings.*
18. *Fiscal revenue (where are royalties)*

1. *Tax revenue*
2. *Import taxes.*
3. *Royalties.*
4. *New government deposits.*
5. *Total government spending.*
6. *Operating expenses.*
7. *Transfers from the government to the households.*
8. *Target public investment (we are studying how to incorporate the supply side effects).*
9. *Public investment adjustment equation.*
10. *Public deficit.*
11. *Bond interest rate*
12. *Government bonds purchased by the banks.*
13. *Desired variation of bonds purchase by banks*
14. *Fraction of government bonds that banks desired to purchase*
15. *Banks demand for cross border lending*
16. *Desired cross-border credit supply to banks*
17. *Leverage*
18. *Funds owned by banks*
19. *Cross border lending rate*

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1. *Cross border lending demanded*
2. *Target domestic currency lending cost*
3. *Variation of premium*
4. *Target premium*
5. *Consumption credit supply.*
6. *Consumption credit demand and supply equality.*
7. *Credit rationing parameter.*
8. *Interest rate on households’ loans (where is a mark – up over interest rate charged to the firms)*
9. *Required regulatory change in Banks foreign reserves*
10. *Variation of central bank loans in foreign currency*
11. *Domestic reserves*
12. *Total financial needs in domestic currency*
13. *Central bank advances*
14. *own funds needed to respect the regulation*
15. *Retained earnings for banks*
16. *Variation of banks own funds*
17. *Gross profits of banks*
18. *Interest rate on household deposits*
19. *Target cost of loans in domestic currency*
20. *Domestic average in funding cost*
21. *Variation in the cost of loans in domestic currency*
22. *Net profits of banks*
23. *Banks dividends*
24. *Bank dividends distributed to the rest of the world.*
25. *Bank dividends distributed to the households.*

1. *Monetary policy interest rate (Taylor rule)*
2. *Variation of currency regulation*
3. Central bank profits
4. *Foreign financial flows entering the domestic economy*
5. *World financial flows*
6. *Share of total global funds entering the domestic economy*

1. *Expected foreign return*
2. *Expected domestic return*
3. *Country risk*
4. *Net International Investment Position (NIIP)*
5. *Total FDI distribution (where is greenfield FDI and is non – greenfield FDI)*
6. *Total FDI growth.*
7. *FDI growth rate.*
8. *Expected FDI implicit profitability.*
9. *Greenfield FDI.*
10. *Ratio of Greenfield FDI to total FDI.*
11. *Non – greenfield FDI.*
12. *Dynamic behaviour of the allocation of non – greenfield FDI between firms and banks.*
13. *Private equity accumulation by the rest of the world.*
14. *Accumulation of equities issued by the firms.*

1. *Accumulation of equities issued by the banks.*
2. *FX demand.*
3. *FX supply.*
4. Uncovered interest parity condition
5. Expected variation of the nominal exchange rate
6. *Income account*
7. *Remittances recived from abroad*
8. *Balance of payments constrains*
9. Variation in government bonds purchase by the rest of the word

**Consistency.**

We start with the identity of the Central Bank balance sheet in its flow form:

We replace the definition of required change in bank reserves:

We incorporate the Total Financial Needs of the banks:

Simplifying we get to:

We add the loans in foreign currency to both sides of the equation (multiplied by the nominal exchange rate):

We subtract the variation of the firms FX deposits (multiplied by the nominal exchange rate):

We add to both sides the foreign direct investment that received by the firms, knowing that :

Now we replace the firms savings knowing that :

The banks savings are equal to the retained earnings , therefore:

Knowing that , we get to:

We incorparate

Replacing the Balance of Payments Identity:

We simplify knowing that

Taking the current account definition, we get to:

Finally, taking into account the relationship between the government savings and the debt accumulation given by , we get to:

