GLEM
A SFC Model for Ecuador

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Main features of Ecuador

- Dollarized economy
- Oil-producing country. Oil exporter
- Oil revenues used to improve public infrastructures
- BCE experimenting digital currency

Main principles of SFC models

- Representation of the economy based on consolidated sectors (Cuenta Economica Integradas)
- Flows consistency: need to identify which sector is paying, and which sector is receiving
- Stock-flow links: sector saving increase the net stock of assets
- Take into account net capital gains on real and financial assets (not addressed at this stage in GLEM)
- Balance sheet consistency: need to identify the creditor-debtor relationship for each asset/liability
- Stock-flow links: assets/liabilities imply future payments

Main data sources

- Cuenta Economica Integradas: annual 2007-2015
- Balance of payment statistics: quarterly 2000q1-2016q2
- Government statistics: monthly 2000m1-2016m9
- Data on population and labor market: quarterly 2003q4-2016q2 (with breaks)
- Other BCE data (foreign debt, etc.)
- International data (GDP of trading partners, etc.)

Level of disaggregation

Cuenta Economica Integradas

- *Hogares*
- *Instituciones sin fines de lucro que sirven a los hogares*
- *Sociedades no financieras*
- *Sociedades financieras (y Banco Central)*

- **Sector privado**
- **Gobierno General**
- **Resto del Mundo**

Data problems

1. Most statistics do not report which sector is paying and which sector is receiving. Same problem with matching assets to liabilities
   - *Solved using assumptions and consistency checks*
2. Our three main sources (CEI, BdP, GA) are constructed using three different methodologies, so that the same aggregate is measured differently
   - *Use of residual variables in the accounting*
3. Some data have not been seasonally adjusted
   - *Seasonal adjustments*

Flow accounting

	Production	Private sector	Government	Rest of the world	C. acc.	Total
Production		Private expenditure = Consumption + Investment	Government consumption	Net exports		GDP
Private sector	Value added		Income from capital + Social benefits + Other current transfers	Wages + Income from capital + other current transfers		Income
Government	Net indirect taxes	Direct taxes + Social contributions + Income from capital + other current transfers		Income from capital + other current transfers		Income
Rest of the world		Income from capital + wages + other current transfers	Income from capital + Other current transfers			Receipts
Capital account		Saving + Net capital transfers	Saving + Net capital transfers	-Current account + Net capital transfers		0
Total	GDP	Income	Income	Receipts	0	

Table 2. Flow of Funds for a 3 sectors model

	Priv. S.	Gov.	RoW	Total
International reserves	$+\Delta RES$		$-\Delta RES$	0
Cash	$+\Delta CASH$		$-\Delta CASH$	0
Foreign loans	$-\Delta LWp$	$-\Delta LWg$	$+\Delta LW$	0
Equities	$-\Delta EQ$	$+\Delta EQg$	$+\Delta EQw$	0
Other net assets	$+\Delta Op$	$-\Delta Og$	$+\Delta Ow$	0
Total	$+S = \Delta FA$	$-GDEF$	$-CA = -\Delta FW$	0

Table 3. Balance sheet for a 3 sectors model

	Priv. S.	Gov.	RoW	Total
International reserves	+RES		-RES	0
Cash	+CASH		-CASH	0
Foreign loans	-LWp	-LWg	+LW	0
Equities	-EQ	+Eqg	+Eqw	0
Other net assets	+Op	-Og	+Ow	0
Total	NFWp	NFLg	-NFWt	0

Model features

- 75 equations
  - 56 accounting identities
  - 19 estimated equations
- 9 equations determined simultaneously
- Most equations estimated with an ECM approach
  - Check for parameter stability
  - Check for weak-exogeneity of regressors

Determination of GDP

Real GDP is demand driven

We are not considering possible supply-side constraint, arising from low capital/output ratios. However, given the expected path of the economy in the medium term, supply-side constraints are not binding.

The components of GDP are determined through econometric estimates, with the exception of government current and capital expenditures, which are treated as policy instruments.

Parameter estimates

Econometric results are not reported for copyright issues

However:

- Demand equation reasonably stable, but stocks-to-flows feedbacks difficult to establish, possibly because of problems in measuring real net wealth
- No evidence of the impact of interest rates on consumption or investment

A note on the role of credit

Following the monetary circuit approach, what should be relevant for the size of investment (and output in general) is the flow of new credit at the beginning of the production period.

If firms cannot obtain the required finance for their planned production levels, output will be credit-constrained.

