Modelling trade and financial liberalisation effects for Argentina

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Summary

This thesis is a response to the growing recognition that the workings of the financial sphere significantly affect the value of social production, its distribution, and the magnitude of income poverty. The thesis extends a general equilibrium single-country model targeted to a developing economy (the IFPRI Standard Model) to account for the workings of the financial sphere and 'money in the production function', in the tradition begun by Milton Friedman (1969). The models are calibrated and their workings are analysed. It is found that the inclusion of "money in the production function" by itself only causes financial outcomes to significantly affect the overall level of production and the unemployment rate in the presence of strong wage rigidities. This is explained in terms of the model parameters. The extended model is employed in a stylised static way to identify the short-run stresses generated by current and capital account liberalisation in Argentina during its Currency Board Regime, adopted over 1991-2001, with the finding that in the short-run the volatility of capital flows was transmitted to employment and activity levels. The model is then linked in a sequential way to a behavioural microsimulations model, separating out the different transmission channels involved. It is found that the significant capital outflows witnessed by the country surrounding the end of its Currency Board Regime worsened poverty and inequality indicators in the country, and that the main transmission channel through which the capital outflow had the most distributional impact was the selectivity of labour market rationing.

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Abbreviations

%	Percentage
A$	Argentinean pesos
B$	Billions of Argentinean pesos
BCRA	Banco Central de la República Argentina (Central bank of Argentinean Republic)
CDF	Cumulative distribution function
CE	Cross entropy
CES	Constant elasticity of substitution
CET	Constant elasticity of transformation
CGE	Computable general equilibrium
CIF	Cost, insurance and freight (price)
CPI	Consumer price index
DFID	United Kingdom Department for International Development
DSGE	Dynamic stochastic general equilibrium
ECLAC	Economic Comission for Latin America and the Caribbean
EPH	Encuesta permanente de hogares (Permanent household survey in Argentina)
Eq(s).	Equation(s)
FCGE	Financial computable general equilibrium
FDI	Foreign direct investment
FGT	Foster-Greer-Thorbecke (poverty indicators)
FOB	Free on board (price)
GDP	Gross domestic product
GNP	Gross national product
GS&D	Global supply and demand
GTAP	Global Trade Analysis Project
IADB	Inter-American Development Bank
IFPRI	International Food Policy Research Institute
IIP	International investment position
ILO	International Labour Organization
IMF	International Monetary Fund
IMMPA	Integrated Macroeconomic Model for Poverty Analysis

INDEC	Instituto Nacional de Estadisticas y Censos (National Institute of Statistics and Census in Argentina)
ISIC	International Standard Industrial Classification
ISS	International Institute of Social Studies
LAC	Latin American countries
LCU	Local currency units
LDC	Least developed countries
LES	Linear expenditure system
LSE	London School of Economics
MDG	Millennium Development Goals
MIPAr97	Matriz insumo-producto (Input-output matrix) Argentina 1997
MRTS	Marginal rate of technical substitution
MSM	Microsimulation model
NDFRA	National Direction of Fiscal Research and Analysis in Argentina
NDIA	National Direction of International Accounts in Argentina
NFS	Non-financial services
NSNA	National system of national accounts in Argentina
OLS	Ordinary least squares
p.p.	Percentage points
PDF	Probability distribution function
R	Real (model)
r.t.	respect to
RBR	Robilliard, Bourguignon et al. (2008)
RER	Real exchange rate
RF	Real financial (model)
RFA	Real financial augmented (model)
RFAS	Real financial augmented (model), short run version
RFASM	Real financial augmented (model), short run version, with endogenous currency demand by households
RHG	Representative household group
RS	Real short-run (model)
SAM	Social accounting matrix
SDR	Special drawing right
SIM	Simulation

SNA	System of national accounts
SURE	Seemingly unrelated regression equations
TPE	Table of public expenditure 1991-2001
UK	United Kingdom
US	United States
UNCTAD	United Nations Conference on Trade and Development
US$	United States dollars
VAT	Value added tax
WB	World Bank
WIDER	World Institute for Development Economics Research
YPF	Yacimientos Petroliferos Fiscales (Oil and Gas Company in Argentina)

Introduction

This thesis aims to capture the transmission channels by which trade and capital account liberalisation impacted growth and income distribution in developing countries during the last wave of globalisation. Additionally, it provides an analysis of Argentina's experience with liberalisation during its Currency Board (1991-2001).

This work further aims to contribute to the debate on globalisation. Thus, it starts by discussing in a non-technical way the different positions on globalisation found in this debate. This establishes the conceptual background to the dissertation, and allows us to identify the transmission channels by which current and capital account liberalisation - the central features of the last globalisation wave (Taylor 2004) - have affected levels of activity and income distribution in developing countries. An important point that transpires from the debate is that, critically, the effects of globalisation depend on institutional and other country-specific characteristics (Goldberg and Pavcnik 2007, p.41).

Given that the globalisation process had large direct and second-round effects on the economy, this thesis draws on CGE modelling, which seems the most pertinent framework to: i) understand how the effects rippled through the markets of goods, factors (Bourguignon and Pereira da Silva 2003, p.12-18) and assets; ii) combine the analysis of macro-level changes in the stocks of financial assets and money, the activity level and the employment level (prone for macro analysis) with a structural adjustment story (prone for CGE analysis); iii) contribute to closing the gap between macro and CGE models identified by Sherman Robinson (2006).

I review CGE models that capture the financial sphere of the economy in a structural way (FCGE models), finding that they enrich the model specification, allow us to capture imperfections in the financial markets and deepen our insight into the real effects of financial shocks, including those generated by capital flows facilitated by capital account liberalisation. However, while some of them model the "working capital" channel – thus capturing firms' credit dependency - none of them allows for the possibility that firms may substitute away from working capital when its cost rises.

Moreover, I identify a debate among CGE modellers concerning the relevance of capturing the workings of the financial sphere (Adam and Bevan 1998).

I define at this point my modelling strategy, with two central goals in mind: 1) to elucidate the structural adjustment effects of trade and capital account liberalisation, with special emphasis on growth and income inequality; and 2) to contribute to the existing debate over the economic significance of including the financial sphere in CGE models. Similarly to Adam and Bevan (1998), I start from a non-financial CGE model that captures in a conventional way the structural adjustment effects of liberalisation and subsequently incorporates the financial sphere into extended models, thus allowing for additional macroeconomic relationships and rigidities. In the incorporation of the financial sphere, I account for the presence of financial stocks and the consistency between stocks and flows noted by Tobin (1969). Following the tradition of "money in the production function" originating with Milton Friedman (1969), I capture the presence of working capital[1], including it as a substitutable factor in the production function. I specify a market for working capital where its allocation and remuneration are determined, filling a gap in the CGE literature.

I thus arrive at a FCGE model which accounts for the channels identified in the debate on globalisation and the structural characteristics common to developing countries.[2] The model also accounts for the presence of substitutable working capital and a completely specified market for it, and is able to capture country-specific characteristics in terms of the calibrated parameters and the economic agents included in it. The model allows to track the specific forms of savings and asset stocks, an essential part of the economic process (Tobin 1981, p.13), as indicated by the series of financial crisis that has hit developing countries over the years and the recent crisis originated in developed countries with worldwide reverberation. Providing analysts with a wide spectrum of policy options, the model includes a variety of macroeconomic policy instruments: a set of fiscal instruments (different tax rates and forms of government expenditures,

[1] The idea of including working capital in the form of "money in the production function" was suggested by Sherman Robinson.

[2] According to Richard Agènor and Peter Montiel (1999,p.4), "among the distinctive aspects of development macroeconomics are the usefulness of a three-good (exportables, importables and non-tradables) disaggregation of production and the roles of financial repression, informal markets, public sector production, imported intermediate goods, working capital, and labor market segmentation".

disentangling transfers, public consumption and public investment), a set of monetary instruments, including levels and rates of rediscounts and bank required reserve ratios and, where there is a fixed exchange rate regime, the nominal exchange rate.

After calibrating the models assuming that the starting point of observation is a solution point of the model, following the tradition started by Shoven and Whalley (1972), I apply a set of real and financial external shocks, with the finding that the inclusion of "money in the production function" only leads the financial outcomes of the capital and trade account shocks to significantly affect the overall level of production in the presence of strong wage rigidities. I explain this outcome in terms of the model parameters.

I next apply a version of the final model, capturing wage rigidities for the Argentinean economy in a stylised way, focusing on the liberalisation phase that took place during the Convertibility Plan (1991-2001). The Argentinean experience with liberalisation seems especially interesting to analyse given that it was associated with a series of crises and a severe worsening of income distribution. I identify stylised facts regarding the Argentinean economy, and check that the model reflects structural characteristics of the economy. Overall, the model reflects the stresses generated by the volatile capital flows that it received by the country, and suggests that the trade liberalisation-cum-export-reimbursement implemented in the country as well as the net capital inflow it received worsened inequality by increasing the income share of the capitalist representative household group (RHG). By the same token, the CGE analysis also suggests that capital outflows improved household income distribution.

In order to fully account for the observed households' and individuals' heterogeneity and to evaluate changes regarding the full income distribution of plausible shocks, I consistently link the CGE model with a microsimulation model (MSM) through the factor markets. As in Anne-Sophie Robilliard, François Bourguignon and Sherman Robinson (2008) (henceforth RBR), I allow the selection of the individuals who are fired (or hired) when there is a change in labour demand to be based on econometric analysis, and investigate the distributional effects of the capital outflow suffered by Argentina in the period surrounding the end of the Convertibility Plan. This is interesting given that these outflows led to an economic crisis in the country that

included a short-run worsening of social indicators, including unemployment rates and the poverty and inequality indices (Frenkel and Rapetti 2006). As in RBR, I find that the selectivity of labour market rationing is the channel through which economy-wide phenomena have the most distributional impact.

The dissertation is organised in two parts. Part I goes through the steps of building and analysing the workings of a model that captures the effects of the last wave of globalisation on activity level and income distribution for a stylised developing country, specifically a middle-income one. It does so by describing the background given by the debate on globalisation and identifying the channels highlighted in it (Chapter 1), reviewing existing FCGE models (Chapter 2), describing the nested FCGE models that are for a stylised middle-income country (Chapter 3) and their calibration (Chapter 4), and analysing their workings (Chapter 5). Part II applies the final model to investigate the effects of liberalisation in Argentina during its Currency Board (Chapter 6), and links the model to micro-simulations, applying the layered model in a sequential way to investigate the full distributional effects of the capital outflows suffered by Argentina near the end of the Currency Board (Chapter 7). Conclusions are organised into i) the modelling of the effects of globalisation on growth and income distribution in developing countries; ii) the understanding of the effects of globalisation on growth and distribution in Argentina during the Currency Board; iii) the derivation of policy implications; and iv) the identification of further research.

Modelling the effects of globalization in a typical middle-income country

This section goes through the steps of building and analysing the workings of a model that captures the effects of the last wave of globalisation on activity level and income distribution for a stylised developing country, specifically a middle-income one. It does so by describing the background given by the debate on globalisation and identifying the channels highlighted in it (Chapter 1), reviewing existing FCGE models (Chapter 2), describing the nested FCGE models that are built focusing on a stylised middle-income country (Chapter 3) and their calibration (Chapter 4), and analysing their workings (Chapter 5).

Chapter 1 The international debate on the effects of globalisation on growth and income distribution in developing countries

In this chapter, I review the literature on the effects that the different spheres of globalisation have had on growth and income distribution. I start by providing a definition of globalisation and an outline of the basic positions. Given that in the last two decades the liberalisation of current (particularly trade) and capital accounts was the central feature of globalisation in developing countries (Taylor 2004), the review mainly focuses on the effects of these spheres. While describing the transmission channels at stake, I identify with a mark (Tr. Channel G_n) the transmission channels to be modelled and consider the insights provided by the econometric approach.

1.1 What is globalisation?

Globalisation may be defined as the growing interdependence and interconnectedness of the modern world through increased flows of goods, services, capital, people and information, a process driven by technological advances and reductions in the costs of international transactions, which spreads technology and ideas, raises the share of trade in world production and increases the mobility of capital. Other important aspects of globalisation are the diffusion of global norms and values, the spread of democracy and the proliferation of global agreements and treaties, including international environmental and human rights agreements (DFID 2000).[3] According to this definition, globalisation includes two clearly distinct phenomena: one related to technological changes and one related to political, economic and social choices (Helleiner 2001).

1.2 How do the different spheres of globalisation affect growth and distribution? Basic positions

A worldwide debate on the effects that globalisation – especially the latest wave[4]- has had on national growth, distribution and poverty has taken place from the beginning of

[3] A definition with less emphasis on social choices is provided by Bhagwati (2004, p.3): "Economic globalisation constitutes integration of national economies into the international economy through trade, direct foreign investment (by corporations and multinationals), short-term capital flows, international flows of workers and humanity generally, and flows of technology".

[4] As described in World Bank (2002), globalisation had a first wave (1870 to 1914) driven by advances in transportation and agreed reductions of barriers at worldwide level, second wave (1950 to 1980) focusing on integration among the developed countries and the present (third) wave (1980 to now) that included LDCs.

the nineties (Milanovic 2002). Even though there are multiple opinions in this debate, it is possible to distinguish among the participants three basic positions on globalisation: the first one, a Pro-Globalisation one, the second, an Anti-Globalisation one, and lastly one which understands globalisation as a definitely complex and multifaceted process, and which therefore proposes a more regulated global environment e.g. Wade (2001).

The Pro-Globalisation position conforms the mainstream view and has two basic identifiers: first, it sustains that globalisation has basically benign effects that by themselves spur growth and contribute to the reduction of poverty (Milanovic 2003); and second, it minimizes or even denies the distributive problem. The Anti-Globalisation position sustains that globalisation inherently comes with more exploitation at individual and country level. It has been caricatured by Pro-Globalisers as a trilogy of discontents constituted by an anti-capitalism – anti-corporation – anti-globalisation mindset (Bhagwati 2004, p.3). Their main proponents are Ralph Nader and Pierre Bourdiex (Bhagwati 2004). Finally, the proponents of a more regulated global environment observe that the arrival of globalisation does not assure greater rates of growth, that it typically generates more instability in growth, particularly in developing countries, and that it tends to worsen the income distribution within these countries and at worldwide level (Foster and Szekely 2001; Milanovic 2002; Milanovic 2003); finally, it emphasises that, in general, not only growth but also distribution plays a relevant role in the determination of poverty (White 2001). In conclusion, their evidence points to a revision of the prevailing Pro-Globalisation vision.

Specifically, the Pro-Globalisation position emphasises that high rates of growth and poverty reduction can be achieved by implementing a set of macro and reform policies that includes trade and capital openness, fiscal discipline, property rights, etc (Washington Consensus-type policies); and suggests that, in general terms, globalisation does not worsen income distribution, which in turn has only scant effects on poverty (Dollar and Kraay 2000, 1999; Fischer 2003; WorldBank 2002). For example, Dollar and Kraay (2000) suggest that “Standard pro-growth macroeconomic policies are good for the poor” (Dollar and Kraay 2000, p.6) and “Income of the poor rises one-for-one with overall growth” (Dollar and Kraay 2000, p.1), which implies that, on average, globalisation is not only beneficial for the poor but also neutral in distributive terms. In the early 2000s, the World Bank (2002), while maintaining the general message that

overall globalisation was reducing inequality (WorldBank 2002, p.2), accepted that in some cases income inequality could be worsening. However, it absolved the globalisation process and signalled the need for complementary policies (e.g. adoption of an education system that serves all levels of society) that, although costly, should be adopted without compromising the speed at which liberalisation takes place (WorldBank 2002, p.14).

The pro-regulation position presents evidence which shows that the latest bout of globalisation can be characterised by more inequality between countries (Milanovic 2003) and within countries (Foster and Szekely 2001), and less growth (Milanovic 2003). If its approach is right – that is, if globalisation is not a *panacea* for world problems and its malignant side cannot be ignored (Milanovic 2003), then a redesign of globalisation may lead to more broadly shared benefits and even to a higher and more stable rate of growth (Stiglitz 2002). However, it is not obvious what specific shape this redesign should eventually take. To help answer this question, and keeping in mind the MDG goal of halving poverty, one of the pre-requisites is to understand the specific channels by which the main spheres of globalisation affect the two basic drivers of poverty: growth and income distribution (Ravallion 2001; White 2001).

1.3 Effects of trade openness on growth

In the mainstream view trade liberalisation is expected to have positive medium- and long- run effects on growth. The medium-run effects would come from changes in relative price signals, which lead to a reallocation of resources (Tr. Channel G_1) in favour of the sectors with static comparative advantages. This resource reallocation, in turn, contributes to increased efficiency (Winters, McCulloch, and A.McKay 2004; Taylor 2004). In other words, trade liberalisation has the expected effect of switching production from non-tradable goods and inefficient import-substitutes towards exportable goods where developing countries have a static comparative advantage (Taylor 2004). The long-run effects would come from increased access to technology, improved access to intermediate and capital goods, and benefits of increased scale[5] and competition (Winters, McCulloch, and A.McKay 2004).

[5] A point also made by Bhagwati (2004).

However, these positive effects are not guaranteed (Winters, McCulloch, and A.McKay 2004). The presence of market failures (Tr. Channel G_2), including the possibility of positive production externalities in import-competing sectors, implies that trade liberalisation may not be beneficial, even in the long run. Rodriguez and Rodrik (2001) illustrates this point with a two-sector-economy model where only one of the sectors enjoys 'learning by doing': when openness induces the developing country to rely more on the other sector (e.g. the primary one), the country's growth rate is negatively affected, with the country falling into what UNCTAD (2002) has called an "international poverty trap", a situation by which the link with the international economy keeps the country underdeveloped[6]. Wood et al (1996) makes a similar point concerning educational investments: for a country where educational levels are relatively low, trade liberalisation may lead to specialisation in goods of low skill intensity. The result is a loss of positive externalities from educational investments and lower growth rates.

Besides, if not accompanied by sound demand policies, liberalisation may imply a switch in aggregate demand away from the country's domestic markets, thus reducing the demand for the country's output and hence growth (Stiglitz 2002). For example, it may be the case that the adoption of international prices leads to an increase in net imports. If real devaluation does not take place (e.g. because of capital inflows and/or a fixed exchange rate coupled with downward inflexibility in domestic prices) as frequently observed in the Latin American country (LAC) context of last bout of liberalisation, then producers will shift to the non-tradable sector and net imports will be sustained, affecting aggregate demand and output (Taylor 2004; Evans 2005). Expansionary fiscal and monetary policies might help compensate for the negative effect of a shift of demand toward foreign markets on the domestic activity level, but they will reinforce the external imbalance by pushing imports even higher. Moreover, to the extent that acquiring production capabilities takes time, an inappropriate timing of trade liberalisation may make national firms collapse and output fall in the face of a competition for which they are not conveniently prepared (Stiglitz 1998). Finally, trade liberalisation may lead to "immeserizing growth", with negative terms of trade shocks

[6] A poverty trap is defined as a situation when 'poverty has effects that act as the causes of poverty' (Nissanke and Thorbecke 2005,p23).

reducing the nominal value (and the purchasing power) of domestic production, even when the domestic production might be growing in physical terms (Bhagwati 2004).

The mainstream view has been supported by econometric work seeking evidence of a significant and positive link from trade openness (or liberalisation) to growth at cross-country level. Regressing per capita income on a trade openness indicator (exports plus imports divided by GDP) plus a set of control variables from around 100 countries, Dollar and Kraay (1999) finds that trade openness has a positive and significant effect on growth. However, Rodrik (2000) argues that the supposedly positive effect is spurious, due to econometric misspecifications, particularly in the election of the trade openness indicator[7]: Rodrik contends that the (exports + imports) / GDP indicator is "selected to systematically bias the results in favour of showing a statistically and quantitatively significant link between trade liberalisation and growth" (2000, p.5), and emphasises that it is a well-known fact that the countries which perform well usually increase their trade/GDP ratios as a by-product. [8] In other words, Rodrik suggests that Dollar and Kraay's regressions suffer from a serious problem of reverse causation.