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|  | Industry | | Households | Banks | | Central Bank | | Government | RoW | ∑ |
| Current | Capital |  | Current | Capital | Current | Capital |
| Consumption  Realized Investment  Government Spending  Imports  Exports  ***[GDP]*** |  |  |  |  |  |  |  |  |  | 0  0  0  0  0 |
| Wages  Taxes on Imports  Taxes on Exports  ***[Gross Operating Surplus]*** |  |  |  |  |  |  |  |  |  | 0  0  0 |
| Interest on Deposits  Interest on Firms Loans  Interest on Households Loans  Interest on Firms FX Loans  Interest on Banks FX Loans  Interest on Bonds  Interest on Advances  Firms Dividends  Banks Dividends  ***[Gross National Income]*** |  |  |  |  |  |  |  |  |  | 0  0  0  0  0  0  0  0  0 |
| Remittances  Central Bank Profits  Taxes on Income and Profits  Welfare Spending  Savings |  |  |  |  |  | 0 | 0 |  |  | 0  0  0  0  0 |
| [Capital]  [Inventories] |  |  |  |  |  |  |  |  |  |  |
| Deposits  Reserves  Firms Loans  Households Loans  Bonds  Advances  FX deposits  FX Reserves  Firms FX Loans  Banks FX Loans  Firms Equities  Banks Equities |  |  |  |  |  |  |  |  |  | 0  0  0  0  0  0  0  0  0  0  0  0 |
| ∑ | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |  |

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| **Initial Values** | | | |
| Expected Sales |  | Government Bonds Owned by the RoW |  |
| Inventories |  | Greenfield Foreign Direct Investment |  |
| Capital Stock |  | Portfolio Foreign Direct Investment |  |
| Households Deposits | 30 | Firms Equities Owned by the RoW |  |
| Firms Indebtness (Domestic Currency) | 40 | Banks Equities Owned by the RoW |  |
| Liquidity Advances | 70 | Equities Owned by the RoW |  |
| Banks Reserves | 3 | Households Indebtness |  |
| Government Debt |  |  |  |
| Government Debt Owned by the Households |  | Desired Consumption |  |
| Historical Unitary Cost |  | Government Deposits |  |
| Banks Own Funds |  | Public Investment |  |
| Armington Propensity to Import – Exports |  | Nominal wages |  |
| Armington Propensity to Import – Investment |  | Government Bonds Owned by the Banks | 75 |
| Armington Propensity to Import – Consumption | 0.250535535322 |  |  |
| Armington Propensity to Import – Public Spending | 0.1175548075 |  |  |
| Exports Elasticity |  |  |  |
| FX Loans Arbitrage Parameter |  |  |  |
| World GDP |  |  |  |
| Population |  |  |  |
| Output to Labour Ratio |  |  |  |
| Domestic Price Level | 1 |  |  |
| International Price Level |  |  |  |
| Nominal Exchange Rate |  |  |  |
| Expected Nominal Exchange Rate |  |  |  |
| Premium on Loans |  |  |  |
| Interest Rate on Domestic Loans |  |  |  |
| Firms FX Indebtness |  |  |  |
| Banks FX Indebtness |  |  |  |
| FX Deposits |  |  |  |
| Interest Rate on FX Loans |  |  |  |
| FX Reserves |  |  |  |
| FX Reserves Owned by the Central Bank |  |  |  |
| FX Reserves Owned by the Banks |  |  |  |