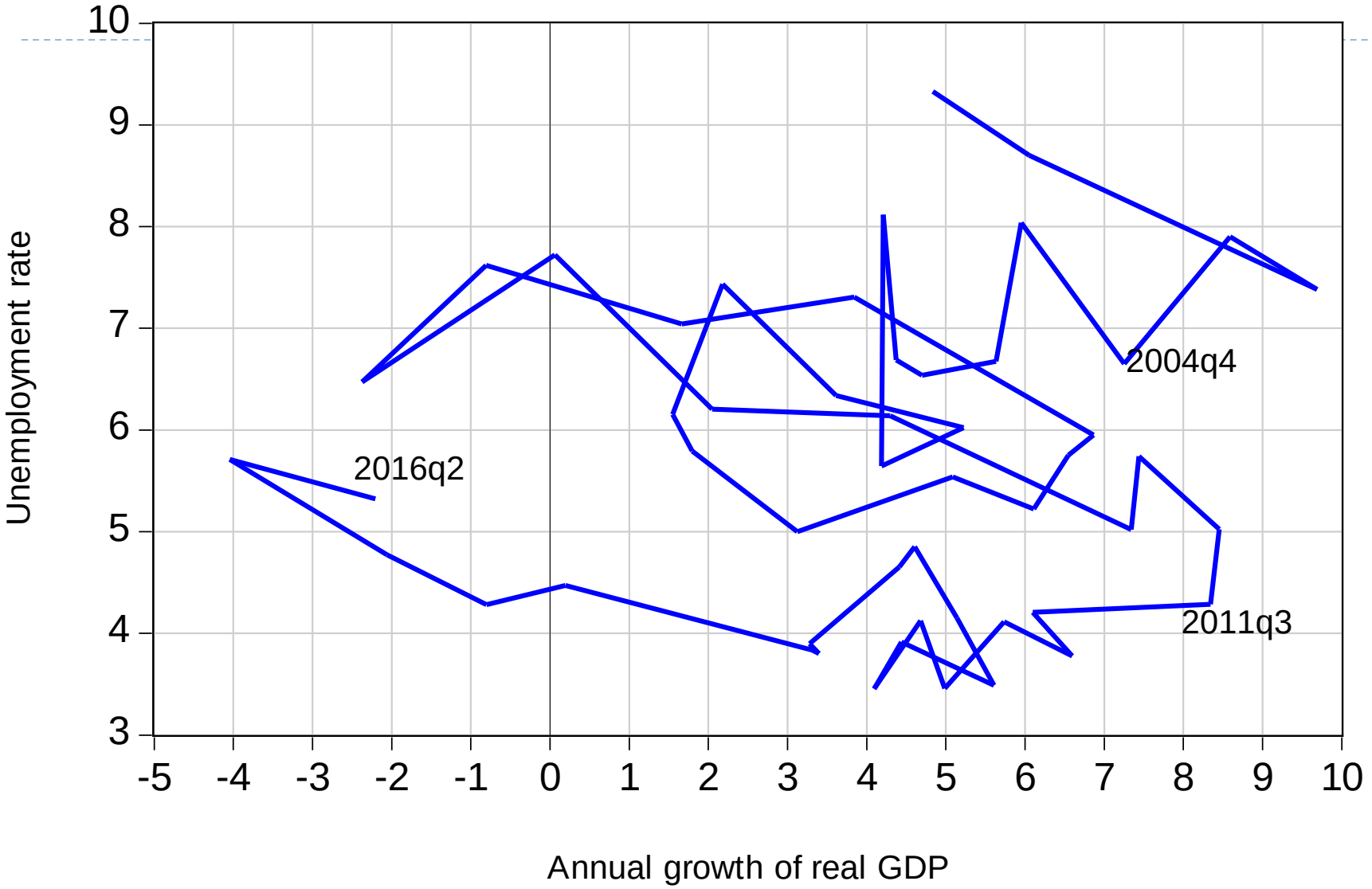
However, what we can observe in published statistics is the net flow over a period of time. If sales proceeds are sufficient to pay back the initial loan, a higher level of output will not necessarily be matched by an increase in either the flow of credit or the stock of credit.

What is often more relevant is the credit-burden.

Employment and unemployment

- Employment is determined from the level of output, given average output-per-worker
- Output per worker is estimated to grow with production
- The unemployment rate is estimated through an estimate of the Okun's Law, with shifts (see next slide). It is implying that a reduction in the unemployment rate requires a smaller output growth rate than in the past
- The size of the labor force also depends on population growth, which is projected exogenously

Ecuador. Unemployment and output growth



Domestic inflation

Inflation depends more on import prices and indirect taxes than on unit labor cost

Oil and non-oil components of import prices are treated separately

Income from capital

Income from capital paid from sector i to sector j (YKij) is determined by an implicit ex-post interest rate Rij on the opening stock of debt Dij

YKij = Rij*Dij

The implicit interest rate on income paid on foreign debt by both the private and the government sectors is linked to the dynamics of the LIBOR 6-months rate

The implicit interest rate paid by the domestic private sector to the government is linked to the dynamics of oil prices.