Rodrik's critics have argued that reverse causation, even when in theory could be relevant, is not such in practice. They have shown that even when reverse causation is taken into account, the positive significant effect from openness remains. Different ways of taking into account reverse causation have been applied, including: i) instrumenting openness with borders and distances among countries, building on a gravity model for international trade, and controlling for the effect of country-size (population and area) on per capita income, as Frankel and Romer (1999) and Frankel and Rose (2002) [9] [10]; ii) regressing in differences and instrumenting openness by lagged openness, as in Dollar and Kraay (2003). The first approach has been criticised by Rodriguez and Rodrik for the existence of channels by which geography might affect

[7] The same comment appears in Birdsall and Hamoudi (2002) and Milanovic (2003)
[8] Rodrik also points out other Dollar and Kraay's arbitrary selection criteria which are misleading, including mismatches between the periods where taxes lowered and the period where trade volumes increased (their instrumental variable).

[9] As explained by Frankel & Romer, 'Just as a country's income may be influenced by the amount its residents trade with foreigners, it may also be influenced by the amount its residents trade with one another' (Frankel and Romer 1999 p.380).
[10] The latter also incorporates controls for closeness to the Equator and to the Tropics and continental dummies.

income, independently of the trade channel (e.g. via affecting the availability of natural resources) and for lack of answer to the relevant policy question at stake: how policy-induced barriers to international trade affect growth. As claimed by the authors, "trade restrictions (…) will work differently from natural or geographical barriers to trade" (Rodriguez and Rodrik 2001, p.2). It is also to be noted that in most cases the authors regress per capita incomes (and not growth), and positive differences in per capita incomes associated with positive differences in openness (ceteris paribus) would be indicative of trade openness positively affecting growth rates only under certain departure levels for trade openness and income. Besides, Lee et al (2004) sustains that lagged openness is not a reliable instrument, as it may lead to an increase in the imports of physical capital and hence cause growth by a channel which is independent of present openness. Finally, all this econometric studies trying to find a strong link between trade openness and growth have been criticised because of a possible need of complementary policies (e.. to encourage investment) to ensure that trade liberalisation leads to sustained growth (Winters, McCulloch, and A.McKay 2004).

1.4 Effects of trade openness on income distribution

The literature on the effect of trade liberalisation or trade openness on income distribution mainly comprises studies that describe the main channels by which trade liberalisation affects income distribution, in addition to a series of econometric and CGE modelling studies which have applied very different methodologies arriving at different conclusions (Goldberg and Pavcnik (2007)) .

With regards to the mechanisms by which trade liberalisation affects income distribution, conventional trade theory (Heckscher-Ohlin theory with its companion Stolper-Samuelson theorem) addresses the issue in a static way using a model with only two factors, two sectors and two countries. Its corollary is that trade liberalisation increases the relative price of the relative abundant factor in each country leading to a fall in inequality. This may not be correct, particularly in the light of empirical evidence suggesting that trade liberalisation is not reducing inequality in the developing world (Milanovic 2002). As argued in the following paragraphs, to analyse the mechanisms just mentioned with more realism, it is particularly important to distinguish the time frame and the existence of more factors, sectors and countries.

In the short run, openness to trade in a small economy will affect income distribution by the increasing adoption of international prices. On the imports side, the competition of cheaper imported goods will erode the rents (profits, wages, land rents) in the protected sectors of producers at home (Milanovic and Squire 2005), with the consequent change in income distribution. On the exports side, the changes will come mainly from a reduction in wedges (taxes and subsidies) to exports[11], with reduction of taxes (subsidies) increasing (lowering) the incomes of exporters. As described by Goldberg and Pavcnik (2007), the latest globalisation wave seems to have led to an increase in the demand for skilled workers, thereby increasing the skill premium and affecting income distribution. For middle-income countries, part of this change in factor demand can be explained by a simple extension of the traditional trade theory, accounting for skilled labour, unskilled labour and capital; and by distinguishing between low-, middle- and high-income countries: as low income countries entered in the world markets and started to export unskilled-intensive goods (e.g. China's textiles), the comparative advantage of middle-income countries may have shifted from unskilled to relatively skilled workers (Goldberg and Pavcnik 2007, p.61), with an associated change in factor demand.

The medium-run changes in income distribution are related to the medium-run transmission channel explained in the "trade liberalisation and growth" section: as changes in relative price signals lead to factor reallocation, the average wages earned by the factors change due to i) the presence of original sector-specific wage distortions and ii) the effects that the reallocations have on overall factor wages (Tr. Channel G_3). The mentioned reallocations are partly motivated by developed countries outsourcing, a mechanism by which firms in the developed countries shift the production of some intermediate goods to developing countries. With the production of these intermediates being relatively skill-intensive[12], this contributes to explain the increase in the skill premium commented above (Goldberg and Pavcnik 2007, p.62).

In the long run, the productivity and technology transfers brought about by trade are likely to generate new changes in factor demands, factor returns and income distribution

[11] Also in taxes and subsidies to inputs imported for the purpose of subsequent exporting, with an importance depending on the importance of outsourcing in the economy.
[12] The production may be characterized as skill-intensive from the perspective of LDCs but unskilled-intensive from the perspective of developed countries.

(Evans 2005). In particular, and in the context of international capital inflows, trade liberalisation may lead to a fall in the price of imported capital goods and increases in the physical capital stock of developing countries with 'skill-biased' embodied technology (Goldberg and Pavcnik 2007, p.63) also helping in explaining the skill premium increase. This is also confirmed by evidence of low substitution between skilled labour and physical capital for middle-income countries reported by Agénor et al (2005, p.11) (Tr. Channel G_4).

Besides, the potential switch in aggregate demand towards foreign markets described in the section "trade liberalisation and growth" may also have lasting distributional effects, especially when liberalisation takes place prior to the adoption of social safety nets (Stiglitz 2002) (Tr. Channel G_5).

Finally, the changes in income distribution as a result of trade liberalisation will depend significantly on country-specific factor endowments (which will impact on the reallocation of resources and on the possibility of productivity and technology transfers) and on market institutions (which will resolve the market disequilibria in favour of changes in prices or in quantities) (Tr. Channel G_6), as well as on the international rate of return to capital, which will influence the national rate of return to capital to the extent that capital is mobile at the international level. In relation to labour market institutions, trade liberalisation will usually come with reduced activity-based or skill-based sindicalisation, thus allowing for more wage flexibility (Milanovic and Squire 2005). Public finances will also have a role in income distribution: as tariffs and subsidies are cut, the government will attempt to budget its finances, which may imply an increase in existing taxes, introduction of new ones, and/or a reduction in public expenditure which may be non-neutral (Evans 2005).

With regards to the regressions approach, there is a number of econometric studies supporting the mainstream view, suggesting that trade openness and/or liberalisation has no systematic effect on income distribution (Edwards 1997; Londono 2002; Dollar and Kraay 2000; Behrman, Birdsall, and Szekely 2001), as well as a number of studies suggesting that it worsens income distribution (Barro 2000; Spilimbergo, Londono, and Szekely 1999; Lundberg and Squire 2003), and even one that suggests that the effects of trade openness may be context-dependent: they may be pro-equality in middle- or high-

income countries but pro-inequality in poor countries (Milanovic 2002) or they may depend on investments in human capital (Edwards 1997, p.209).

Milanovic (2002) analyses the effects of trade openness and FDI on income distribution in developed and developing countries, using seemingly unrelated regressions (SURE), a class of regression targeted to a system of simultaneous equations. The author does cross-country regressions analysis, regressing the ratio of expenditure or income (depending on availability) of each population decile to the mean income in each country on a set of variables including trade openness, with data on income by deciles coming from household surveys of "almost 90 countries" around two benchmark years: 1988 and 1993. In addition to trade openness, defined as imports + exports normalised by GDP, some of the other covariates the study includes are: FDI in recipient country, also as a percentage of GDP; and interaction terms between trade openness and GDP and between FDI and GDP to take account of possible diverse effects of these spheres of globalisation. Milanonic applies regressions both in levels and first differences, finding significant effects of trade openness only in levels, with the sign of the effect depending on countries' initial income level: his evidence suggests that for countries with per capita GDP below $5000-$6000, it is the rich who benefit relatively more from openness; above that range, it is the relative income of the poor and the middle class which increases.

Edwards (1997, p.206), in turn, regresses the change in the Gini and in the income share of the poorest quintile of 27 developing and 17 developed countries over the 1970s and 1980s on variables that account for trade liberalisation[13], increase in the percentage of population with secondary education, and macroeconomic conditions (GNP, growth and inflation) and a dummy for developed countries. His results suggest that "trade reform (…) does not appear to have significantly affected changes in income distribution" (Edwards 1997, p.209). He suggests that investment in education leads to a reduction in inequality, but he does not interact education with openness, which would have allowed checking whether the effect of trade liberalisation depends on the human capital stock of the country (e.g. by affecting the education premium).

[13] Specifically, these are: average tariffs; average quantitative restrictions coverage; the World Bank index of outward orientation; average collected tariff ratio; Wolf's index of import outward orientation; and average black-market premia.

Behrman et al (2001) study uses an unbalanced panel based on 93 national household surveys micro data[14] from 17 Latin American countries over the 1977-2000 period. It groups individuals in poor, middle-class and rich according to the position in the country-level income distribution, and classifies those in the first three deciles as poor; those in the tenth decile as rich; and the rest as middleclass. It regresses the differences between the log of the average incomes of the rich group and the middle class group over that of the poor group, applying first-difference OLS on a set of covariates that include direct measures of the liberalisation effort, as well as controls for average individual and time-varying country-characteristics which are assumed to have different effects across the income distribution (e.g. inflation). The purpose of regressing the differences (and not the levels) of income is essentially to get rid of the effect on wages of country-specific differences. The purpose of applying OLS in first-differences is to avoid the endogeneity problem as country's inequality may affect their liberalisation efforts. Both are devices that intend to avoid omitted variable biases. In particular, the liberalisation effort is accounted for by a trade policy index (the "average level of tariffs and tariff dispersion" and a capital account liberalisation index that averages a) controls to FDI; b) limits to profits repatriation; c) limits to foreign credit to domestic private sector; d) controls to capital flows (Behrman, Birdsall, and Szekely 2001, p.13). The results suggest that trade liberalisation does not significantly affect inequality, something which they interpret as trade liberalisation having a set of offsetting effects on inequality.

1.5 Effects of capital account openness on growth

In the mainstream view, "free capital movements help channel resources into their most productive uses, and thereby increase economic growth and welfare—nationally and internationally" (Camdessus 1998). More broadly, financial globalisation is expected to enhance growth by a series of channels described by Prasad et al (2003) that directly or indirectly affect growth. The former include reducing the cost of capital from increased risk sharing; transferring technology and developing domestic financial sectors. The latter include increasing specialisation in production due to the possibility of augmented risk sharing; and improving macro policies and institutions by the disciplining force of the markets. Besides, capital account liberalisation is expected to allow for economic

[14] With the exemptions of surveys for Argentina and Uruguay, which are urban, but where the urban populations have 70% and 90% of the total population, respectively.

activity smoothing, with countries borrowing in bad times and lending in good times (Prasad et al. 2003; Gottschalk and Cirera 2003).

However, the pro-regulation position has highlighted that 1) the presence of market failures in the international capital markets (Rodrik 1999), 2) the lack of a sequential opening of the economy (McKinnon 1991) and 3) the lack of sound domestic and international institutions and policies (Prasad et al. 2003; WorldBank 2002) may induce international capital mobility to not enhance - and possibly harm- growth.

The existence of informational asymmetries, agency problems, self-fulfilling expectations, bubbles (rational and otherwise), and myopia are common examples of market failures in worldwide capital markets (Rodrik 1999, p.22). These, combined with international capital mobility, may generate irrational changes in the direction of capital flows, as acknowledged by World Bank (2002). It is found that capital account liberalisation comes with a significant increase in volatility of capital flows, which in turn makes the rate of growth less stable (Birdsall 1999; Wade 2001). Even worse, as capital flows tend to move pro-cyclically, they provide an additional source of instability (Prasad et al. 2003; Stiglitz 2002), probably also generating uncertainty, a loss in efficiency, and a lower trend growth (Gottschalk and Cirera 2003). As described by Taylor (2004), capital account liberalisation, especially in LAC, has led to capital inflows that caused appreciation in real exchange rates (via changes in the nominal exchange rates or in domestic prices) and to domestic credit expansions. The former switched demand away from the liberalising country. The latter encouraged consumption of domestic and foreign goods, thereby affecting the domestic activity level and external balances. Sooner or later, due to unsustainable external imbalance or capital outflow, the demand expansion ended.

As highlighted by Mc Kinnon (1991), the capital account liberalisation may not be growth enhancing if conducted before the following sequence is executed: i) the government achieves fiscal equilibrium hence allowing for price stability; ii) capital markets are opened at the domestic level; iii) the current account is liberalised slowly and orderly, following a “five-to ten-year adjustment period” toward zero tariffs after converting quantitative restrictions into tariffs, with tariffs better cascading downward from domestic finished consumer goods, to manufactured intermediate products, to

industrial raw materials and energy. Besides, once this sequence is executed, capital account liberalisation should not take place in a big-bang way, but rather as a gradual process, starting with FDI; continuing with long-term flows; followed by short-term flows; and being concluded with outflows by residents, first institutional investors, then individuals (Gottschalk and Cirera 2003). Brecher and Diaz-Alejandro (1977), departing from previous work by Bhagwati (1973), shows sufficient conditions under which a capital inflow after the opening of the capital account but before eliminating import tariffs leads to "immiserizing growth", by which the economy grows but aggregate welfare falls. They consider a small tariff-imposing country within the standard two-commodity two-factor model of international trade with an economy incompletely specialised in the production of labour-intensive goods and constant returns to scale in production. The economy receives a capital inflow that is small enough for the host country to continue incompletely specialised. With the capital inflow being the only source of savings for the economy, it is directly used to finance an increase in the existing physical capital stock, thereby contributing to the expansion of the domestic production possibility frontier. To the extent that non-residents receive the full (untaxed) value of the marginal product of its capital (i.e. its market rate of return), the authors demonstrate that the capital inflow leads to an upward shift in domestic income but to a downward shift in national income (the relevant one for residents). As explained by the authors (Brecher and Diaz-Alejandro 1977, p.317), the fall in national income can be decomposed into three components: i) the loss due to tariff-created distortions in consumption and production given the initial factor endowments; ii) the loss (or gain) coming from the accumulation of capital in the presence of the distorting tariff if the capital were owned by residents; and iii) the repatriation of profits to non-residents. As explained in Johnson (1967), the accumulation of capital in the protected industry attracts resources thereby increasing the waste through an excess cost of additional protected production. While these workers increase their contribution to output at tariff-distorted market prices, they may lower it at social prices, hence driving social welfare down. In essence, the tariff distortion channels the capital inflow towards the production of the good where the country has no comparative advantage (the capital-intensive one) and, provided the inflow of capital does not lead the country to a complete specialisation in capital-intensive goods, it makes aggregate welfare fall once foreign profits on the incoming capital are deducted.

Finally, the absence of a series of institutions and policies at international and national level could make the capital account liberalisation harm growth. These include international coordination on accounting standards and policies to address global imbalances, in addition to policies that can address issues such as: lack of transparency, existence of corruption, and risky lending practices (WorldBank 2002; Prasad et al. 2003). Also, capital account liberalisation may hurt the government's autonomy in different ways. The actual or feared event of capital outflows may induce governments to adopt a set of "market friendly" economic policies, i.e. policies that discourage capital to leave the country, or that sacrifice the adoption of measures to address the development problems facing the country at stake. For example, governments may adopt restrictive demand policies and liberalise the labour market because these policies are perceived to be market friendly even in the context of deep recession which may call instead for a stimulus to aggregate demand. With a fixed exchange rate regime, governments will lose some autonomy to manage aggregate demand (and hence the activity level) as the domestic interest rate will be basically driven by the international rate (Bhagwati 2004). Lastly, governments may lose some taxing autonomy as the capacity to tax capital will be reduced by the possibility of domestic capital flowing towards jurisdictions with lower or no taxes.

The econometric evidence is one more time elusive. Even when a positive statistical association is found in general terms - but with exceptions for countries of high growth but late or partial financial globalisation (China, India) and countries of low growth but financially opened (South Africa) -, the positive effect of financial globalisation on growth is not conclusive. The majority of recent studies finds no effect or a mixed effect at best (generally with only FDI having a positive effect on domestic investment and growth), thus not supporting the theoretical argument that financial globalisation per se enhances economic growth (Prasad et al. 2003). As a brief illustration, Rodrik (1998), using a cross-country regression approach on a sample with almost 100 countries, finds that capital openness does not have a significant effect on growth; Kraay (1998) who regresses growth on three measures of capital account openness, concludes that "capital account liberalisation…does not appear to have measureable first-order effects on key macroeconomic outcomes such as growth".

1.6 Effects of capital account openness on income distribution

The effects of capital account liberalisation on income distribution remain relatively uncovered by the literature. Among the few studies on the topic, Behrman et al (2001) suggests that capital account liberalisation may lead to capital inflows that in turn make the price of capital fall and physical investment go up (Tr. Channel G_7)[15]. With capital being complementary to skilled labour and substitute for unskilled labour, the gap between their wages increases and income distribution worsens. Under this argument, it is implicitly assumed that the capital inflow leads to increased foreign savings that do not (completely) offset domestic savings, such that the overall level of savings (and investment) increases[16]. When the authors perform regressions to estimate the effect of capital account liberalisation on income distribution – with a methodology described in the section "trade liberalisation and growth", they find that international financial liberalisation does increase inequality, reinforcing the validity of their theoretical argument. At the same time, Milanovic (2002) – with a methodology described in the same section - suggests that capital account liberalisation does not affect income distribution.

1.7 Conclusions

The international debate on the effects of globalisation on income and distribution in developing countries allows us to understand the transmission channels at work. The conflicting econometric results suggest that it may simply be wrong to assume that a model applies equally to every country; that dynamics and path dependency are irrelevant, and that measurements across countries are homogeneous (Winters, McCulloch, and A.McKay 2004). Instead it may be the case that the relationship between trade and capital account liberalisation, on one hand, and growth and distribution, on the other, is a contingent one, dependent on a host of country and external characteristics which should be identified (Rodriguez and Rodrik 2001), and that can be captured with a single-country economic model.

[15] The fall in the price of capital will be included in the model in the sense that trade liberalisation will affect the price at which physical capital can be imported.
[16] Otherwise, one would conclude that they confuse financial and physical capital.

Chapter 2 Review of CGE models

2.1 CGE models: origins, concept, types and uses

"Computable general equilibrium (CGE) models can be seen as a natural outgrowth of input-output and linear programming models, adding neoclassical substitutability in production and demand, as well as an explicit system of market prices and a complete specification of the income flows in the economy" (Robinson 1989, p.888). The first application was done by Johansen (1960) and the first developing country applications by Adelman and Robinson (1978) and Taylor and Lysy (1979). The evolution of CGE models was close to policy concerns in the international agenda: "In the early 1970s, international attention shifted to a concern about income distribution", and models included prices and incomes, as it was perceived that rapid growth and structural change did not suffice to reduce poverty and that large groups of poor people were not benefiting from growth. In the late 1970s and 1980s, with a growing concern with issues of foreign debt, policy analysis focused on questions of "structural adjustment"[17]. How could countries bring about the changes in the structure of production and trade required to adapt to lower levels of foreign exchange availability? What macroeconomic adjustments were required, and what was their impact on medium- to long-run growth and structural change? Faced with a foreign exchange crisis that significantly affected growth, issues of income distribution and poverty alleviation gradually lost priority in the international agenda, and policy-modellers reacted, among other actions, by improving the treatment of foreign trade in CGE models.

In essence, a "CGE model works by simulating the interaction of various economic actors across markets" using the following components: 1) the actors or agents whose behaviour is analysed (e.g. consumers and producers); 2) their behavioural rules, reflecting their assumed motivation (e.g. producers decide their factor uses at given prices in order to maximize profits); 3) the signals observed by the agents that affect their actual behaviour (typically prices); 4) the rules of the game for the interaction of agents (e.g. perfect competition); 5) the system constraints (e.g. markets for products and factors clear) (Robinson 1989, p.906) .

[17] As mentioned in Robinson (1989), "structural adjustment" is a catch-all term. Here it is used as defined by Robinson (1989, p.891): "an adjustment to some shock that requires not only compositional changes in production, resource allocation, demand, and relative prices, but also changes in macroeconomic aggregates such as income, investment, absorption, consumption and government expenditure".