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| Parameter | **Description** | **Value** | Parameter | **Description** | **Value** |
|  | Population growth rate | 0,015 |  | Proﬁt retention rate | 0,45 |
|  | Labour productivity growth rate | 0,0384 |  | Minimum FX borrowing ratio for ﬁrms | 0 |
|  | Output adjustment speed | 4 |  | Tax rate on proﬁts | 0,253 |
|  | Desired Inventory ratio | 0,25 |  | Arbitrage parameter for ﬁrms | 0 |
|  | Labour productivity | 0,21 |  | Speed of adjustment of ﬁrm debt currency allocation | 0 |
|  | Capital productivity | 0,4 |  | Firm FX deposits ratio to Firm FX debt | 0 |
|  | Elasticity of consumption imports | 0,7 |  | Exogenous share of bank bond demand | 0,7 |
|  | Elasticity of investment imports | 0,22 |  | Elasticity of bank bond demand to relative lending rates | 1 |
|  | Elasticity of export-input imports | 0,3 |  | Scaling parameter for domestic banks’ bond demand | 0,155118 |
|  | Elasticity of government spending imports | 0,2 |  | Scaling parameter for global bank leverage | 0 |
|  | Armington share parameter for consumption bundle | 0,823563 |  | Elasticity of global bank leverage to risk | -4 |
|  | Armington share parameter for investment bundle | 0,943976 |  | Elasticity of global bank leverage to foreign policy rates | -4 |
|  | Armington share parameter for export bundle | 0,990253 |  | Scaling parameter for cross-border lending supply | 0,0426 |
|  | Armington share parameter for government bundle | 0,999957 |  | Ratio of global banks’ own funds to world GDP | 0,1 |
|  | Minimum import intensity thresholds | - |  | Speed of adjustment for cross-border lending rate | 2 |
|  | Tax Rate on Imports | 0,025 |  | Speed of adjustment for premium on lending rates | 2 |
|  | Elasticity of exports to real exchange rate | 0,75 |  | Exogenous parameter in premium on lending rates | 0,005 |
|  | Scaling parameter in export share | 0,0080233 |  | Scaling parameter in premium on lending rates | 0,00096 |
|  | Import adjustment speed | 1 |  | Elasticity of premium to total debt/expected proﬁt ratio | 2 |
|  | Export adjustment speed | 1 |  | Required reserve ratio on domestic currency deposits | 0,1 |
|  | Tariffs on Exports | 0,25 |  | Capital adequacy ratio | 0,12 |
|  | Exógenous mark-up | 0 |  | Speed of adjustment to regulatory CAR ratio | 1 |
|  | Sensitivity of mark-up to inventories | 0 |  | Scaling parameter for markdown on deposit rates | 0,00047868 |
|  | Percentage of price-adjusting firms | 0,2 |  | Elasticity of mark-down on deposit rates to bank liquidity | 0,8 |
|  | Depreciation rate | 0,2 |  | Inverse maturity of domestic currency debt of ﬁrms | 0,2 |
|  | Autonomous investment | 0,23 |  | Tax rate on bank proﬁts | 0,2 |
|  | Sensitivity of investment to expected real proﬁt rate | - |  | Ratio of government spending to total production | 0,2743 |

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|  | Ratio of welfare spending per unemployed to wages | 0,08 |  | Speed of exchange rate adjustment | 0,8 |
|  | Tax rate on wages | 0,025 |  | Speed of exchange rate expectations adjustment | 0,9 |
|  | Scaling parameter on government bond interest rate | 0,05 |  | Elasticity of exchange rate expectation to interest diﬀerential | 1 |
|  | Sensitivity of interest on bonds to public debt/GDP ratio | 1 |  | Scaling parameter in exchange rate expectations | 1 |
|  | Exogenous real interest rate in the Taylor Rule | 0,0325 |  | Ratio of remittances to world GDP | 0,0004 |
|  | Sensitivity of Taylor Rule to inﬂation | 1 |  | Scaling parameter for risk | 0,015 |
|  | Target FX reserve/Imports ratio for central bank | - |  | Scaling parameter for risk sigmoid | 5 |
|  | Speed of adjustment of the Phillips curve | 0,9 |  | Sensitivity of risk to net investment position | 300 |
|  | Exogenous nominal wage growth rate | 0,06 |  | Exegenous risk at zero IIP | - |
|  | Sensitivity of nominal wages to employment rate | 0,12 |  | Foreign policy rate | 0,0537032 |
|  | Base employment rate in wage dynamics | 0,8 |  | Foreign bond rate | 0,0505997 |
|  | Sensitivity of nominal wages to inﬂation | 1 |
|  | Scaling parameter for mpc out of wages | 1,15768 |
|  | Scaling parameter for mpc out of capital income | 0,902923 |
|  | Scaling parameter for mpc out of wealth | 1,14086 |
|  | Elasticity of mpc out of wages to real deposit rates | 0 |
|  | Elasticity of mpc out of capital income to real deposit rates | 0 |
|  | Elasticity of mpc out of capital income to real deposit rates | 0 |
|  | Adjustment speed of consumption to target | 4 |
|  | Exogenous share of household bond holdings | 0 |
|  | Scaling parameter for household bond holdings | - |
|  | Elasticity of household bond holding to relative returns | 0 |
|  | Ratio of global portfolio ﬂows to world GDP | - |
|  | Scaling coeﬃcient for foreign portfolio ﬂows | 0,1 |
|  | Arbitrage parameter for portfolio ﬂows | 0 |
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|  | Autonomous Exports | 12 |
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