Components of net foreign assets

The change in net foreign assets is determined by the overall net lending/borrowing position

- The change in foreign loans to the government is determined by demand (next slide)
- The change in foreign loans to the private sector is currently exogenous
- Foreign direct investment in Ecuador is exogenous
- The change in international reserves is determined as a residual

Foreign loans to the government

We have assumed that the government increases its demand for foreign loans with respect to the demand for liquid assets (cash) of the economy.

We also found a significant negative link between the opening stock of government debt and the demand for new foreign loans, which implies a stabilizing behavior

Other net financial assets of the government

- The increase/decrease of overall government debt is determined by net borrowing/lending
- We assume that the government purchases a share of newly issued domestic equities
- Given the change in foreign loans to the government, the change in other net financial assets is determined as a residual

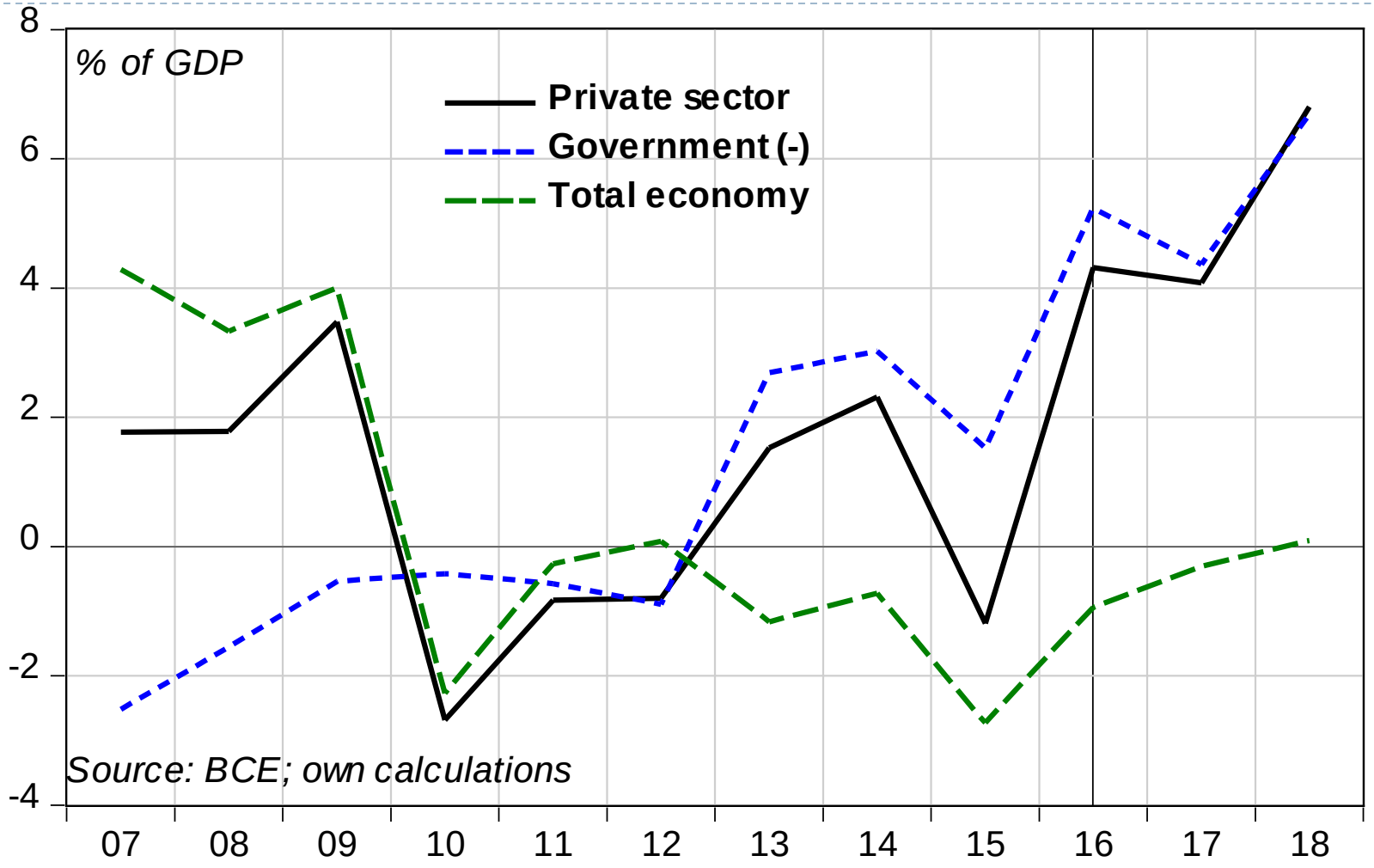
Closing the government account

- In an initial version, the model used the consistency constraints in the balance sheets to determine the change in «other net financial assets» of the Rest of the World
- However, keeping as exogenous the same item for the private sector, this closure implied that any changes in government debt were financed by the foreign sector
- We therefore exogenized this item for the RoW, and assumed that the financing requirement of the government is closed through the domestic financial system
- Further developments should endogenize «other net financial assets» of the RoW