As a consequence, CGE models are essentially structural, capturing market mechanisms explicitly, and specifying demand and supply behaviours with roles for prices and demand and supply elasticities. "Walras rather than Keynes is the patron saint (…)" (Dervis, de Melo, and Robinson 1982, p.6), i.e. their spirit is essentially microeconomic. However, in order to gain realism, the factor and products equilibrium concepts that come from the Arrow-Debreu general equilibrium theory are sometimes enriched by additional equilibria concepts and ad-hoc elements. The former include: 1) flow equilibrium in the market for loanable funds; 2) equilibrium in specific asset markets; and 3) inter-temporal equilibrium, with agents' behaviour based on their expectations about the future course of the economy. The ad-hoc elements include the following "structuralist" features: 1) limited substitution elasticities in a variety of important relationships ("elasticity structuralist"); 2) lack of proper work or even absence of various markets – e.g. restrictions to factor mobility, price rigidities, rationing, neoclassical disequilibrium, non-profit maximising behaviour by firms- ("micro structuralist"); 3) equilibrating mechanisms among macro aggregate nominal flows ("macro structuralism" typical in Lance Taylor's work). Models are then set in a continuum going from Walrasian to Keynesian models, and can be classified in different ways, e.g. according to the equilibrium concepts they include, the ad-hoc devices they have, their treatment of expectations, their size, etc. In any case, the Walrasian model is "an uneasy host for incorporating macro phenomena", not existing still an "acceptable reconciliation of micro and macro theory" (Robinson 1989, p.895) .

2.2 Macro financial CGE models

A survey of one-country macro financial CGE models seems useful to frame the set of models I build[18]. These models generally depart from traditional CGE models that already incorporate flow equilibria in product and factor markets, with the assumptions in these markets being critical. Also as traditional CGE models, they tend to incorporate a functional relationship between the real exchange rate and the trade balance, being this

[18] A detailed survey of CGE models is out of the scope of the dissertation. McKibbin and Sachs (1989) Global and McKibbin and Wilcoxen (1999) G-Cubed dynamic GE models of the world economy divides the world into regions and deals with financial assets (public bonds, foreign investment positions), but their perfect foresight assumption, perfect substitutability among financial assets and global character lets the case at stake out of the domain of applicability of these models. Dynamic Stochastic General Equilibrium models are left out also due to their lack of concern with structural adjustment and perfect foresight assumptions.

a critical transmission channel, and tend to reflect imperfect substitution between imports and domestic goods, and imperfect transformation between domestic goods and export goods, reflecting the difficulty of changing trade shares at the sector level and giving a degree of isolation to the domestic price level.

However, FCGE models significantly differ from traditional CGEs. While in traditional CGEs the "loanable funds" market collects savings and purchases capital goods in a single account, financial CGE models focus on the elaboration of this account (Robinson 1991), adding a set of imperfectly substitutable assets that capture imperfections in the capital markets. These models are generally designed to analyse the short- and medium- run impact on economic performance and income distribution in developing economies of structural adjustment and stabilisation programmes implemented in response to external macro shocks (e.g. increased oil prices, reduced availability of foreign borrowing). Given their concern with the short- and medium- run effects on the economy, they tend to directly incorporate macro phenomena and to have a simple treatment of expectations[19]. They all break the neoclassical separation between the real and financial spheres of the economy and, for doing this, each of them has at least one structuralist feature.

A review of a set of sixteen macro-financial CGE models that focuses on the equilibrating mechanism in different markets, on the structuralist features and on the channels by which the performance of the financial sphere affects the real one is summarised in the following table. To avoid repeating the description of characteristics which are common to many models, a row – denominated "default" – is added specifying these characteristics, and then referring to their presence in specific models. The table starts with a non-financial CGE model (the IFPRI Standard Model), as it is useful to illustrate the difference between financial and non-financial CGE models and to show the departure point for my modelling strategy in following chapter. The summary suggests the following general patterns among financial CGE models:

- Their factor markets tend to be similar, with the capital stock being immobile across sectors and with some form of wage rigidity in the labour market: a fixed nominal wage (Rosenzweig and Taylor 1990), a price-indexed nominal wage (Taylor 1981;

[19] As mentioned in Robinson (1991), "long-run models which assume full employment and embody steady-state equilibria with rational (or model-consistent) expectations will miss most of the action".

Easterly 1990), or a wage curve by which the real wage is affected by the unemployment rate (Fargeix and Sadoulet 1994; Vos 1997).

- The product markets tend to assume perfect competition, but in some models prices are determined as a mark-up on variable costs (e.g. Yeldan (1997)), are fixed by the government (Decaluwe and Nsengiyumva 1994), or even have the overall price level as the variable that equilibrates the money market (Yeldan 1997).
- Asset markets tend to clear via quantity adjustment, with the interest rate sometimes equilibrating sources and uses of funds by banks (Taylor 1981), with ex-ante savings sometimes limiting fixed investment (Decaluwe and Nsengiyumva 1994; Yeldan 1997; Vos 1997; Lewis 1992)[20], but also sometimes with investment driving savings (Taylor 1983; Easterly 1990). They include a large set of financial assets, and can include currency, deposits, loans, required reserves, domestic and foreign bonds, and international reserves held by the central bank, with these assets sometimes classified according to their currency denomination (local vs. foreign).
- A variety of exchange rate regimes are modelled, including fixed and flexible (as in traditional CGE models), but also administered fluctuation (IMMPA) and crawling peg (Taylor 1983).
- By including the financial sphere, these models make it possible to track the economic actors' portfolios (in size and composition). They enrich the way in which the relationship with the rest of the world is captured, allowing us to explain financial flows between residents and non-residents, their effects on the domestic economy liquidity, and valuation effects (e.g. due to an appreciation of the foreign currency).
- They capture a variety of links going from the financial to the real side of the economy. These include impacts on the aggregate supply and aggregate demand for goods.
    - Concerning the former, they tend to reflect it via a "working capital" channel. As explained by Decaluwe et al (1994, p.263-4), this channel incorporates firms credit dependency, and was pioneered by Kapur (1976) and Mathieson (1980). "In these studies, they consider that there is a direct link between bank credit availability and the level of production. The link is introduced in their models by supposing that the fixed or variable capital

[20] Lewis (1997) only in the scenario with fixed interest rate

stock used by the firms is financed in a certain proportion by bank credit". In some studies the cost of working capital hits the effective production cost of firms and, in turn, the firm's desired level of production - the 'maquette' (Bourguignon, Branson, and Melo 1992), IMMPA -; in others the higher production cost is passed on to consumers (Taylor 1981). Finally, in some models the availability of working capital directly affects the production possibilities of the firm, as working capital is entered as an argument in a Leontief production function that does not allow for substitution away from working capital (Decaluwe and Nsengiyumva 1994; Naastepad 2002).

- Concerning the effects from the financial sphere to the demand for goods, they capture: i) the positive effect of real balances on consumption (Easterly 1990); ii) the negative effect of the interest rate on physical investment (Bourguignon, Branson, and Melo 1992; Thissen 2000); and iii) the positive effect of international capital inflows on physical investment via relaxing binding financial constraints, as in Vos(1997). The mentioned effects on the demand for goods in turn affect the overall supply of goods contemporaneously (to the extent that factor use is flexible) or with a lag, as investment decisions affect the capital stock supply and the production possibility frontier for subsequent periods.

Overall, it is clear that all these models rupture the neoclassical duality between the real and financial spheres, and major differences show up in how the loanable funds market is modelled and in how the performance of the financial sphere affects the real side of the economy. Many of them include a working capital channel, but do not allow for the possibility that firms will tend to substitute away from working capital when its cost rises.

Table 2-1 Macro FCGE Models

Model	Factors closures	Products closures	Asset markets and their closures	Loanable funds market ("Saving-Investment") closure	Fiscal closure	RoW closure 1: exchange rate regime	RoW closure 2: balance of payments	Intertemporal equilibrium	Core links from financial to real sphere
Default	Only labour factors are mobile across sectors and have fixed wages and unemployment.	Prices are market-clearing	Quantity adjustment	Savings-driven	Flexible public savings			Single period without role for expectations	
IFPRI Standard Model	For each factor, the user chooses between 1) flexible wages vs. flexible factor use and 2) mobility vs. immobility across sectors	Prices vary to clean the markets	Absent	The user chooses between default and investment-driven savings	The user chooses betweeen default and flexible tax rates	The user chooses between fixed exchange rate (with flexible trade balance) or viceverse.	The balance of payments is limited to the trade balance and international transfers	Absent	Absent
Taylor (1981A) IS-LM in the Tropics	Default, or the labor wage is price-indexed	Default	Deposits, loans from households and banks to firms, and banks reserves are present. Asset demands are in terms of stocks. Working capital loans are not rationed. Interest rates are endogenous.	The interest rate equilibrates the market	Default	Fixed	The capital account is absent. The foreign reserves held by the central bank change as derived from the endogenous trade balance.	Default	Depending on selected parameters of saving and investment functions, monetary contractions can either lift or reduce the activity level. Firms borrow to finance working capital needs, and pass along its financial cost without an effect on total output.
Taylor (1981B) Ch8: "Foreign Assets and Balance of Payments" (basic version)	Fixed real wages (fixed mark-up for capital) with flexible use of labor and capital	Demand-driven quantities clear the markets	Households demand the following imperfectly substitutable assets: deposits, foreign assets and a non-tradable ("gold" or "land"). There are also bank loans to firms.	Investment-driven	A fiscal institution is absent	Crawling peg	The capital account is absent. The foreign reserves held by the central bank and households change as derived from the endogenous trade balance.	Perfect-foresight, multiperiod model	Excess supplies of loans lead to price level increases that lower the real interest rate and lifts physical investment.
Bourguignon, Branson and De Melo "Maquette" (1992)	Default or Keynesian mark-up pricing with endogenous capacity utilization		Money holdings (against a consolidated financial system), domestic bonds, foreign bonds, equity, loans and international reserves are present. The portfolio composition of assets by households and liabilities by firms depends on asset returns. The interest rate adjusts to clear the money market, and the return on equity is endogenously given by the return on physical capital.	Default via investment credit being rationed	Default	Versions with fixed exchange rate (with flexible trade balance) and viceverse.	The balance of payments is always in equilibrium. In the fix exchange rate regime, the government borrows to equilibrate it.	Adaptive expectations, multi-period model	The interest rate affects physical investment and there is a working capital channel.

Table 2-1 Macro FCGE Models (cont.)

Model	Factors closures	Products closures	Asset markets and their closures	Loanable funds market ("Saving-Investment") closure	Fiscal closure	RoW closure 1: exchange rate regime	RoW closure 2: balance of payments	Intertemporal equilibrium	Core links from financial to real sphere
Default	Only labour factors are mobile across sectors and have fixed wages and unemployment.	Prices are market-clearing	Quantity adjustment	Savings-driven	Flexible public savings			Single period without role for expectations	
Rosenzweig and Taylor (1990)	Default	Default	Currency, deposits, loans, bonds, equity, deposits of non-residents, foreign exchange reserves of Central Bank, rediscounts and required reserves are present. CES and CET functions determine the composition of household's assets and firms liabilities. The interest rate adjusts to equate bank sources and uses of funds. The price of equity adjusts to clear the equity market.	Not explicit	Default	Fixed	Endogenous trade balance, capital account balance and overall balance of payments.	Multi-period	The interest rate affects physical investment
Easterly (1990)	Fixed or price-indexed labor and capital wages, with flexible employment level and capacity utilization	Demand-driven quantities clear the markets	Deposits, loans, required reserves, foreign assets and bonds denominated in local and foreign currency are present.	Investment-driven, with foreign savings being the equilibrating variable.	Default	Fixed	Endogenous trade balance, capital account balance and overall balance of payments.	Default	Real balances hit consumption. Firms interest payments affect their cash flow and hence their investment levels.
Lewis (1992)	The wages are flexible. Only labour is mobile.	Default	The core of the financial system is provided by deposits and loans from banks - see Savings-Investment closure.	Either i) the interest rate is fixed at a level where planned savings are below planned investment (credit rationing); or ii) the interest rate equilibrates planned savings and investments.	Default	Flexible and other schemes, e.g. a premium rationing scheme for imports.	Exogenous international capital flows determine the capital account balance and, with a change in sign, the current account balance, such that the balance of payments is always in equilibrium.	Default	The interest rate affects real investment and hence the composition of aggregate demand, but not the activity level, determined by the full employment assumption. A working capital channel is present.
Decaluwe et al (1994)	Default	Mostly quantity adjustment given a strong degree of price rigidity - e.g. the producer price for exports is fixed via an equalization public fund.	Money, deposits, loans, international reserves held by Central Bank, bonds and equity are present.	Default via investment credit being rationed	Default	Fixed	Exogenous exports, Armingtonian imports and exogenous capital account flows determine the overall result of the balance of payments.	Default	The credit supply limits the firms effective demand for variable production factors and physical investment, with short and medium run effects.

Table 2-1 Macro FCGE Models (cont.)

Model	Factors closures	Products closures	Asset markets and their closures	Loanable funds market ("Saving-Investment") closure	Fiscal closure	RoW closure 1: exchange rate regime	RoW closure 2: balance of payments	Intertemporal equilibrium	Core links from financial to real sphere
Default	Only labour factors are mobile across sectors and have fixed wages and unemployment.	Prices are market-clearing	Quantity adjustment	Savings-driven	Flexible public savings			Single period without role for expectations	
Fargeix and Sadoulet (1994)	The labor wages adjust partially through wage curves.	Default	Currency, deposits, loans, bonds, foreign currency held by Central Bank and households, and Equity are present	The interest rate equilibrates the market	Default	Fixed vs. flexible exchange rate regimes	The current account, the capital account (via endogenous capital flight) and the overall result of the balance of payments (in the fixed exchange regime case) are endogenous.	Multi-period, adaptive expectations	Money emission leads to inflation and real wage fall, lifting labor use and output. A working capital channel is present
Yeldan (1997)	Default	Prices are set as markups over variable costs, and product market equilibria are achieved via quantity adjustment. The overall price level clears the money market.	There are domestic and foreign currency, public and private bonds and saving deposits. The interest rate equilibrates banks sources and uses of funds	Default	Default	Flexible	The balance of payments is in equilibrium. Exogenous limited borrowing abroad by private and public sectors determine the capital account balance and, with a change in sign, the current account balance	Default	Money emission leads to inflation and real wage fall, lifting labor use and output.
Vos (1997) for Philipines	The labor wages adjust partially through wage curves.	"Fix-flex prices": Mark-up pricing and quantity adjustment in some sectors, price adjustment in others	A system of supply-led finance (credit rationing) with fixed nominal returns and perfectly elastic liability demand	Default	Default	Fixed	Capital flows are exogenous and exports are derived from CET functions. The balance of payments is equilibrates via adjustment of imports.	Multiperiod	Capital inflows - which are exogenous - boost investment if binding.
Adam & Bevan asset market model (1998)	The wages are flexible. Only labour is mobile.	Default	Currency holdings, deposits in domestic banks in local currency, deposits abroad, equity, bonds, loans, international reserves and required reserves are present.	As Lewis (1992)	Default	Flexible	The foreign savings are exogenous	Multi-period	With full employment, financial decisions - e.g. public deficit bond-financed vs. money-financed - may affect output composition

Table 2-1 Macro FCGE Models (cont.)

Model	Factors closures	Products closures	Asset markets and their closures	Loanable funds market ("Saving-Investment") closure	Fiscal closure	RoW closure 1: exchange rate regime	RoW closure 2: balance of payments	Intertemporal equilibrium	Core links from financial to real sphere
Default	Only labour factors are mobile across sectors and have fixed wages and unemployment.	Prices are market-clearing	Quantity adjustment	Savings-driven	Flexible public savings			Single period without role for expectations	
Thissen (2000)	The labor wages adjust partially through wage curves.	Default	Currency holdings, deposits in domestic banks in local and foreign currency, deposits abroad, equity, bonds, loans, international reserves, rediscounts, required reserves and excess reserves are present. All asset returns are determined with independence of market clearing, e.g. the interest rate on bonds follow a uniform rate of variation path.	The investment follows a partial adjustment model. Savings are provided by households - as a function of their income and net wealth, the governemnt, and non-residents. There is not a single variable which adjusts to equilibrate savings and investments.	Default	Fixed	Endogenous current account balance and exogenous capital flows - reflecting limited access to foreign borrowing - determine an endogenous balance of payments result.	Multi-period, averaging adaptive and rational expectations	The interest rate affects real investment
Naastepad (2002)	The labor wage is price-indexed.	Fix-flex prices as in Vos (1997)	Loans, deposits, rediscounts, bonds, and required reserves are present. Asset returns are determined by regulation, with the financial system being supply-led as in Vos (1997)	An ex-post investment function has a roof given by the available savings.	Default	Fixed	As in Thissen (2000)	Default	The production function is Leontief and includes working capital.
IMMPA (2003)	The labor market is segmented. In a segment, labor wages are price-indexed. In another, they move along wage curves. Land is fully employed and immobile across agricultural activities.	Default	Currency, deposits (in local and foreign currency), bonds (in middle-income country version) and deposits abroad - among other assets - are present. The public bonds market has a market-clearing price. The interest rates on deposits and loans are linked to the rate on Central Bank rediscounts.	Savings depend on the interest rate, household income and other variables. Investment depends on the return on capital and a flexible accelerator effect. There is not a single variable which adjusts to equilibrate savings and investments.	Public transfers to households adjust to meet a fiscal deficit target.	Fixed, flexible or administered	The banks can borrow abroad without limit until they close their gap between sources and uses of funds. As a consequence, the overall balance of payments may end in disequilibrium.	Adaptive expectations, multiperiod	When the Central Bank reduces the rediscount rate, the interest rates and therefore the cost of working capital go down. This reduces the effective cost of labor and leads the employment level and production to raise.
Agenor and Montiel (2008) - Version with rigid labor real wage	The labor wage is fixed in real terms.	Default	Currency holdings in local and foreign currency, deposits in domestic banks in local and foreign currency, deposits abroad, bonds, loans, international reserves, rediscounts, and required reserves are present. Banks supply of liquidity to firms is perfectly elastic at the prevailing lending rate.	Default	A fiscal institution is absent	Fixed or flexible	Residents are allowed to hold assets abroad - in an exogenous amount -, while non-residents are not allowed to hold domestic assets	Default	Same as IMMPA (2003)

Chapter 3. Design of a set of nested CGE models for a typical middle-income country

3.1 Introduction

Having identified the main transmission channels linking the last wave of globalisation with growth and inequality in developing countries and surveyed macro financial CGE models, I will next describe the modelling approach I take. The modelling strategy has the following aims:

1. Push the frontier of CGE modelling by including money as a substitutable factor in the production function, following the tradition of Friedman (1969).

2. Contribute to the existing debate over the economic significance of including the financial sphere in CGE models.

3. Help understand the structural adjustment effects of trade and capital account liberalisation in a sytlised middle-income country, with special emphasis on the effects on growth and income inequality.

3.2 Money in the production function

Departing from a real CGE model characterized by the absence of strong wage rigidities and an activity level essentially locked by the availability of real factors, I intend to reflect that not only the availability of real factors, but also that of money matters in the determination of the activity level. For this, I include a transmission channel from the financial to the real sphere in the tradition of 'money in the production function' started by Levhari and Patinkin (1968). Specifically, I include (endogenous) working capital in real terms as a substitutable factor in the (CES) production function, which allows to free real factors for the production of commodities proper,

via allowing for greater specialization and exchange (Levhari and Patinkin, p. 737). In turn, this affects the efficiency with which real factors are used in economic activities and, as a result, the overall supply of output, the structure of production and the return for working capital (the interest rate on bank loans). A conventional "cash-in-advance" approach could have allowed for effects on the activity level when applied to the demand of intermediate goods (used in fix proportion with value added), but it would not have captured in a structural form that it allows to free real factors for the production of commodities proper.

As Milton Friedman (1969) argued, the money supply is not necessarily neutral in the short run: "the separation of the act of sale from the act of purchase (provides money with a) fundamental productive function" (p.3), such that "() real cash balances are at least in part a factor of production" (p.14). Friedman illustrated his point in the following way: "a retailer can economize on his average cash balances by hiring an errand boy to go to the bank on the corner to get change for large bills tendered by customers. When it costs ten cents per dollar per year to hold an extra dollar of cash, there will be a greater incentive to hire the errand boy, that is, to substitute other productive resources for cash. This will mean both a reduction in the real flow of services from the given productive resources and a change in the structure of production, since different productive activities may differ in cash-intensity, just as they differ in labour- or land- intensity" (p.14). This is not captured in existent FCGE models where either: 1) working capital is absent (e.g. Thissen 2000); 2) working capital is not included in the production function but affects the effective cost of the real factors (e.g. IMMPA model); 3) working capital acts as a constraint to hire real production factors which are assumed to be strictly complements of working capital (via a Leontief function) - e.g. Decaluwe et al (1994), Naastepad (2002). This chapter seeks to fill this gap.

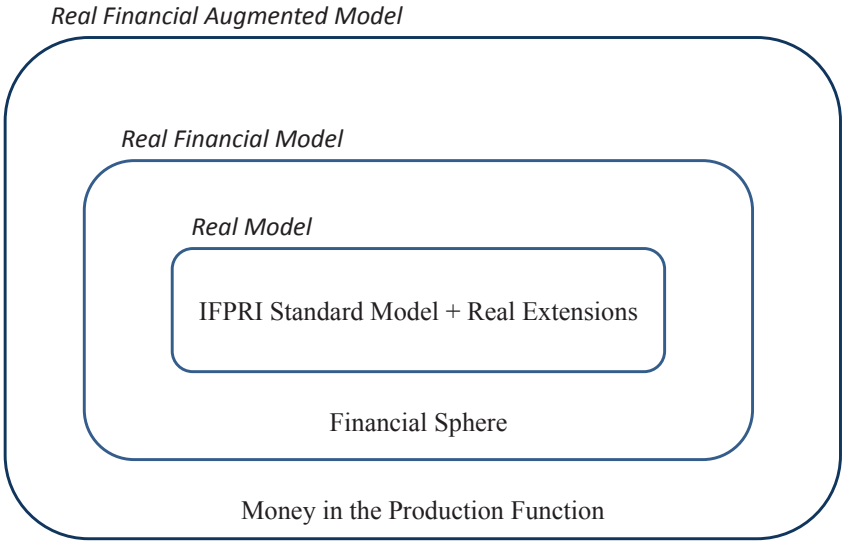
3.3 Nested modeling

To contribute to the existing debate over the economic significance of including the financial sphere in CGE models that Christopher Adam and David Bevan (1998) describe and participate in, and as in that paper, I start from a conventional non-financial CGE model and subsequently incorporate into extended models the financial sphere and its relevance for the real sphere of the economy.

I begin with the IFPRI Standard Model, a stylised non-financial CGE model targeted to a developing country, with a neoclassical core that captures the structural adjustment effects of liberalisation in a conventional way. As shown in Figure 3-1, the nested models I build are denominated real model (R), real financial model (RF) and real financial augmented model (RFA). The models are nested in the sense that the latter ones include the former ones but endogeneise additional variables and include additional equations. The real model is a straightforward extension of the IFPRI Standard model; the real financial model essentially captures the financial assets and liabilities present in the economy; and the real financial augmented model includes money in the production function - in the lines explained above. The last model includes a "Short-Run" version (RFAS) that captures additional short-run rigidities in the economy, allowing financial and real shocks to hit employment and activity levels harder.

The real model includes skilled labour, unskilled labour and physical capital. There are three straightforward departures from the IFPRI Standard Model: 1) skilled labour and physical capital have a relatively low substitution elasticity, which helps to shape the change in primary income distribution as observed in the last globalisation wave for middle-income countries (Tr. Channel G_4); 2) there is imperfect mobility between (formal and informal) segments of the labour market; 3) different regions with which the country trades are separated out, allowing for different traded

Figure 3-1: Nested Models



output varieties, prices, and tax rates.

The financial extension mainly accounts for a set of financial assets and liabilities with the consistency between the stocks and the flows in the economy that was remarked by Tobin (1969). The purpose is to try to capture in a stylised way an essential aspect of the economic process, improving our understanding of it. The financial markets are subject to market failures (Tr. Channel G_2), but with asset portfolios determined as a choice coming from utility theory - as in Adam and Bevan (1998) and Naastepad (2002) -. The model treatment of expectations is very simple, as in most FCGE models. External capital flows are allowed to partly hit the current account balance that the country can afford (particularly, the trade balance) and partly to result in the build-up of Central Bank's foreign reserves and domestic monetary expansion. However, the working capital channel is absent in this model. A wide variety of macroeconomic policy instruments is present, including different tax rates, government expenditures, deficit monetisation, rediscount levels and rediscount rates, and bank required reserve ratios, but in this model the production sphere of the model is essentially unaffected by the monetary policy instruments, given the absence of

the working capital channel.

The real financial augmented (RFA) model incorporates the working capital channel, including money in the production function and specifying a market for working capital that determines the interest rate on bank loans. Given that domestic financial conditions are linked to exogenous external capital flows, the model captures the strong influence that these can have on the activity level, whereas other models (e.g. IMMPA) assume that the country (via the banking sector) can borrow any amount from world capital markets at the prevailing interest rate. In the short-run version of this model, the perceived existence of capital vintages and nominal wage rigidity in the formal labour markets reinforce this link.

The final model captures the transmission channels identified in the globalization debate. The traditional transmission channels from foreign prices to factor allocation and factor income distribution - G_1, G_3 and G_5 - identified in Chapter 1 is captured. Factor unemployment and rigidities in asset returns reflect the presence of market institutions, solving disequilibria by changing quantities rather than prices - channel G_6. Segmentation in the markets for factors, goods, and financial and physical assets illustrate the presence of other market failures - channel G_2. The causal chain from capital inflows (allowed by capital account liberalisation) to the domestic interest rate and in turn to physical investment reflects G_7. Finally, the especially low elasticity of factor substitution between physical capital and skilled workers leads physical investments to bias labour demand in favour of the skilled workers, capturing G_4.

Three main reasons preclude the final model from being characterized by the classical dichotomy between the real and the financial spheres:
1. A working capital transmission channel, by which increases in the monetary base in real terms allow banks to increase their real supply of working

capital to firms, reducing its cost and allowing firms in turn to increase their output (with an upper bound).
2. The presence of nominal wage rigidities in the formal labour market segments, by which the changes in the domestic price level generated by capital account movements translate into changes in real wages, labour demand, and the levels of factor use and output.
3. The effect of capital flows on the composition of aggregate demand via i) their effect on the value of the trade balance that the country can finance; ii) their effect on the financial cost of physical investment and the physical investment demand.

3.4 The actors

The disaggregation of sectors of activity, commodities, production factors, representative households, the rest of the world and the financial sector mainly seeks to frame in a stylised way the causal chains by which the last wave of globalisation affected the level of activity and income distribution of middle-income countries. Economic activity is disaggregated into primary, industrial, construction, private services and public services sectors, perceived as reflecting different pricing, distribution rules, tradability and tax treatment. The set of commodities coincides with the set of activities but, as usual in the CGE literature, the relationship between activities and commodities is not bi-univocal: an activity is allowed to produce more than one commodity, and a commodity can be produced by more than one activity. Real factors are classified as capital and labour, with labour further classified according to skills and formality. The model includes four real factors: formal skilled, formal unskilled, informal unskilled and physical capital. As in the IMMPA model, a high perceived disutility of work or fear of an adverse signalling effect on future employers dissuades skilled workers from looking for a job or working in the informal sector.

The model includes three representative household groups (RHG): skilled wage recipients, unskilled wage recipients, and capitalists. In order to take account of the different evolution of taxes for different trading partners and (probably) different traded commodity varieties, the world is disentangled into different regions for trade. The domestic financial sector is divided into commercial banks and the central bank. The financial assets available to domestic actors - which include public bonds, equity, deposits in local and foreign currency and deposits abroad - and the relative simplicity of the financial system here represented, makes the stylised final model applicable only to middle-income countries. As with any of the surveyed models, the models built here allow us to track changes in household income distribution at a rather aggregate level - i.e. that allowed by the disaggregation of households into representative household groups.

3.5 The closures and the numeraire

The models are closed by fixing some exogenous variables in the system (Adelman and Robinson 1978; Taylor and Lysy 1979). Savings are investment-driven, with households' marginal propensity to save varying in order to make the overall savings flow (determined by households, firms, public and foreign sectors) consistent with the overall investment value (determined in turn with a Tobin's Q type investment function). The public sector has exogenous tax rates and real expenditures (essentially outcomes of policy decisions), with its savings endogenously determined. Foreign savings become locked once the capital flow in the balance of payments is determined.

In the real model, the classical dichotomy between real and nominal variables prevails. With the number of domestic currency units per unit of foreign currency being fixed (fixed nominal exchange rate) and the price of imported goods in foreign currency being also fixed due to the small coun-

try assumption, the domestic currency price of imported goods becomes locked and the numeraire is provided by the bundle of imported goods. With the price of exports being also fixed (small country assumption), the barter terms of trade become fixed. The flexibility of the real exchange rate is achieved through changes in the prices of non-traded goods.

In the real-financial models, the numeraire is provided by local currency. As illustrated in Chapter 2, where I reviewed a set of real-financial models, the determination of the domestic price level is done differently by different authors. Jeffrey Lewis states that in the market for currency of the real-financial model he builds, the major equilibrating mechanism is given by changes in the price level (Lewis, 1992, p.150). In Richard Agenor and Peter Montiel (2008), the nominal price level assures the equilibrium of the goods market. And in Rob Vos (1997), the nominal price level is generated reflecting a set of adjustment mechanisms with roles for mark-up pricing, world market prices, and supply constrains (Vos 1997, p.335). In the real-financial models I present, the prices of domestic goods are generated reflecting: i) the nominal anchor, ii) the small country assumption, iii) the functional relationship between the real exchange rate and the trade balance, and iv) a fixed relation between the current and the capital account balances. To reflect a fixed exchange rate regime, the nominal exchange rate is held fixed and the international reserves held by the Central Bank are allowed to vary in order to equilibrate the foreign exchange market.[1]The nominal price level, i.e. an average of the (nominal) prices of domestic and import goods, varies through changes in the prices of domestic goods to generate a given value for the trade and current account balances consistent with the capital account balance. This role of the nominal price level prevents it from having the role of equilibrating the money market.[2] In any case, a capital inflow is expected to lead to a domestic

[1]A float could be captured by holding the international reserves of the Central Bank fixed and solving the equilibrium condition of the foreign exchange market for the nominal exchange rate, as done in Richard Agenor and Peter Montiel (2008)

[2]The money market reaches equilibrium with quantity adjustment: the part of the money supply which

price level increase, a result that we would also get in a qualitative way in a real-financial model where a capital inflow translates into a money supply increase, which in turn translates into an increase in aggregate demand and hence in the domestic price level.

Equilibria in the commodity markets are achieved via Walrasian price adjustments. Equilibria in the informal labour market and in the sector-specific markets for sunk physical capital are determined via full wage-adjustment, while equilibria in the markets of formal workers are reached via partial wage-adjustment with unemployment. The rate of returns on financial assets are endogenous, except for those determined via a small country assumption in financial markets (the risk-free world interest rate) and a policy-determined rate (the rediscounts rate).

3.6 Specification of the nested models

Next, I describe the full specification of the models I build, organising the explanation in relevant blocks, and referring to the surveyed models as the description evolves. The model equations can also be seen in Appendix II, together with a complete description of their elements.

3.6.1 Real Model

Prices of domestic goods, imports and exports. As in the 1-2-3 model of Shantayanan Devarajan, Jeffrey Lewis and Sherman Robinson (1990), domestic prices are partially insulated from changes in foreign prices, by assuming imperfect substitutability among commodities of different origins and destinations. Outputs used domestically comprise goods produced domestically and imports, while outputs produced domestically can be used do-

is not demanded by households is residually demanded by the banks in the form of reserves. This is a critical mechanism in the link from foreign capital inflows to the expansion of working capital and output which I am intending to capture as a stylized fact of the Argentinean experience with the Currency Board.

mestically or exported. The prices of domestic goods (PD_c) are endogenous and market-clearing, with excess demand generating rises and excess supply generating falls until market equilibrium is re-established. The sector-specific demand for goods are given by the sum of intermediate consumption, final private consumption, investment and public consumption.

$$QQ_c = \sum_a QINT_{c,a} + \sum_h QH_{c,h} + QI_c + \overline{QGC_c} \tag{1}$$

Domestic currency-denominated regional import prices, as perceived by purchasers, are calculated as exogenous regional CIF dollar-denominated import prices (small country assumption) plus regional ad-valorem import tariffs times the nominal exchange rate (fixed reflecting a fixed exchange regime).

$$PMR_{c,r} = pwmr_{c,r} \cdot (1 + tmr_{c,r}) \cdot exr \qquad c \in CM \tag{2}$$

Domestic currency-denominated regional export prices as perceived by producers are analogously calculated as exogenous dollar-denominated FOB world export prices, minus ad-valorem export taxes, times the nominal exchange rate.

$$PER_{c,r} = pwer_{c,r} \cdot (1 - ter_{c,r}) \cdot exr \qquad c \in CE \tag{3}$$

The world-wide import (export) price is an average of the regional import (export) prices, with weights given by import (export) quantities.

$$PM_c \cdot QM_c = \sum_r PMR_{c,r} \cdot QMR_{c,r} \qquad c \in CM \tag{4}$$

$$PE_c \cdot QE_c = \sum_r PER_{c,r} \cdot QER_{c,r} \qquad c \in CE \tag{5}$$

Other prices. As in the IFPRI Standard Model, the sector-level prices of composite goods are determined so as to make the sector-level value of absorption consistent with the sum of the values of domestic spending on

domestic output and imports.

$$PQ_c \cdot QQ_c = PD_c \cdot QD_c + PM_c \cdot QM_c \tag{6}$$

The producer prices are calculated such that the value of production is consistent with the sum of the values of domestic spending on domestic output and exports.

$$PX_c \cdot QX_c = PD_c \cdot QD_c + PE_c \cdot QE_c \tag{7}$$

The price obtained by each producer for his gross output is a weighted average of the prices of the commodities produced by him, weighted by the shares of the goods in his production.

$$PA_a = \sum_c \theta_{a,c} \cdot PXAC_{a,c} \tag{8}$$

The value-added prices are determined such that payments for value-added and intermediate consumption fully exhaust the revenues for each producer.

$$PA_a \cdot QA_a = PVA_a \cdot QVA_a + PINTA_a \cdot QINTA_a \tag{9}$$

The CPI, the price of capital (at replacement cost) and the price of intermediate aggregates are differently weighted averages of composite good prices: the consumer price index (CPI) is weighted by using the commodity value shares in overall final consumption, the price of capital for the private sector is weighted by the commodity value shares in overall physical private investment, and the price of intermediate aggregates is weighted by the intermediate input coefficients.

$$CPI = \sum_c wcpi_c \cdot PQ_c \tag{10}$$

$$PK = \sum_c capcomp_c \cdot PQ_c \tag{11}$$

$$PINTA_a = \sum_c ica_{c,a} \cdot PQ_c \tag{12}$$

The GDP deflator simply measures the ratio between domestic value-added calculated at current and base-year value added prices.

$$GDPDEFL = \frac{\sum_a PVA_a \cdot QVA_a}{\sum_a PVA0_a \cdot QVA_a} \tag{13}$$

Production. Real GDP is determined by summing the value-added of each sector at base-year prices.

$$RGDP = \sum_a PVA0_a \cdot QVA_a \tag{14}$$

The quantity produced of each commodity (c) by each sector (a) is given by the sector's yield of the commodity, times its activity level, allowing single sectors to produce more than one commodity.

$$QXAC_{a,c} = \theta_{ac} \cdot QA_a \tag{15}$$

The aggregate production of each commodity is defined as a CES aggregate of the output level of the different activities producing the commodity.

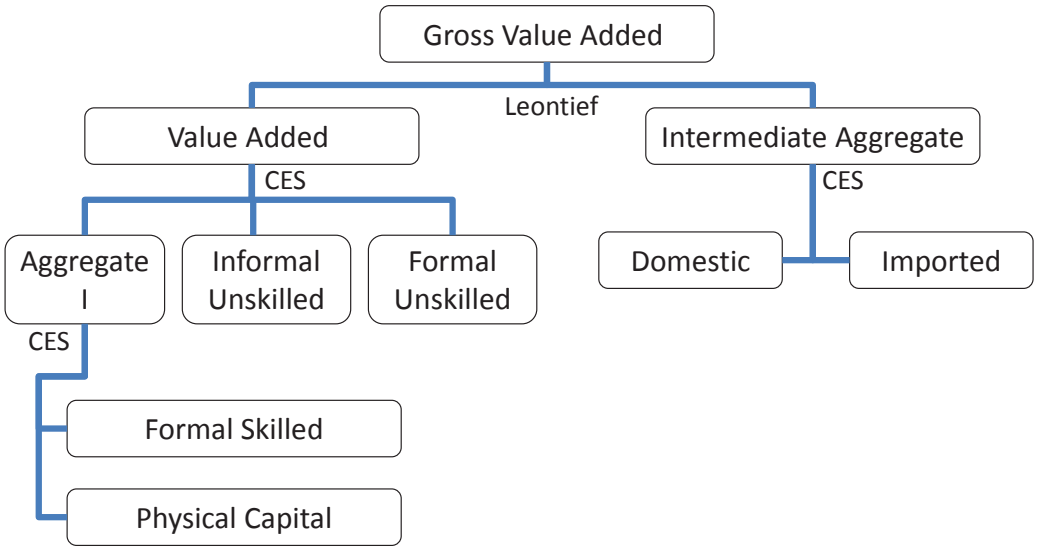
$$QX_c = \alpha_c^{ac} \cdot \sum_a (\delta_{a,c}^{ac} \cdot QXAC_{a,c}^{-\rho_c^{ac}})^{\frac{-1}{\rho_c^{ac}}} \tag{16}$$

The optimal quantity produced by each activity ($QXAC_{a,c}$) is positively related to the overall commodity price and inversely related to the activity-specific commodity price.

$$PXAC_{a,c} = PX_c \cdot QX_c \cdot \sum_{a'} (\delta_{a',c}^{ac} \cdot QXAC_{a',c}^{-\rho_c^{ac}})^{-1} \cdot \delta_{a,c}^{ac} \cdot QXAC_{a,c}^{-\rho_c^{ac}-1} \tag{17}$$

As illustrated in Figure 3-2, the activity level (gross production value) in each sector is generated by a nested production function that, at the top, uses value added and a set of intermediate inputs in fixed proportions.