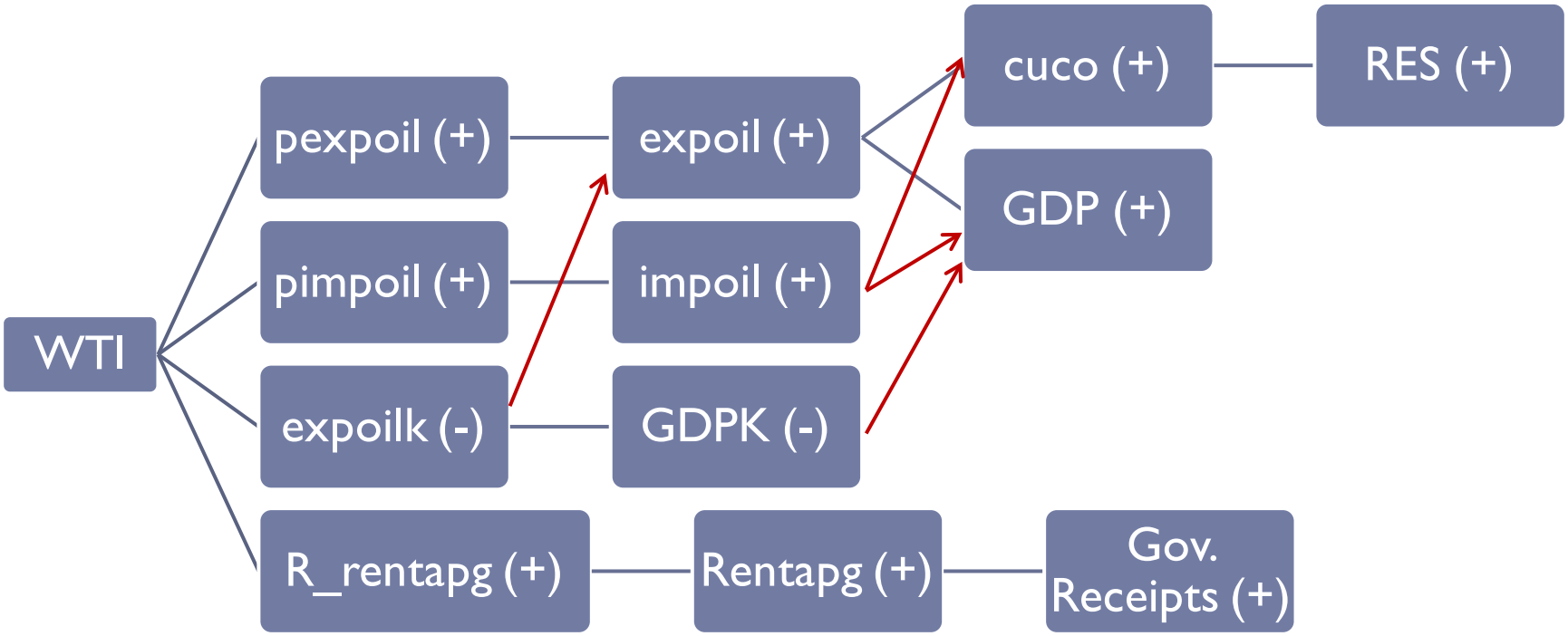
Balance sheet of the private sector

- The change in net financial wealth is given by net lending
- We found a stable relation between M1 and GDP
- While the share of cash in M1 has increased rapidly
- At present, M1 is endogenously given by GDP, while cash is exogenously determined
- We assume that firms finance a fixed share of their investment by issuing new equities
- The change in other net financial assets is given by accounting consistency

Figure 1. Ecuador. Financial balances



Example of feedbacks. Increase in WTI



Main findings

- The Godley-Levy 3-sectors SFC approach has good properties for a developing, dollarized economy
- But modeling the financial side implies non-standard assumptions
- The endogenous money approach is valid for a dollarized economy, putting emphasis on the ability of domestic institutions in generating a sufficient amount of income flows from abroad

Summing up

In its current stage, GLEM represents a coherent and complete representation of the economy of Ecuador, for the available level of disaggregation: private sector, government sector, and foreign sector.

As such, it can be used for conditional projections over the medium term (three years), where the goal is not to provide an exact estimate of where the economy will be in the (uncertain) future, but rather to show the global implications of alternative policies.

The accounting structure of GLEM allows for flexible explorations of alternative hypothesis of institutional behavior on financial markets.