Figure 3-2: The Production Function in the Real Model



$$QVA_a = iva_a \cdot QA_a \tag{18}$$

$$QINTA_a = inta_a \cdot QA_a \tag{19}$$

$$QINT_{c,a} = ica_{c,a} \cdot QINTA_a \tag{20}$$

Value added, in turn, is a CES function of an aggregate of physical capital and skilled labour (FA_1), informal unskilled workers and formal unskilled workers.

$$QVA_a = \alpha_a^{va} \cdot (\sum_{fa} \delta_{fa,a}^{va} \cdot QF_{fa,a}^{-\rho_a^{va}})^{-\frac{1}{\rho_a^{va}}} \quad fa = \{FA_1, IU, FU\} \tag{21}$$

Physical capital and skilled labour in each activity are aggregated through a CES function. The substitution elasticity among factors in the aggregate is relatively low, reflecting the perception that physical capital tended to subtitute unskilled rather than skilled labour during the last globalization wave in middle-income countries.

$$QF_{FA_1,a} = \alpha^g_{FA_1,a} \cdot \sum_f (\delta^g_{f,FA_1,a} \cdot QF_{f,a}^{-\rho^g_{FA,a}})^{-\frac{1}{\rho^g_{FA_1,a}}} \quad f = FS, K \tag{22}$$

Trade. For non-tradable commodities, absorption coincides with the domestic production and the domestic production for domestic use.

$$QQ_c = QX_c = QD_c \qquad c \in (CMN \cap CEN) \tag{23}$$

For tradable commodities (primary and industrial), absorption is a CES aggregate of imperfectly substitutable imported and domestic commodities (i.e. an Armington function).

$$QQ_c = \alpha^q_c \cdot \left(\delta^q_c \cdot QM_c^{-\rho^q_c} + (1-\delta^q_c) \cdot QD_c^{-\rho^q_c}\right)^{-\frac{1}{\rho^q_c}} \qquad c \in (CM \cap CD) \tag{24}$$

with the optimal mix achieved through expenditure minimisation under perfect competition such that a fall in the relative price of imports makes the imported share of absorption rise in real terms.

$$\frac{QM_c}{QD_c} = \left(\frac{PD_c}{PM_c} \cdot \frac{\delta^q_c}{1-\delta^q_c}\right)^{\frac{1}{1+\rho^q_c}} \qquad c \in (CM \cap CD) \tag{25}$$

Tradable goods produced domestically are allocated either to exports or to domestic sales, with imperfect transformability between them captured through a Constant Elasticity of Transformation (CET) function.

$$QX_c = \alpha^t_c \cdot \left(\delta^t_c \cdot QE_c^{\rho^t_c} + (1-\delta^t_c) \cdot QD_c^{\rho^t_c}\right)^{\frac{1}{\rho^t_c}} c \in (CE \cap CD) \tag{26}$$

and the exported share of production increasing in real terms with the relative price of exports.

$$\frac{QE_c}{QD_c} = \left(\frac{PE_c}{PD_c} \cdot \frac{1-\delta^t_c}{\delta^t_c}\right)^{\frac{1}{\rho^t_c - 1}} \qquad c \in (CE \cap CD) \tag{27}$$

Imperfect substitutability (transformability) between imports from (exports

to) different regions is also assumed, deriving optimal mixes in analogous ways:

$$QMR_{c,r} = QM_c \cdot [\frac{PMR_{c,r} \cdot (\alpha_c^m)^{\rho_c^m}}{PM_c \cdot \delta_{c,r}^m}]^{-\frac{1}{\rho_c^m+1}} \qquad c \in CM \tag{28}$$

$$QER_{c,r} = QE_c \cdot [\frac{PER_{c,r}}{PE_c \cdot \delta_{c,r}^e \cdot (\alpha_c^e)^{\rho_c^e}}]^{\frac{1}{\rho_c^e-1}} \qquad c \in CE \tag{29}$$

Factor markets. The factor demands of each sector are derived from firms' short-run profit maximisation under perfect competition both at the levels of aggregates and individual factors:

$$\begin{aligned} W_{fa} \cdot WDIST_{fa,a} =& PVA_a \cdot (1 - tva_a) \cdot QVA_a \cdot \sum_{fa'} (\delta_{fa',a}^{va} \cdot QF_{fa',a}^{-\rho_a^{va}})^{-1} \\ & \cdot \delta_{fa,a}^{va} \cdot QF_{fa,a}^{-\rho_a^{va}-1} \quad fa = \{FA_1, IU, FU\} \end{aligned} \tag{30}$$

$$\begin{aligned} W_f \cdot WDIST_{f,a} = \sum_{FA_1} (W_{FA_1} \cdot WDIST_{FA_1,a} \cdot QF_{FA_1,a}) \cdot \sum_{f'} (\delta_{f',FA_1,a}^{g} \cdot QF_{f',a}^{-\rho_{FA_1,a}^{g}})^{-1} \\ \cdot \delta_{f,FA_1,a}^{g} \cdot QF_{f,a}^{-\rho_{FA_1,a}^{g}-1} \qquad f = FS, K \end{aligned} \tag{31}$$

The sector-specific supply of physical capital results from the accumulation of excesses of past gross physical investments over depreciations. Once installed in a sector, it is immobile and fully utilised, so that sector-specific equilibria are reached via adjustment of the sector-specific wage distorsions, using equation (31).

$$QK_{a,t} = (1 - \delta^k) \cdot QK_{a,t-1} + \Delta QK_{a,t-1} \tag{32}$$

$$QF_{FK,a} = \overline{CAPUT}_a \cdot QK_a \tag{33}$$

The supplies of skilled and unskilled workers are exogenous. As in IMMPA, skilled workers prefer remaining openly unemployed in the formal sector to getting a job in the informal one, due to reasons that include their concern with possible adverse signalling effects associated with informal work. Unskilled workers, besides, have imperfect mobility between the formal and the informal segment of the labour market, in the spirit of Harris and Todaro's (1970) migration model. During each period a fraction of the unskilled workers moves into or out of the formal segment if there is an expected wage gain in doing so, with the expected wage in the formal segment given by the average wage W_{FLFU} times the probability of finding a job (proxied by $1-UR_{FLFU}$), and the expected wage in the informal segment proxied by the average wage W_{FLIU}.

$$\overline{QFS}_{FLUN} = QFS_{FLFU} + QFS_{FLIU} \tag{34}$$

$$\frac{QFS_{FLFU,t} - QFS_{FLFU,t-1}}{QFS_{FLIU,t}} = \varepsilon_w^{mig} \cdot \log \frac{(1-UR_{FLFU,t}) \cdot W_{FLFU,t}}{W_{FLIU,t}} + \gamma_w^{mig} \tag{35}$$

The formal (skilled and unskilled) labour market segments are subject to unemployment, with wages that adjust only partially through real wage curves (Blanchflower and Oswald 1994), and a complementary slackness condition included to assure the non-negativity of unemployment rates. ($UR_{flf} \geq 0$).

$$(1-UR_f) \cdot QFS_f = \sum_a QF_{f,a} \qquad f \in FLF \tag{36}$$

$$\frac{W_f}{CPI} = \gamma_f^w \cdot (UR_f - nur)^{\varepsilon_f^w} \qquad f \in FLF \tag{37}$$

In the informal component of the labour market, equilibrium is reached via variation in the economy-wide undistorted wage (W_{FLIU}), using the following equation:

$$QFS_{FLIU} = \sum_{a} QF_{FLIU,a} \tag{38}$$

The income of each factor can now be determined by summing the (after-tax) incomes earned in each sector, in turn given by an overall (undistorted) wage, times a sector-specific distortion factor, times the quantity of factor used. The distortions are fixed for labour factors - allowing the model to reflect initial wage differentials observed across sectors, and are flexible in the case of physical capital, allowing sector-specific demands for physical capital to meet sector-specific supplies.

$$YF_f = \sum_{a} W_f \cdot WDIST_{f,a} \cdot QF_{f,a} \tag{39}$$

The ratio between factor income and the total use of each factor allows us to find average wages per unit of factor use.

$$WAV_f = \frac{YF_f}{\sum_a QF(f,a)} \tag{40}$$

Institutions: income, expenditure, and savings.

Households. Representative households differ in their income sources. The skilled (unskilled) RHG has skilled (unskilled) labour income and an interest flow received from deposits at the domestic bank, net of interest on loans. The unskilled one also receives public transfers. The capitalist RHG gets dividends from holding shares in domestic firms and interest not only on deposits at domestic banks, but also on holdings of public bonds and deposits abroad, net of interest on loans. All interest flows come from multiplying a fixed relevant rate of return by a relevant asset/liability value, thus being essentially fixed and analogous to fixed transfers among economic agents. To keep the focus on the real sphere, the determination of these flows is explained in Section 2 (Real Financial Model).

$$YH_S = \sum_{fl}(shhf_{S,fl} \cdot (1 - tf_{fl}) \cdot YF_{fl}) + \overline{FINT}_{S,B} - \overline{FINT}_{B,S} \tag{41}$$

$$YH_U = \sum_{fl}(shhf_{U,fl} \cdot (1 - tf_{fl}) \cdot YF_{fl}) + \overline{FINT}_{U,B} - \overline{FINT}_{B,U} + \overline{TRNSFR}_{U,G} \tag{42}$$

$$YH_C = \sum_{e} DIVD_e + \sum_{n=B,G,R} \overline{FINT}_{C,n} - \overline{FINT}_{B,C} \tag{43}$$

Households save a share of their income (their propensity to save) which adjusts proportionately so that overall savings (of households, firms, public and foreign sectors) finance overall planned investment in the economy.

$$SAV_h = mps_h \cdot MPSADJ \cdot YH_h \tag{44}$$

The remaining income is spent over available goods using a Linear Expenditure System (LES) derivable from the maximisation of a Stone-Geary utility function.

$$EH_h = YH_h - SAV_h \tag{45}$$

$$PQ_c \cdot QH_{c,h} = PQ_c \cdot \gamma^m_{c,h} + \beta^m_{c,h} \cdot (EH_h - \sum_{c'}(PQ_{c'} \cdot \gamma^m_{c',h})) \tag{46}$$

Enterprises. Before-tax firm profits are composed of physical capital income and interest flows received from banks on their deposits, minus interest flows paid to banks on their loans. In the case of the private service sector, bank profits - in turn determined as the difference between interest earned and paid by the bank - are summed as a transfer from the bank to the private services sector.

$$PROFBT_e = \sum_a W_{FK} \cdot WDIST_{FK,a} \cdot QF_{FK,a} + \overline{FINT}_{e,B} - \overline{FINT}_{B,e} + TRNSFR_{e,B} \tag{47}$$

$$TRNSFR_{ES,B} = PROFBT_B \tag{48}$$

$$PROFBT_B = \sum_n (\overline{FINT}_{B,n} - \overline{FINT}_{n,B}) \tag{49}$$

To find after-tax profits, a fixed fraction is deducted to pay for profit tax - if profits are positive - and exogenous public transfers are added.

$$PROFAT_e = min((1 - tpr_e) \cdot PROFBT_e, PROFBT_e) + \overline{TRNSFR}_{e,G} \tag{50}$$

To the extent that after-tax firm profits are positive, an exogenous fraction of them (the "pay-out ratio") is used for dividend payments. The rest is saved by the firm.

$$DIVT_e = max(0, shrp_e \cdot PROFAT_e) \tag{51}$$

$$SAV_e = PROFAT_e - DIVT_e \tag{52}$$

The fractions of dividends paid to residents and non-residents are determined by their (exogenous) share in the firms' equity.

$$DIVD_e = \overline{SHEQD}_e \cdot DIVT_e \tag{53}$$

$$DIVE_e = (1 - \overline{SHEQD}_e) \cdot DIVT_e \tag{54}$$

Government. The government obtains its income from ad-valorem taxes on value added, the labour formal wage bills, the value of traded goods

and firms' profits, and from transfer of the interest earned by the Central Bank. The value-added tax is modelled as an activity tax. Banks' profits are indirectly taxed as their profits are transferred to the private services sector, whose profits are taxed.

$$\begin{aligned} YG = &\sum_{a} tva_a \cdot PVA_a \cdot QVA_a + \sum_{f \in flf} tf_f \cdot YF_f \\ &+ \sum_{c,r} tmr_{c,r} \cdot pwmr_{c,r} \cdot exr \cdot QMR_{c,r} + \sum_{c,r} ter_{c,r} \cdot pwer_{c,r} \cdot exr \cdot QER_{c,r} \\ &+ \sum_{e} max(0, tpr_e \cdot PROFBT_e) + TRNSFR_{G,CB} \end{aligned} \tag{55}$$

$$TRNSFR_{G,CB} = PROFBT_{CB} \tag{56}$$

There are two main sources of profits for the Central Bank: interest on rediscounts given to commercial banks and interest on the international reserves it holds abroad.

$$PROFBT_{CB} = \overline{FINT}_{CB,B} + \overline{FINT}_{CB,R} \tag{57}$$

Public current expenditures include public consumption as well as public transfers and interest payments on the public debt.

$$EG = \sum_{c} PQ_c \cdot \overline{QGC_c} + \sum_{n} \overline{TRNSFR}_{n,G} + \sum_{n} \overline{FINT}_{b,G} \quad b = \{C, R, B, CB\} \tag{58}$$

The difference between the public sector income and its current expenditures determines public savings.

$$SAV_G = YG - EG \tag{59}$$

Non-residents. Foreign savings are determined as non-residents' income net of their expenditures, and more specifically by the sum of domestic

net imports (valued at world prices) plus dividends, net interests and net transfers paid to non-residents. They are denominated in local currency for consistency with the savings of other actors.

$$\begin{aligned} SAV_R = & exr \cdot \sum_{c,r} (pwmr_{c,r} \cdot QMR_{c,r} - pwer_{c,r} \cdot QER_{c,r}) \\ & + \sum_{e} DIVE_e + \sum_{n} \overline{FINT}_{R,n} - \sum_{n} \overline{FINT}_{n,R} \\ & + \sum_{n} (\overline{TRNSFR}_{R,n} - \overline{TRNSFR}_{n,R}) \end{aligned} \tag{60}$$

Savings and investments. Savings are generated by households, firms, the public sector (usually negative) and the rest of the world.

$$SAVTOT = \sum_{h} SAV_h + \sum_{e} SAV_e + SAV_G + SAV_R \tag{61}$$

Sector-specific firms' gross physical investments by sector of destination follow Tobin's Q type functions that depend on the ratio between the sector remuneration for physical capital and the financial unitary cost of physical capital - a cost that is included in Lewis' (1992) model of the investment function.

$$\Delta QK_a = dqkn_a \cdot [\frac{W_{FK} \cdot WDIST_{FK,a}}{RL \cdot PK}]^{\varepsilon_q^I} \qquad a \in APRI \tag{62}$$

It is converted into investments by sector of origin by multiplying its sum by sector-specific capital coefficients, and summing to it the public investments by sector of origin. The disaggregation of public investments by sector of origin reflects that the sector distribution of public investment is a policy tool.

$$QI_c = capcomp_c \cdot \sum_{a} \Delta QK_a + qgi_c \tag{63}$$

The values of the sector-specific private investements by sector of origin come from multiplying the associated quantities by the price of capital

relevant to the private activities.

$$VI_a = PK \cdot \Delta QK_a \qquad a \in apri \tag{64}$$

For the public sector, the quantities invested are separated out among sectors, and multiplied by the sector-specific commodity prices.

$$VI_{AG} = \sum_c PQ_c \cdot qgi_c \tag{65}$$

The value of the total investment for the economy is given by the sum of the investments by sector of destination.

$$VIT = \sum_a VI_a \tag{66}$$

The total value of domestic savings is identical to that of investments, and a "Walras" term is added to the original identity to check the consistency between the total income flow and the total expenditure flow in the model.

$$VIT = SAVTOT + WALRAS \tag{67}$$

3.6.2 Real Financial Model

Financial stock holdings are represented in the assets-liabilities matrix in Figure 3-3 and in actor-specific financial balance sheets (Appendix III), as in IMMPA. The cells inside the matrix have financial stock values, with the asset holder in the column and the liability holder in the row. The financial net wealth of each institution - accumulated through past and present savings excess over physical investment - is given by the sum of the values in its column minus the sum of the values in its row. The sum of the financial wealth of all the institutions is necessarily zero.

Explicit portfolio balance equations, equalling the value of assets to that of liabilities plus net financial wealth for individual agents, are present in the model for households, firms, banks and the Central Bank, and can be calculated for the public sector and non-residents.

Figure 3-3: Matrix of Financial Assets and Liabilities

Asset holder / Liability holder	House-holds	Enter-prises	Govern-ment	Rest Of World	Banks	Central Bank
Households					Loan	
Enterprises	Equity			Equity	Loan	
Government	Bond			Bond	Bond	Bond
Rest of the World	Deposits Abroad				Deposit Abroad	Intern. Reserves
Commercial Banks	Deposit	Deposit		Deposits		Rediscount
Central Bank	Currency				Required Reserves	

Household liabilities consist of bank loans. Skilled and unskilled households allocate their assets in cash holdings (for transaction purposes) and domestic bank deposits. Capitalist households are assumed not to face informational difficulties and transaction costs to enter into other financial markets (as in IMMPA), and also hold other assets i.e. equity in private firms, bonds, dollar-denominated deposits in domestic banks and deposits abroad. Currency holdings are assumed to be fixed, to simplify the workings of the money multiplier by which monetary base changes affect working capital and other bank loans.

$$\overline{CURR}_h + DEP_h = LOAN_h + NFW_h \qquad h = S,U \tag{68}$$

$$\overline{CURR}_C + DEP_C + exr \cdot DEPD_C + AH_C = LOAN_C + NFW_C \tag{69}$$

Firms' financial assets consist of deposits in domestic banks in local currency, and their liabilities are given by the sum of bank loans and equity - a financial asset for the share holders.

$$DEP_e = LOAN_e + EQT_e + NFW_e \tag{70}$$

Banks' assets consist of loans, bonds and deposits abroad (amalgamated into *AB*) and required reserves. Their liabilities are given by the sum of deposits (in local currency and dollars) and rediscounts received from the Central Bank. Given that banks transfer their profits to the private services sector, their savings are null and their net financial wealth constant.

$$AB + REQRES = \sum_{dd} DEP_{dd} + exr \cdot DEPD_C + \overline{RED} + \overline{NFW}_B \quad dd = h \cup e \cup \{R\} \tag{71}$$

The assets of the Central Bank are given by the local currency value of the country's international reserves, the value of public bonds held by it coming from past and present deficit monetisations, and the rediscount credits given to domestic banks. Its liability is the monetary base held by households and by banks - the latter in the form of required reserves. Given that the Central Bank transfers its profits to the (Central) Government, its savings are null and its net financial wealth is constant.

$$exr \cdot INTRES + PBOND \cdot \overline{BOND}_{CB} + \overline{RED} = MB + \overline{NFW}_{CB} \tag{72}$$

$$\sum_h \overline{CURR}_h + REQRES = MB \tag{73}$$

Households assets demand. Since currency held by households is exogenous, skilled and unskilled households' deposits are determined as a residual from their portfolio balance equation. Deposits by capitalist households are consistent with the stock of required reserves held by the banking sector, and the allocation into local-currency-denominated deposits and dollar-denominated deposits follows a fixed proportion for the sake of simplicity.

$$exr \cdot DEPD_C = k \cdot DEP_C \tag{74}$$

The portfolio allocation of capitalist households among bonds, equity and deposits abroad is then determined by maximising a CES utility function (as derived in Appendix IV) with arguments being the expected earnings of the assets, as in Adam and Bevan (1998). This reflects the perception that agents look at relative returns when deciding portfolio asset shares and that they are risk averse (they tend to avoid corner solutions). With the elasticity of substitution on asset earnings ε_C exceeding one, the share of each asset rises with its relative return. A set of perceived probability of defaults $pdef$ on domestic assets (as in IMMPA model) affects their expected returns.

$$PBOND \cdot BOND_C = \Theta_G^C \cdot AH_C \tag{75}$$

$$EQD_e = \Theta_e^C \cdot AH_C \tag{76}$$

$$DEPA_C = \Theta_R^C \cdot AH_C \tag{77}$$

$$\Theta_G^C = \frac{(\delta_G^C)^{\varepsilon_C} \cdot [RB \cdot (1 - pdef_{C,G})]^{\varepsilon_C - 1}}{Q^C} \tag{78}$$

$$\Theta_e^C = \frac{(\delta_e^C)^{\varepsilon_C} \cdot (RE_e)^{\varepsilon_C - 1}}{Q^C} \tag{79}$$

$$\Theta_R^C = \frac{(\delta_R^C)^{\varepsilon_C} \cdot [\overline{RW} \cdot (1 - pdef_{C,R})]^{\varepsilon_C - 1}}{Q^C} \tag{80}$$

$$\begin{aligned} Q^C = &(\delta_G^C)^{\varepsilon_C} \cdot [RB \cdot (1 - pdef_{C,G})]^{\varepsilon_C - 1} + \sum_e (\delta_e^C)^{\varepsilon_C} \cdot (RE_e)^{\varepsilon_C - 1} \\ &+ (\delta_R^C)^{\varepsilon_C} \cdot [\overline{RW} \cdot (1 - pdef_{C,R})]^{\varepsilon_C - 1} \end{aligned} \tag{81}$$

The equity demanded by capitalist households and that demanded by non-residents - the latter determined in (115) - determines the total equity and the share of residents in the equity of each sector.

$$EQT_e = EQD_e + EQE_e \tag{82}$$

$$SHEQD_e = \frac{EQD_e}{EQT_e} \tag{83}$$

Firms assets demand. Firms allocate their financial assets to domestic bank deposits, as derived from their portfolio balance.

Rest of the world assets demand. Non-residents hold domestic assets in the form of deposits in domestic banks, equity and bonds, with the flows that alter the values of these stocks being exogenous - as shown in the determination of the capital account of the balance of payments.

Commercial banks assets demand. Banks' required reserves are defined by the required reserves ratio times total deposits, both in local and foreign currency.

$$REQRES = rr \cdot (\sum_{dd} DEP_{dd} + exr \cdot DEPD_C) \qquad dd = h \cup e \cup \{R\} \tag{84}$$

The rest of the portfolio (AB) is allocated using a CES utility function analogously to capitalist households.

$$LOAN_l = \Theta_l^B \cdot AB \quad l = h \cup e \tag{85}$$

$$PBOND \cdot BOND_B = \Theta_G^B \cdot AB \tag{86}$$

$$exr \cdot DEPA_B = \Theta_R^B \cdot AB \tag{87}$$

$$\Theta_l^B = \frac{(\delta_l^B)^{\varepsilon_B} \cdot RL^{\varepsilon_B - 1}}{Q^B} \tag{88}$$

$$\Theta_G^B = \frac{(\delta_G^B)^{\varepsilon_B} \cdot [RB \cdot (1 - pdef_{B,G})]^{\varepsilon_B - 1}}{Q^B} \tag{89}$$

$$\Theta_R^B = \frac{(\delta_R^B)^{\varepsilon_B} \cdot [\overline{RW} \cdot (1 - pdef_{B,R})]^{\varepsilon_B - 1}}{Q^B} \tag{90}$$

$$\begin{aligned} Q^B = & \sum_l (\delta_l^B)^{\varepsilon_B} \cdot (RL)^{\varepsilon_B - 1} + (\delta_G^B)^{\varepsilon_B} \cdot [RB \cdot (1 - pdef_{B,G})]^{\varepsilon_B - 1} \\ & + (\delta_R^B)^{\varepsilon_B} \cdot [\overline{RW} \cdot (1 - pdef_{B,R})]^{\varepsilon_B - 1} \end{aligned} \tag{91}$$

Rates of return. Interest rates are allowed to vary endogenously in the financial models. The interest rate on deposits in domestic banks *RD* is determined with an LM equation that captures transactions demand and liquidity preference and where, as in Lewis (1992), *ceteris paribus*, increases in the real stock of money (proxied by the monetary base divided by the GDP deflator) leads the interest rate to fall, and increases in transactions (proxied by real GDP) lead it to rise. The interest rate on bank loans *RL* is determined by the interest rate on deposits adjusted by the reserves ratio (exogenously determined by the Central Bank) and an exogenous mark-up rate. The reserve ratio is included to reflect that, for a given rate on deposits, an increase in the reserve ratio needs to be balanced by a higher rate on loans to keep banks' profits constant.

$$log \frac{MB}{GDPDEFL} = \varepsilon_y^m \cdot log(RGDP) - \varepsilon_r^m \cdot log(RD) + \gamma^{LM} \tag{92}$$

$$RL = \frac{RD}{1 - rr} \cdot (1 + \mu) \tag{93}$$

The return on bonds *RB* adjusts to clear the bonds market, and it is assumed to be paid as a perpetuity.

$$BONDS = \sum_{b}(BOND_b) \qquad b = \{C,R,B,CB\} \tag{94}$$

$$RB = \frac{1}{PBOND} \cdot RB0 \tag{95}$$

Sector-specific returns on equity RE_e are determined by the ratio between after-tax profits (distributed and retained) and equity.

$$RE_e = \frac{PROFAT_e}{EQT_e} \tag{96}$$

The interest rate on Central Bank rediscounts $RRED$ is exogenously determined by the Central Bank, bank reserves in the Central Bank are not remunerated (as in IMMPA model), and the return on deposits abroad RW is exogenously determined in the international financial markets (small country assumption).

Interest flows. The holdings of financial stocks and relevant rates of return determine a set of interest flows among the actors in the model. Banks remunerate depositors (households, enterprises and non-residents) at the rate of return on deposits, RD [(97),(98)]. Loan holders (households and enterprises) remunerate the banks at the rate of return on loans, RL (99). The central government remunerates bond holders (capitalist households, non-residents, banks and the central bank) at the rate of return on bonds, RB (100). Non-residents remunerate domestic depositors (households, banks and the Central Bank) at the risk-free world interest rate, $\overline{RW}$ [(101),(102)]. Finally, the banks remunerate the central bank at the Central Bank rediscount rate, $\overline{RRED}$ (103).

$$FINT_{dd,B} = RD \cdot DEP_{dd} \quad dd = \{S,U\} \cup e \cup \{R\} \tag{97}$$

$$FINT_{C,B} = RD \cdot (DEP_C + exr \cdot DEPD_C) \tag{98}$$

$$FINT_{B,l} = RL \cdot LOAN_l \qquad l = h \cup e \tag{99}$$

$$FINT_{b,G} = RB \cdot PBOND \cdot BOND_b \qquad b = \{C,R,B,CB\} \tag{100}$$

$$FINT_{da,R} = \overline{RW} \cdot exr \cdot DEPA_{da} \quad da = \{C,B\} \tag{101}$$

$$FINT_{CB,R} = \overline{RW} \cdot exr \cdot INTRES \tag{102}$$

$$FINT_{CB,B} = \overline{RRED} \cdot \overline{RED} \tag{103}$$

Balance of payments. The current account of the balance of payments is determined as foreign savings, changed in sign and converted into dollars. The capital account balance is determined as the sum of the value increases in non-resident holdings of equity in domestic firms, deposits in domestic banks and domestic bonds, minus the increase in deposits abroad held by domestic actors (capitalist households and banks). The overall balance of payments is found by summing the current and capital account balances, and determines the variation of international reserves held by the Central Bank.

$$exr \cdot CAB = -SAV_R \tag{104}$$

$$exr \cdot KAB = \sum_e (\overline{\Delta EQE_e}) + \overline{\Delta DEP_R} + \overline{\Delta VBOND_R} - exr \sum_{da} \Delta DEPA_{da} \tag{105}$$

$$\Delta INTRES = CAB + KAB \tag{106}$$

While Lewis (1992) and Yeldan (1997) models assume that the current account balance exactly mirrors the capital account balance, in this model, reflecting the perception that capital inflows lead both to a rise in domestic monetisation and to finance deficits in the current account, the current account superavit (deficit) is assumed to move together with the capital account deficit (superavit), in a proportion given by a parameter k_I, to be calibrated.

$$CAB = -k_I \cdot KAB \tag{107}$$

Updates for financial stocks. The financial stocks are updated using the financial flows of the current period without lag. There are updating conditions for households' net financial wealth - using their savings in (108) - and enterprises' net financial wealth (using their excess of savings over physical investments in (109)) and the value of the public debt - using the public deficit in (110) -. For banks and the Central Bank, given that they transfer their profits (to the private services sector and the central government, respectively), their savings are null and their net financial wealth is constant.

$$\Delta NFW_{h,t} = SAV_{h,t} \tag{108}$$

$$\Delta NFW_{e,t} = SAV_{e,t} - VI_{a,t} \tag{109}$$

$$PBOND \cdot \Delta BONDS = \sum_c PQ_c \cdot qgi_c - SAV_G \tag{110}$$

There are also updating conditions for the total quantity of public bonds (111), the quantity and the value of the bonds held by economic actors (capitalist households, non-residents, banks and the Central Bank) -in (112) and (113)-, non-residents' deposits at domestic banks (114) and their equity holdings (115), and the deposits abroad by capitalist households and

banks (116), as well as the Central Bank international reserves (117).

$$BONDS_t = BONDS_{t-1} + \Delta BONDS_t \tag{111}$$

$$BOND_{b,t} = BOND_{b,t-1} + \Delta BOND_{b,t} \quad b = \{C,R,B,CB\} \tag{112}$$

$$\Delta VBOND_{b,t} = PBOND_t \cdot BOND_{b,t} - PBOND_{t-1} \cdot BOND_{b,t-1} \quad b = \{C,R,B,CB\} \tag{113}$$

$$DEP_{R,t} = DEP_{R,t-1} + \overline{\Delta DEP}_{R,t} \tag{114}$$

$$EQE_{e,t} = EQE_{e,t-1} + \overline{\Delta EQE}_{e,t} \tag{115}$$

$$DEPA_{da,t} = DEPA_{da,t-1} + \Delta DEPA_{da,t} \quad da = \{C,B\} \tag{116}$$

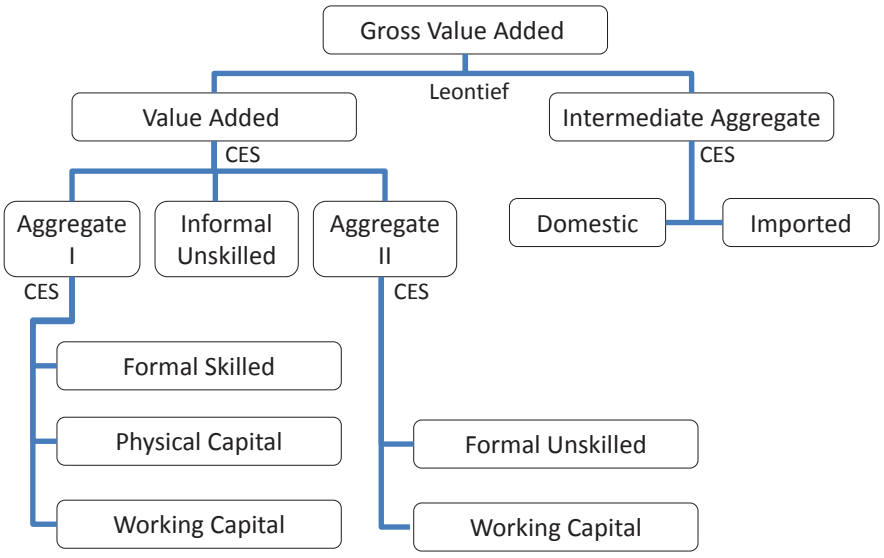
$$INTRES_t = INTRES_{t-1} + \Delta INTRES_t \tag{117}$$

3.6.3 Real Financial Augmented Model

To allow financial outcomes to affect the efficiency with which real factors are used in the economy and, as a result, the overall supply of output and the structure of production, a working capital channel is incorporated along the lines of Friedman (1969), including working capital as an additional factor in the formal components of each private activity as shown in Figure 3-4 and reflected in the following equations.

$$QVA_a = \alpha_a^{va} \cdot (\sum_{fa} \delta_{fa,a}^{va} \cdot QF_{fa,a}^{-\rho_a^{va}})^{-\frac{1}{\rho_a^{va}}} \quad fa = \{FA_1, IU, FA_2\} \tag{118}$$

Figure 3-4: The Production Function in the Real Financial Augmented Model



$$QF_{FA_1,a} = \alpha^g_{FA_1,a} \cdot \sum_f (\delta^g_{f,FA_1,a} \cdot QF_{f,a}^{-\rho^g_{FA_1,a}})^{-\frac{1}{\rho^g_{FA_1,a}}} \quad f = FS,K,WK_1 \quad (119)$$

$$QF_{FA_2,a} = \alpha^g_{FA_2,a} \cdot \sum_f (\delta^g_{f,FA_2,a} \cdot QF_{f,a}^{-\rho^g_{FA_2,a}})^{-\frac{1}{\rho^g_{FA_2,a}}} \quad f = FU,WK_2 \quad (120)$$

First order conditions concerning factor demands are accordingly adjusted at the level of factor aggregates and individual factors:

$$W_{fa} \cdot WDIST_{fa,a} = PVA_a \cdot (1 - tva_a) \cdot QVA_a \cdot \sum_{fa'} (\delta^{va}_{fa',a} \cdot QF_{fa',a}^{-\rho^{va}_a})^{-1} \cdot \delta^{va}_{fa,a} \cdot QF_{fa,a}^{-\rho^{va}_a - 1} \quad fa = \{FA_1, IU, FA_2\} \quad (121)$$

$$W_f \cdot WDIST_{f,a} = \sum_{fa} (W_{FA_1} \cdot WDIST_{FA_1,a} \cdot QF_{FA_1,a}) \cdot \sum_{f',FA_1} (\delta^g_{f',FA_1,a} \cdot QF_{f',a}^{-\rho^g_{FA_1,a}})^{-1} \cdot \sum_{FA_1} (\delta^g_{f,FA_1,a} \cdot QF_{f,a}^{-\rho^g_{FA_1,a}-1}) \quad f = FS,K,WK_1 \quad (122)$$

$$W_f \cdot WDIST_{f,a} = \sum_{fa}(W_{FA_2} \cdot WDIST_{FA_2,a} \cdot QF_{FA_2,a}) \cdot \sum_{f',FA_2} (\delta^g_{f',FA_2,a} \cdot QF_{f',a}^{-\rho^g_{FA_2,a}})^{-1}$$
$$\cdot \sum_{FA_2} (\delta^g_{f,FA_2,a} \cdot QF_{f,a}^{-\rho^g_{FA_2,a}-1}) \qquad f = FU, WK_2 \tag{123}$$

A market for working capital is specified, allowing working capital to move across sectors. Its total supply in nominal terms is determined by banks in (124) as the total loanable funds (AB) of banks, times the sum of the shares of enterprises derived in (88). It is translated into real terms in (125) using the GDP deflator.

$$LOAN_E = \sum_e \Theta^B_e \cdot AB \tag{124}$$

$$QFS_{FW} = \frac{LOAN_E}{GDPDEFL} \tag{125}$$

The return per real unit of working capital adjusts until market-clearing is reached, unless a minimum wage for working capital is reached first, in which case a halt is put to the productive use of working capital and thus on its effect on the activity level. This intends to reflect that there is a limit after which monetary expansions stop raising the activity level.[3]

$$(1 - UR_W) \cdot QFS_{FW} = \sum_{fw,a} QF_{fw,a} \quad fw = \{WK_1, WK_2\} \tag{126}$$

$$WAV_{FW} = \frac{YF_{FW}}{\sum_{fw,a} QF_{fw,a}} \quad fw = \{WK_1, WK_2\} \tag{127}$$

$$WAV_{FW} \geq minwwk \tag{128}$$

The return per real unit of working capital is then translated into a return per nominal unit of working capital by multiplying it by the GDP deflator.

[3] In the experiments with the model, I never hit this limit.

This determines the rate of return on bank loans *RL*, replacing the LM equation (92). The functional relationship between *RD* and *RL* in (93) continues to hold, so now *RD* is determined using (93).

$$RL = WAV_{FW} \cdot GDPDEFL \tag{129}$$

Last, the shares of working capital are used to assign loans across enterprises.

$$LOAN_e = \frac{\sum_{fw} QF_{fw,a}}{QFS_{FW}} \cdot LOAN_E \qquad e = a \in apri \tag{130}$$

Short-run Version. This version of the RFA model seeks to allow for higher effects of financial shocks on the aggregate supply of goods by reflecting a higher degree of wage rigidity in the factor markets. In the market for physical capital, the existence of capital vintages (which should be researched in an institutional framework) is reflected by imposing a minimum real wage for physical capital [(131),(132)]. Once this minimum is reached, the capacity utilization of the physical capital stock is allowed to adjust downwards (133).

$$WKR_a \cdot GDPDEFL = WDIST_{FK,a} \cdot W_{FK} \qquad a \in apri \tag{131}$$

$$WKR_a \geq minwpk \qquad a \in apri \tag{132}$$

$$CAPUT_a \leq 1 \qquad a \in apri \tag{133}$$

To add rigidity to the wages of formal workers derivable from nominal contracts, the wage curve (134) is replaced by a curve on nominal instead of real wages and the elasticity in the wage curve is significantly reduced - from 0.1 to 0.01 - letting the model approach the case of nominal wage rigidity in the formal labour market segments.

$$W_f = \gamma_f^w \cdot (UR_f - nur)^{\varepsilon_f^w} \qquad f \in FLF \qquad (134)$$

Chapter 4 Calibration of the parameters of the set of nested models

Once the models are specified, their parameters must be assigned. They can be econometrically estimated or, as often the case in CGE models, calibrated. As argued by Dawkins et al (2001), calibration is conceptually similar to conventional estimation, in the sense that both refer to choosing parameter values subject to a goodness of fit criterion with respect to data. Calibration can be conceptualised as a special case of estimation: estimation in the case of under-identification, where the number of parameters to be estimated exceeds the number of observations. Calibration is widely used in microeconomic models, has become in recent years a mainstream form of empirical investigation in macroeconomics, and is a widely used technique in natural and life sciences (Dawkins, Srinivasan, and Whalley 2001). The reason for calibrating vis-à-vis estimating the model is to keep the focus on the main causal chains at stake, i.e. the modelling aims stated at the start of the preceding chapter. In any case, calibration does have a cost: the resulting numerical model lacks a complete and consistent econometric formulation which, in turn, precludes the use of the model for forecasting, with its results only yielding "indications of the relative orders of magnitude for possible policy (or shock) adjustments in the economy" (Dawkins, Srinivasan, and Whalley 2001, p.3677). The goal of the analysis becomes to obtain a quantitatively informed insight for better understanding of the economic processes at stake and policy input, enabling one to evaluate which effects are large, which are the major stresses to which the economy is subjected, whether the effects are opposite to received wisdom and, if so, what explains them.

In principle, one would like to follow best practices in calibration. However, as explained by Dawkins et al (2001), there is no discussion in the literature as to what these are. As usual, in calibrating a general equilibrium model, the numerical values of some model parameters are set exogenously, while others, the calibrated parameters, are endogenously determined so as to reproduce the benchmark data[21] as an equilibrium of the model. This follows a tradition started by Shoven and Whalley (1972), who, when seeking to calculate the welfare costs of differential tax treatment of capital income by

[21] It refers to the micro-consistent equilibrium dataset derived from adjusting basic data in order to satisfy the equilibrium conditions of the model.

sectors in the US, introduced equations characterising the equilibrium solution of the model to solve for the values of the parameters whose values had not been set exogenously. Essentially, they converted the parameters into variables, and solved for their values by trivially imposing equilibrium as an identifying restriction, using benchmark data.

4.1 Calibration and the SAM

The benchmark data in CGE models is typically organised in a Social Accounting Matrix (SAM), which "provides a complete account of the circular flow in the economy" (Robinson 1989, p.907), its level of disaggregation depending on the problem at hand. The SAM must satisfy certain conventions: "the rows and columns represent the income and expenditure accounts (respectively) of the various actors, and must always balance. A SAM is thus defined as a square matrix, with the totals of corresponding rows and columns always being equal", such that there are "no leakages or injections into the system and every flow must go from some actor to some other actor" (Robinson 1989, p.898).

For the purpose of calibrating the models and enabling us to evaluate their workings, I designed and completed the cells of a SAM targeted to a middle-income country (the Argentinean economy at the beginning of the Convertibility Plan in 1991), taking account of real and financial flows, and arrived at a SAM which is presented in a conceptual way below (in Figure 4-1). In the current accounts of the SAM, there are activities (sectors), commodities, factors, and the institutions included in the model: households, enterprises, government, rest of the world, commercial banks and the central bank. Each of the institutions in the current account has also a capital account which describes how it allocates its savings into financial and real investments. The categories of activities, commodities, factors, households and enterprises follow those already defined for the model. Payments in the SAM, as usual, are made from accounts in the columns to accounts in the rows. The description of the flows present in the SAM follows the order in which the accounts are presented there, going downward through its main diagonal:

- Activities (producers) gain their income from the commodities account and pay for intermediate inputs to commodities, for value added at factor cost to factors and for value-added tax to the government.
- Commodities gain their income from selling intermediate inputs to activities, consumption goods to households and government, exports to the rest of the world, and gross fixed physical investment to the (capital accounts of) the enterprises and the government[22]. Their income is spent on payments to activities (for production), to the rest of the world (for imports) and to the government (for taxes on imports and exports).
- Factors get their income from adding value to activities, and spend it on payments to households (labour income), enterprises (physical and working capital factors) and to the government (taxes on labour).
- Households receive after-tax labour income from factors, dividends from enterprises, transfers from the government and interest payments from banks (on domestic deposits), from government (on public bonds) and from non-residents (on deposits abroad). They allocate this income to consumption, paying interest on their bank loans, and savings.
- Enterprises receive (capital) factor income, transfers from the public sector and from domestic banks (in the case of private service enterprises) and interest payments on domestic deposits. They pay interests on their bank loans and taxes on their profits, saving a fraction of their post-tax profits and then distributing the rest among capitalist households and non-residents, these last two in proportions which depend on their equity shares.
- The government receives income from taxes and central bank profits, and in its current account spends on public consumption, transfers to households and enterprises, and interest payments on their bonds stock, saving the difference.
- Non-residents receive income from the country's imports, profits distributed by domestic firms to non-residents and interests on their holdings of domestic deposits and bonds, and pay for the country's exports and for interests on deposits abroad by domestic agents.
- Banks get interest payments on their loans to households and enterprises, their bond holdings and their deposits abroad. They pay interests on deposits to

[22] Changes in inventories are ignored to avoid unnecessary complicating the model.

households, enterprises, and non-residents, and on central bank rediscounts, transferring their profits to the service sector.

- The central bank receives income on its bond holdings, rediscounts and reserve deposits abroad, and transfers eventual profits to the central government.
- Households allocate their savings into acquiring currency, deposits in domestic banks (in local or foreign currency) and banks abroad, shares in enterprises and public bonds.
- Enterprises allocate their retained post-tax profits plus loans from banks to acquiring capital stock and domestic deposits.
- The government conducts public investment, financing it with own and/or borrowed savings – via selling public bonds to households, non-residents, commercial banks and the central bank.
- Non-residents allocate their savings to deposits in domestic banks, shares in domestic enterprises, and public bonds.
- Banks allocate the savings received by them to reserves at the central bank, lending to households, enterprises and non-residents, and the acquisition of public bonds.
- The central bank balances its liability increases and its asset increases. Its liabilities are composed of the monetary base (held by banks and households) and its assets by its holdings of public bonds, foreign reserves and rediscounts to commercial banks

Figure 4-1 Conceptual social accounting matrix for Argentina

		CURRENT ACCOUNTS									CAPITAL ACCOUNTS						
		Activities	**Commodities**	**Factors**	**Households**	**Enterprises**	**Government**	**Rest of the World**	**Banks**	**Central Bank**	**Households**	**Enterprises**	**Government**	**Rest of the World**	**Banks**	**Central Bank**	**TOTAL**
CURRENT ACCOUNTS	**Activities**		Supply matrix														
	Commodities	Intermediate Consumption			Private Consumption		Public Consumption	Exports				Private Investment	Public Investment				
	Factors	Value added at factor cost															
	Households			Factor income to households		Profits distributed by enterprises to households	Interests paid by government on hh's holdings of gov bonds **&** Gov transfers to hhs	Interests paid by non-residents on household deposits abroad	Interests paid by banks on household's deposits								
	Enterprises			Factor income to enterprises			Government transfers to enterprises		Interests paid by banks on enterprises deposits **&** Transfer of profits								
	Government	Taxes on value added	Taxes on imports and exports	Taxes on labor		Taxes on profits				Transfer of profits from Central Bank to gov							
	Rest of the World		Imports			Profits distributed by enterprises to non-residents	Interests paid by government on non-residents' holdings of gov bonds		Interests paid by banks on non-resident' deposits								
	Banks				Interests paid by households on bank loans	Interests paid by enterprises on bank loans	Interests paid by government on banks' holdings of gov bonds	Interests paid by non-residents on banks deposits abroad									
	Central Bank						Interests paid by government on central bank' holdings of gov bonds	Interests paid by non-residents on Central Bank foreign reserves	Interests paid by banks on rediscounts								
CAPITAL ACCOUNTS	**Households**				Household savings										Variation in loans by banks to households		Variation in households liabilities and net wealth
	Enterprises					Enterprise savings					Variation in property of enterprises by households			Variation in property of enterprises by non-residents	Variation in loans by banks to firms		Variation in firms liabilities and net wealth
	Government						Public Savings				Variation in household's holdings of public bonds			Variation in non-residents' holdings of public bonds	Variation in banks' holdings of public bonds	Variation in Central Bank's holdings of public bonds	Variation in government's liabilities and net wealth
	Rest of the World							Foreign savings			Variation in household's deposits abroad				Variation in banks' deposits abroad	Variation in Central Bank's foreign reserves	Variation in non-resident's liabilities and net wealth
	Banks										Variation in households' deposits at banks	Variation in firms' deposits at banks		Variation in non-residents' deposits at banks		Variation in rediscounts	Variation in bank's liabilities
	Central Bank										Variation in household's cash holdings				Variation in banks' reserve requirements		Variation in central bank's liabilities
	TOTAL										Variation in households assets	Variation in firms assets		Variation in non-residents assets	Variation in banks' assets	Variation in Central Bank's assets	

4.2 Calculating the cells of the Numeric SAM

The SAM cells are calculated in three main steps. First I prepare an aggregated proto-SAM, a table mostly based on National Accounts data where I keep activities, commodities, factors, households and enterprises aggregated into a single activity, a single commodity, etc, and where consistency is not assured: agents' sources of income do not necessarily match their uses. Second, I disaggregate the accounts in the proto-SAM using other sources, still without assuring consistency. Finally, I eliminate inconsistencies generating a consistent SAM based on the proto-SAM by minimising the "cross-entropy" distance between the SAM and the proto-SAM.

This distance in a previous version of the cross-entropy software prepared by Sherman Robinson, Andrea Cattaneo and Moataz El-Said (2000) was given by the Kullback-Leibler cross-entropy distance, which is equal to the expression $\sum_i \sum_j a_{ij} ln \frac{a_{ij}}{a_{ij}^0}$, with $\sum_i a_{ij} = 1$, where a_{ij} are the elements of the SAM, and a_{ij}^0 are those of the proto-SAM. In the present version, elaborated by Sherman Robinson and Scott Mc Donald, the cross-entropy technique estimates the cells of a consistent SAM assuming that the initial data are inconsistent and measured with error. The cross entropy minimand only includes probability weights for the various error support sets, which can be specified as additive or, as here, multiplicative, and that can affect specific cells, rows, columns, blocks, or macro aggregates. I imposed macro controls on GDP, aggregate demand components apart from private consumption (obtained as residual in National Accounts), and tax receipts. I modified the code slightly to assure that the sector-specific payments to capital match with the payments from capital to the sector-specific enterprises, and that the commodity shares in private investment are invariant across enterprises, to be consistent with the uniqueness of the composition of the private capital good assumed in the model. While the details of the construction of the Proto-SAM - steps 1 and 2 described above - can be seen in Appendix V, the final Numeric Macro-SAM can be seen below.

4.3 Exogenous parameters and calibration

The elasticities are choice parameters, except for those in the wage curve equations (0.10), which are taken from an econometric estimation for Argentina during the period of the Convertibility Plan, conducted by Damill, Frenkel et al (2002). Elasticities in the production function are 0.8, except for that of the skilled-capital composite, which is assigned a 0.2 value, reflecting evidence of low substitution between skilled labour and physical capital for middle-income countries, as reported by Agénor et al (2005, p.11). The elasticities in the import-domestic Armington function and export-domestic CET function are 4.5, and those for import origins and export destinations 1.5, reflecting especially low substitution and transformation possibilities between Mercosur area and the rest of the world[23]. The migration elasticity among segments of the labour market equals 0.1. The semi-elasticity in the investment function equals 0.2. Elasticities of money demand are 2 with respect to interest rate on deposits and 1 with respect to real GDP changes. Elasticities in the CES utility functions on asset earnings equal 1.05, such that the asset shares in the portfolios of capitalist households and banks tend to be quite stable (they would be stable with a value approaching 1).

In relation to the remaining choice parameters, the originally perceived probabilities of default were set at 0, the annual depreciation of the capital stock at 2 per cent, and the nominal exchange rate was fixed at 1. The sensitivity of the current account superavit (deficit) to the capital account deficit (superavit) was calculated as the benchmark ratio between them, resulting in the value 0.797. The natural unemployment rate was assumed to be relatively low (3 per cent).

As usual in CGE models, most initial prices are given a value of 1,[24] thus allowing one to directly read most values in the SAM as quantities: for example, by setting the initial PM (import price perceived by the purchaser) equal to 1, the benchmark QM (import quantity) is read directly from the value paid by buyers for imported commodities in the SAM. The setting of the original prices together with the use of benchmark data as identifying restrictions allows for the calibration of the remaining model parameters,

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[23] The elasticities in the CES and CET functions (ε) inform the ρ parameters which enter explicitly in the model, with $\rho=1/\varepsilon-1$ in the CES and $\rho=1/\varepsilon+1$ in the CET functions.

[24] Excluding those which are assigned as a function of other prices e.g. $pwmr_{c,r}$ in equation (2).

with the only exception of those in the LES consumption function. For example, for each commodity which is both imported and produced domestically, the scale (α_c^q) and the share parameters (δ_c^q) in the import-domestic Armington function are assigned using as identifying restrictions the Armington function and the import-domestic demand equilibrium ratio (eqs. 24 and 25), with the remaining elements in the equations already set: ρ_c^q from the exogenous Armington elasticity, the associated prices (PM and PD) from the arbitrary unitary setting, and the associated quantities (QQ,QD and QM) from reading values of absorption, domestic demand of domestic good and import of the commodity in the SAM. For the calibration of the marginal share ($\beta_{c,h}^m$) and subsistence ($\gamma_{c,h}^m$) consumption parameters, the Frisch parameters were taken from De Melo and Tarr (1992), and adjusted to assure Engel-Law-consistent elasticities, following the methodology explained in their Appendix B. The minimum wage for working capital is set at a value which does not bind the wage of working capital in any experiment ($1*10^{-12}$).

Chapter 5 Models sensitivity analysis

In this chapter I investigate the workings of the built models, comparing the results of a set of shocks across them. Given the focus of this thesis, I concentrate on shocks related to the foreign sector. I perform 10 simulations on the real, the real financial and the real financial augmented model, largely focusing the description on the main transmission mechanisms at work and results on the balance of payments with non-residents, Macro indicators, and household income distribution. The available set of parameters accounting for external shocks (tabulated below) include five where the impulse to the economy is given essentially via the capital account of the balance of payments ($pdef_{n,n'}$, RW, $\overline{\Delta DEP}_R$, $\overline{\Delta EQE}_e$ and $\overline{\Delta B}_R$) and five via the trade balance ($tmr_{c,r}$, $ter_{c,r}$, $pwmr_{c,r}$, $pwer_{c,r}$ and exr[25]).

Figure 5-1 Models parameters accounting for external shocks

Parameter	Description
$pdef_{n,n'}$	Probability of default perceived by institution n on payments of institution n'
$\overline{RW}$	Risk-free world interest rate
$\overline{\Delta DEP}_R$	Stock of non-residents' deposits in domestic banks
$\overline{\Delta EQE}_e$	Non-residents' holdings of equity in domestic firms
$\overline{\Delta B}_R$	Non-residents public bond holdings
$tmr_{c,r}$	Import taxes
$ter_{c,r}$	Export taxes
$pwmr_{c,r}$	World prices of imports
$pwer_{c,r}$	World prices of exports
exr	Nominal exchange rate (domestic-currency price of foreign currency)

For the sake of conciseness I report in detail the results of only two simulations, which illustrate the essential differences between the models: one relating to capital account (pdef) and the other to trade account (tmr) of the balance of payments. The results of the remaining simulations, which help improve our understanding of the models workings only marginally, are located in Appendix VI. In order to investigate the extent to which wage rigidies are critical in getting significant real effects from external shocks, I also consider the short-run version of the augmented model.

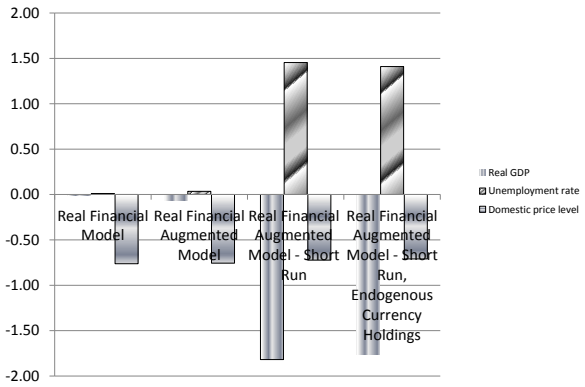
[25] The last simulation gives an impulse in the investment income component of the current account and in the capital account, as it changes the dollar-denominated value of assets denominated in local currency.

It is found that the factor market distortions introduced at the end play an important role. As a consequence, and in order to get a clear sense of the net contribution of the financial factors, the factor market distortions are also introduced into the non-financial model ("Real model, short run version") and the experiments are run on this version. Additionally, the experiments are carried on a variation of the short-run financial augmented model, where currency demand is made endogenous by specifying a simple transactions demand for money ($log(CURR_h) = \varepsilon_Y^{M^d}\ log(YH_h) + cdemh0_h$), where $\varepsilon_Y^{M^d} = 0.33$ as reported from an econometric estimation carried out for Argentina for the period 1993-1999 (Canavese et al. 2001).

5.1 Shock 1: 30 percentage points increase in perceived probability of default on domestic assets

This shock sets $pdef_{n,n'} = 0.30$ for every pair where n' (the liability holder) is a domestic institution. The figure below summarises the effects of the shock, according to the different models. It shows that, in all the financial models, the shock ends up leading to a contraction of the activity level, an increase in the unemployment rate and price deflation, with a significant economic contraction only in the short-run version of the augmented model, where GDP contracts 1.82 per cent and the unemployment rate increases 1.45 percentage points. I next describe the main transmission channels for this shock in each model.

Figure 5-2 Macro effects of 30 p.p. increase in perceived probability of default on domestic assets[26]



[26] Real GDP and domestic price level variations in percentages, unemployment rate variation in percentage points.

5.1.1 Real Model and Short-Run Real Model

These models are essentially non-financial and as such do not account for the effect of changes in the perceived probability of default on domestic assets.

5.1.2 Real Financial Model

The shock reduces the expected return on domestic assets, increases the relative return on foreign assets and hence gives a signal that leads capitalist households to reallocate their asset portfolios, substituting away from domestic into foreign assets. This reduces the initial net capital inflow to the economy, slowing down the accumulation of international reserves of the central bank and cutting the current account deficit that the economy is able to finance. The withdrawal of deposits by capitalist households from domestic banks, in turn, reduces the banks' asset portfolio size, leading banks to cut their deposits abroad together with other asset holdings, leading to raise the external capital inflow to banks by 0.52%, only partially offsetting the reduction in the capital account superavit.

Table 5-1 Balance of payments

	Base (B$)	% change
Current Account	-8.46	12.16
Trade Balance	3.44	32.72
Exports of Goods and NFS	21.51	2.59
Imports of Goods and NFS	18.07	-3.14
Investment Income	-11.90	-0.82
Interests	-10.91	-0.97
Profits and Dividends	-0.99	0.77
Capital Account	10.62	-12.16
Non Financial Private Sector	7.50	-17.28
Public Sector	1.99	FIXED
Commercial Banks	1.13	0.52
Balance of Payment Result	2.16	-12.16

With a fixed nominal exchange rate, the reduction in the current account deficit is achieved through domestic deflation, which causes a depreciation in the real exchange rate and increases the country's trade superavit: the total value of exports increases and that of imports falls, thus increasing the share of exports and decreasing that of imports in aggregate demand, as shown in the following table.

Table 5-2 Aggregate demand component shares

	Base (%)	p.p. change
Absorption	98.20	-0.61
Private Consumption	77.35	-0.58
Fixed Investment	15.37	-0.03
Public Consumption	5.49	0.00
Exports	11.22	0.38
Imports	-9.43	-0.23
GDP (C+I+G+E-M)	100.00	0.00

With export prices fixed, producer prices fall proportionately less in the tradable sectors, providing incentives for the economy to mobilise resources out of construction and private services sectors toward the sectors producing tradable commodities. This shift leads to an increase in the shares of the primary sector and industry in total value added, which in turn allows for the increase in exports and import substitution, as noted above.

Table 5-3 Sector value added shares

	Base (%)	p.p. change
Primary	7.9	0.07
Industry	18.0	0.05
Construction	5.5	-0.01
Private Services	61.6	-0.11
Public Services	7.1	0.00
Total	100.0	FIXED

The fall in domestic prices lowers the demand for factors at given nominal wages and leads to cuts in the nominal wage of every factor[27] and marginal cuts in the use of formal workers.

Table 5-4 Factor use

	Base (mill. individuals)	% change
Formal Skilled	1.43	-0.01
Formal Unskilled	7.39	-0.02

With the growing primary sector a particularly intensive user of informal unskilled workers, real wages end up changing in their favour.

[27] Not tabulated.

Table 5-5 Real wages

	Base	% change
Formal Skilled	16.82*	-0.02
Formal Unskilled	9.29*	-0.01
Informal Unskilled	9.29*	0.20
Capital	0.20 (%)	-0.05

*In thousands of Argentinean pesos per year per worker.

The reduction in the central bank's international reserves leads to contract the monetary base by 2.64 per cent, and to drop real liquidity in the economy even after accounting for the 0.76 per cent fall in the CPI, so that bank rates shift upward. The return on equity falls in every sector except the primary one which, being highly export-intensive, is fairly insulated from the falls in revenue caused by domestic deflation.

Table 5-6 Rates of return

	Base (%)	p.p. change
Bonds	48.7	0.53
Deposits	23.0	0.22
Equity, primary	20.7	0.16
Equity, industry	20.6	-0.07
Equity, construction	21.2	-0.30
Equity, private services	23.5	-0.29
Loans	35.0	0.34

The falls in domestic prices, wages, employment and output lower the tax base for direct and indirect taxes and public revenue by 0.73 per cent, as shown in the following table. As a result, both the public deficit and the public sector supply of bonds increase; the price of the latter lowers and its rate of return increases (0.53 p.p. - Table 5-6). In turn, the higher rate paid by the public sector on its bonds has an immediate reinforcing effect on the public sector deficit, which shows a final increase of 1.14 per cent. The increase in the public deficit is balanced by higher private savings (reflecting the investment-driven savings assumption), which lowers private consumption demand as evidenced in the fall of the share of consumption (-0.58 p.p.) in aggregate demand in Table 5-2.

Table 5-7 Public sector finance

	Base (B$)	% change
Total Revenue	21.18	-0.73
Direct Taxes	9.50	-0.74
Indirect Taxes	11.68	-0.72
Total Expenditure	53.65	0.19
Consumption	10.52	-0.77
Transfers	12.11	FIXED
Domestic Interest Payments	16.91	0.17
Foreign Interest Payments	13.25	1.25
Investment	0.85	-0.77
Total Financing	32.47	1.14
Non-Financial Private Sector	11.99	0.36
Bank	2.40	-1.87
Central bank	16.09	FIXED
Rest of the World	1.99	FIXED

These changes in turn lead to a marginal increase in the income share of informal unskilled workers that, in parallel to a fall in dividend payments due to domestic deflation, marginally reduces the share of capitalist households and raises that of the unskilled households (both by 0.08 p.p.).

Table 5-8 Factor income shares

	Base (%)	p.p. change
Formal Skilled	13.2	0.00
Formal Unskilled	37.7	-0.01
Informal Unskilled	14.1	0.03
Physical Capital	35.0	-0.02

Table 5-9 Household income shares

	Base (%)	p.p. change
Skilled	14.1	0.00
Unskilled	64.6	0.08
Capitalist	21.3	-0.08

To sum up, in this model the increase in the perceived probability of default on domestic assets generates a capital outflow that leads to a real devaluation. This, in turn, leads resources to shift to the tradable sectors, without significantly affecting the

domestic activity level, and slightly shifting income distribution in favour of the unskilled RHG and against the capitalist RHG.

5.1.3 Real Financial Augmented Model

The deposit contraction generated by the shock reduces the supply of working capital loans by banks (1.16 per cent[28]), in turn negatively affecting the productivity of and the producers' demand for real factors, besides the negative effect of falling prices on factor demand and use. The economic contraction is larger than in the real financial model, but is still negligible: the effects on the use of formal workers (-0.03 per cent skilled, -0.06 per cent unskilled[29]), on the unemployment rate (0.04 p.p.) and on total output (-0.06) are relatively insignificant.

Besides, the contraction of the capital inflow worsens the capital account balance. With investment income relatively unaffected, the economy is forced to significantly improve its trade balance. This calls for a real devaluation that gives incentives for the economy to mobilise factors to the tradable sectors, allowing exports to rise and imports to fall, as shown in the following table.

Table 5-10 Balance of payments

	Base (B$)	% change
Current Account	-8.46	12.27
Trade Balance	3.44	33.05
Exports of Goods and NFS	21.51	2.58
Imports of Goods and NFS	18.07	-3.22
Investment Income	-11.90	-0.84
Interests	-10.91	-0.99
Profits and Dividends	-0.99	0.81
Capital Account	10.62	-12.27
Non-Financial Private Sector	7.50	-17.44
Public Sector	1.99	FIXED
Commercial Banks	1.13	0.55
Balance of Payment Result	2.16	-12.27

With regard to distribution, real wages increase for working capital (driven by its supply contraction) and for the informal unskilled (as before) (Table 5-11), driving changes in factor income shares (Table 5-12).

[28] Not tabulated.
[29] Not tabulated.

Table 5-11 Real wages

	Base	% change
Formal Skilled	16.82*	-0.06
Formal Unskilled	9.29*	-0.03
Informal Unskilled	9.29*	0.15
Physical Capital	0.20 (%)	-0.19
Working Capital	0.35 (%)	2.28

*In thousands of Argentinean pesos per year per worker.

Table 5-12 Factor income shares

	Base (%)	p.p. change
Formal Skilled	13.2	0.00
Formal Unskilled	37.7	-0.01
Informal Unskilled	14.1	0.03
Physical Capital	31.7	-0.05
Working Capital	3.3	0.04
Total	100.0	FIXED

At the household level, the income share of the unskilled increases, and that of capitalist households falls in similar magnitudes to those in the real-financial model: the contraction of the income share of physical capital more than offsets the working capital share increase, as the share of the former in factor income is much larger (31.7% vs. 3.3%), as shown in Table 5-12.

Table 5-13 Household income shares

	Base (%)	p.p. change
Skilled	14.1	0.00
Unskilled	64.6	0.08
Capitalist	21.3	-0.08

Overall, and as in the real financial model, the shock generates a capital outflow with marginal effects on the activity level (-0.06 per cent) and the unemployment rate (+0.04 p.p.). It also has a deflationary effect (CPI lowers 0.76 per cent), and leads to a slight fall in the capitalist RHG income share and a slight raise in that of the unskilled RHG in the same magnitudes as in the previous model (0.08 p.p.).

5.1.4 Real Financial Augmented Model, Short-Run Version

In its short-run version, this model suggests that there are indeed significant short-run effects on unemployment (+1.45 p.p.) and the activity level (-1.82 per cent), together with deflation in the order of magnitude seen in the previous models (0.72 per cent).

Table 5-14 Macro indicators

	Base	change
Real GDP	189.86*	-1.82%
Unemployment rate **	14.0	1.45
CPI	1.00	-0.72%

* In billions of Argentinean pesos
** Base in percentage terms, change in percentage points

As in the standard version of this model, the capital outflow forces the economy to improve its trade balance (Table 5-15) by moving resources towards the tradable sectors, and reduces the availability of working capital in the economy, causing a fall in the productivity of, and demand for, real factors.

Table 5-15 Balance of payments

	Base (B$)	% change
Current Account	-8.46	16.61
Trade Balance	3.44	51.17
Exports of Goods and NFS	21.51	2.96
Imports of Goods and NFS	18.07	-6.22
Investment Income	-11.90	-2.99
Interests	-10.91	-3.54
Profits and Dividends	-0.99	2.96
Capital Account	10.62	-16.61
Non-Financial Private Sector	7.50	-23.88
Public Sector	1.99	FIXED
Commercial Banks	1.13	2.51
Balance of Payment Result	2.16	-16.61

However, in the present model this leads to quantity rather than price adjustments: with physical capital capacity utilisation being flexible, the use of the physical capital stock falls by more than 2 per cent; and with wage curves that leave the nominal wages of formal workers essentially fixed, employers' use of formal workers shrinks (1.95 per cent skilled, 2.27 per cent unskilled) (Table 5-16). In the short run, the increase in the perceived probability of default generates thus a significant cut in the use of formal

labour, physical capital and working capital (1.91%), resulting in a significant contraction in the activity level (1.82 per cent).

Table 5-16 Factor use

	Base*	% change
Formal Skilled	1.43	-1.95
Formal Unskilled	7.39	-2.27
Physical Capital	288.65	-2.02
Working Capital	17.15	-1.91

*Workers in millions of individuals. Capital in billions of Argentinean pesos

The contraction of the economy reduces firms' profits and lowers the return on equity in every sector, as shown in Table 5-17. The contraction also significantly reduces the demand for working capital at given nominal wage and leads to falls in the nominal remuneration of working capital, bank loans (-0.48 p.p.) and bank deposits (-0.32 p.p.). Public revenue falls with the contraction of the economy more severely than before, which in turn causes an increase in the government deficit and in the supply of public bonds, which leads to a fall in the price of bonds and hence an increase in their return of 1.79 p.p.

Table 5-17 Rates of return

	Base (%)	p.p. change
Bonds	48.7	1.79
Deposits	23.0	-0.32
Equity, primary	20.7	-0.28
Equity, industry	20.6	-0.66
Equity, construction	21.2	-0.35
Equity, private services	23.5	-0.78
Loans	35.0	-0.48

Household income distribution moves in the same direction as in the previous models, driven now not only by the sector reallocation of production, but also by the real wage increase for formal workers (whose nominal wage is rigid in the short run): the unskilled RHG increases its income share and the capitalist one decreases its own by 0.09 p.p., as the negative effect on equity return earned by capitalist households is larger.

Table 5-18 Household income shares

	Base (%)	p.p. change
Skilled	14.1	0.00
Unskilled	64.6	0.09
Capitalist	21.3	-0.09

To sum up, in this model the capital outflow mobilises resources to the tradable sectors with similar distributional effects to in the previous financial models. However, there is now an additional relevant transmission channel at work: formal labour wage rigidity. In contrast to the previous models, this leads the capital outflow to significantly reduce the activity level in the short-run.

The results of this model are laid out in Figure 5-3.

5.1.5 Real Financial Augmented Model, Short-Run Version, Endogenous Currency Holdings

As can be seen in the following table, the short-run effects when currency holdings are explained in terms of transactions demand are similar than when currency holdings are simply kept exogenous. Real GDP falls 1.76 per cent (instead of 1.82 per cent), the unemployment rate increases 1.41 p.p. (instead of 1.45 p.p.), and the CPI falls by 0.71 per cent (instead of 0.72 per cent).

Table 5-19 Macro indicators

	Base	change
Real GDP	189.86*	-1.76%
Unemployment rate **	14.0	1.41
CPI	1.00	-0.71%

* In billions of Argentinean pesos
** Base in percentage terms, change in percentage points

The balance of payments with non-residents suffer variations in the same direction than when households keep the currency holdings constant, and with magnitudes which are quite close to the previous model variation. For example, the increase in the probability of default perceived by domestic actors ends up reducing the superavit of the balance of payments by 16.44 per cent instead of 16.61 per cent.

Table 5-20 Balance of payments

	Base (B$)	% change
Current Account	-8.46	16.44
Trade Balance	3.44	50.04
Exports of Goods and NFS	21.51	2.91
Imports of Goods and NFS	18.07	-6.06
Investment Income	-11.90	-2.79
Interests	-10.91	-3.30
Profits and Dividends	-0.99	2.88
Capital Account	10.62	-16.44
Non-Financial Private Sector	7.50	-23.53
Public Sector	1.99	FIXED
Commercial Banks	1.13	1.83
Balance of Payment Result	2.16	-16.44

As in the previous version of the model, factor use falls for formal workers, physical capital and working capital, with magnitudes which are only slightly smaller. This is essentially due to the fact that as the prices faced by consumers fall (as in the previous model), households nominal demand for currency also fall slightly (0.64 per cent for the skilled RHG, 0.60 per cent for the unskilled RHG, and 0.78 per cent for the capitalist RHG[30]), allowing households to mitigate their reduction of deposits in domestic banks, and banks to mitigate their reduction of working capital loans to enterprises. Compared to the previous version of the model, the productivity of the real factors is thus slightly larger, giving firms an incentive to slightly mitigate their reduction of factor use.

Table 5-21 Factor use

	Base*	% change
Formal Skilled	1.43	-1.88
Formal Unskilled	7.39	-2.20
Physical Capital	288.65	-1.95
Working Capital	17.15	-1.72

*Workers in millions of individuals. Capital in billions of Argentinean pesos

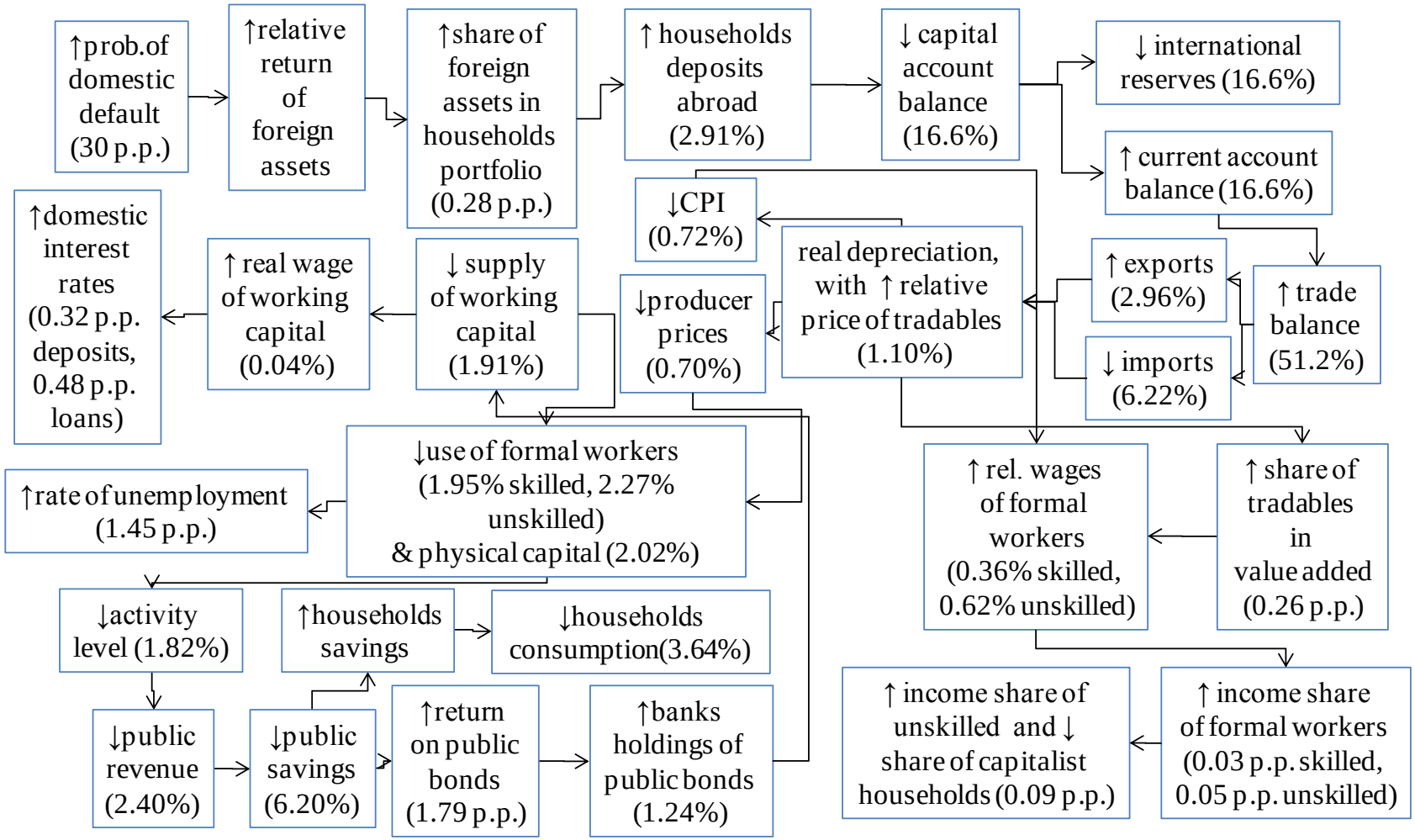
In the end, the distribution of income among representative household groups changes as in the previous model version, with an increase in the share of the unskilled RHG and a fall in the one of the capitalist one, with the same magnitudes than in the previous version of the model.

[30] Not tabulated.

Table 5-22 Household income shares

	Base (%)	p.p. change
Skilled	14.1	0.00
Unskilled	64.6	0.09
Capitalist	21.3	-0.09

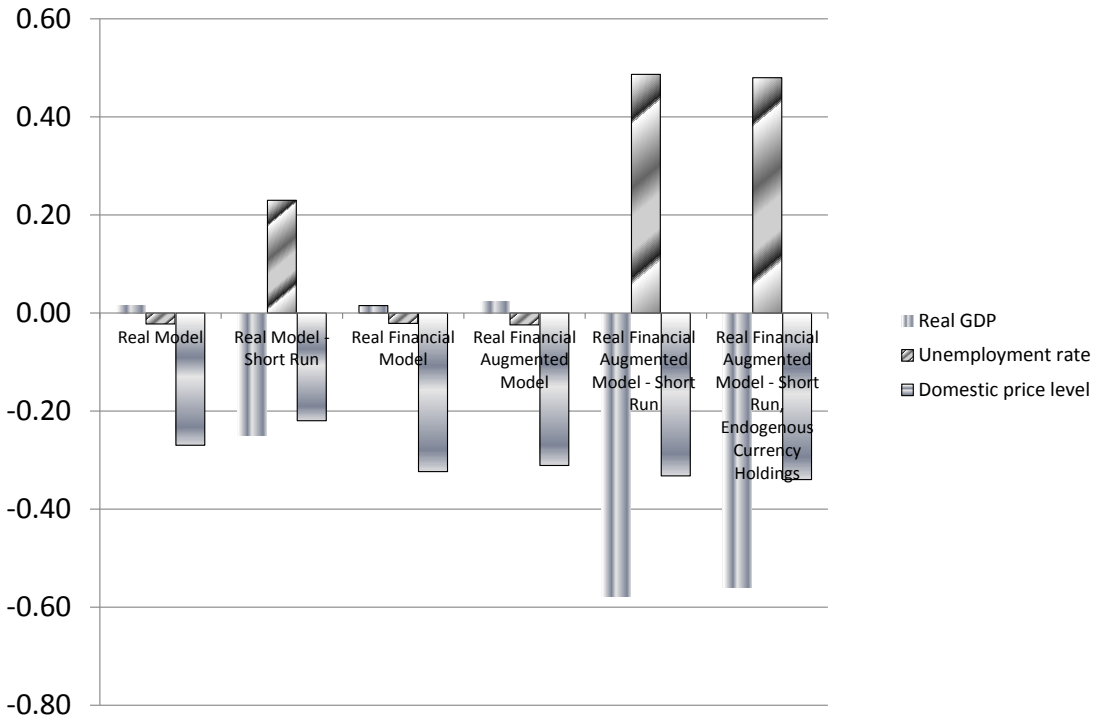
Figure 5-3 Transmission channels for a 30 p.p. increase in the perceived probability of default on domestic assets in the short run



5.2 Shock 2: 10 per cent fall in import taxes

To deepen the investigation of the workings of the set of models, I next simulate a shock which is related to the trade account of the balance of payments. As can be seen in the following summary graph, a fall in import taxes – as in the previous shock – only has significant effects on the overall levels of activity and unemployment in the short-run versions of the real and real-financial models, with the effects being larger in the case of the real-financial ones. In the following, I describe the main transmission channels by which this shock ripples through the economy in each version of the model.

Figure 5-4 Macro effects of 10 per cent fall in import taxes [31]



5.2.1 Real Model

The original tariff rate uniformly affects imports across the board at the level of 5.7 per cent. The 10 per cent fall in import taxes lowers the import prices perceived by domestic buyers by 0.57 per cent and increases the ratio of imports to GDP (+0.13 p.p.) (Table

[31] Real GDP and domestic price level variations in percentages, unemployment rate variation in percentage points.

5-23). Also, through its direct effect on public revenue (-0.58 per cent), it increases the financing needs of the public sector (0.46 per cent).

Table 5-23 Aggregate demand components shares

	Base (%)	p.p. change
Absorption	98.20	0.00
Private Consumption	77.35	0.00
Fixed Investment	15.37	0.00
Public Consumption	5.49	0.00
Exports	11.22	0.13
Imports	-9.43	0.13
GDP (C+I+G+E-M)	100.00	0.00

In order to increase imports, domestic purchasers substitute away from domestically produced goods, which generates excess supply of domestic goods and leads to a fall in domestic prices, still allowing for a fall in the relative price of imports (of 0.28 per cent). The fall in domestic prices, in turn, leads to an increase in the relative price of exports (0.23 per cent overall), giving producers an incentive to increase exports (export GDP share increases 0.13 p.p., leaving absorption unaltered), as shown in the following table. The capital account balance is unaffected in this model, which only accounts for the workings of the real sphere of the economy.

Table 5-24 Balance of payments

	Base (B$)	% change
Current Account	-8.46	FIXED
Trade Balance	3.44	-0.05
Exports of Goods and NFS	21.51	0.95
Imports of Goods and NFS	18.07	1.14
Investment Income	-11.90	0.01
Interests	-10.91	FIXED
Profits and Dividends	-0.99	0.16
Capital Account	10.62	FIXED
Non Financial Private Sector	7.50	FIXED
Public Sector	1.99	FIXED
Commercial Banks	1.13	FIXED
Balance of Payment Result	2.16	FIXED

As a result of the increase in both imports and exports, the degree of openness (measured as the trade/GDP ratio) goes up (by 0.26 p.p.), and mobile factors marginally

shift to the sectors producing export goods (the primary sector value-added share increases 0.012 p.p. and that of industry 0.002 p.p.)[32].

Table 5-25 Sector value added shares

	Base (%)	p.p. change
Primary	7.9	0.012
Industry	18.0	0.002
Construction	5.5	0.000
Private Services	61.6	-0.013
Public Services	7.1	-0.001
Total	100.0	0.000

Given that the prices of imports fall by more than the price of domestically produced goods, the CPI (which includes imports) falls by more than the GDP deflator (0.27 vs. 0.21 per cent, respectively), leading in turn to an increase in CPI-deflated factor wages, especially for those factors for which the real wage is allowed to vary freely to achieve market equilibrium (informal unskilled workers and physical capital).

Table 5-26 Real wages

	Base*	% change
Formal Skilled	16.82	0.02
Formal Unskilled	9.29	0.02
Informal Unskilled	9.29	0.13
Capital	0.20	0.09

*Labor wages in thousands of A$ per year, capital wages in percentage.

The higher increases in the real wages of informal unskilled labour and capital increases their factor income shares slightly (by 0.01 per cent each) and reduces those of the formal factors (Table 5-27)[33].

[32] Imports and exports in the same sector can co-exist given the presence of different varieties within each sector of activity that was accounted in the model.
[33] The relatively low elasticities in the formal wage curves (0.1) account for the small quantity effect in the real wage bill of the formal workers.

Table 5-27 Factor income shares

	Base (%)	p.p. change
Formal Skilled	13.2	-0.01
Formal Unskilled	37.7	-0.01
Informal Unskilled	14.1	0.01
Physical Capital	35.0	0.01

Capitalist households, which receive dividends associated with the capital factor income, increase their share in household income, the (formal) skilled decrease theirs, and the unskilled keep their share constant given offsetting effects of changes in formal and informal unskilled factor income shares.

Table 5-28 Household income shares

	Base (%)	p.p. change
Skilled	14.1	-0.01
Unskilled	64.6	0.00
Capitalist	21.3	0.01

Overall, in this model the degree of openness of the economy increases (0.26 p.p.), income distribution changes in favour of the capitalist households, and factor use, the unemployment rate and real GDP do not suffer significant variations. There are negligible expansions of factor use and the activity level, a result generated by the wage curve working in reverse: as the fall in the CPI increases real wages, it leads to lower the unemployment rates, increasing the employment and production levels.

5.2.2 Real Model – Short Run

As in the original version of the real model, and by the same transmission channels, the tariff reduction leads to a fall in the price of imports, and increases in imports and exports as shares of aggregate demand. However, differently than in that version, there are contractions in factor use (commented below) that reduce household income and households consumption, in absolute terms[34] and as a share of aggregate demand, as can be seen in the following table.

[34] Not tabulated.

Table 5-29 Aggregate demand components shares

	Base (%)	p.p. change
Absorption	98.20	-0.01
Private Consumption	77.35	-0.07
Fixed Investment	15.37	0.04
Public Consumption	5.49	0.02
Exports	11.22	0.13
Imports	-9.43	0.13
GDP (C+I+G+E-M)	100.00	0.00

With the increase in exports and the fall of consumption as shares of aggregate demand, factors shift out of the private services sector and into the primary (export-oriented) sector. In parallel, the increase in imports leads to a fall in the share of the industrial sector in value added, which produces import-substitutes in a relatively intensive way.

Table 5-30 Sector value added shares

	Base (%)	p.p. change
Primary	7.9	0.03
Industry	18.0	-0.02
Construction	5.5	0.01
Private Services	61.6	-0.04
Public Services	7.1	0.01
Total	100.0	0.00

The fall in import prices leads to falls in output prices that reduce the factor demand at given nominal wages. In the case of formal workers, whose wages are nominally fixed, their real wages increase (0.16 per cent skilled, 0.21 per cent unskilled) and their employment level falls (0.26 per cent skilled, 0.36 per cent unskilled), as can be seen in the following two tables. The contraction of the industrial and private services sectors reduces the demand for physical capital in these sectors, leading to an overall fall in the rate of utilization of the physical capital stock (0.26 per cent). The commented reduction in the use of formal workers and physical capital reduces the productivity and hence the real wage of the informal unskilled workers, as can be seen in the following table.

Table 5-31 Real wages

	Base*	% change
Formal Skilled	16.82	0.16
Formal Unskilled	9.29	0.21
Informal Unskilled	9.29	-0.21
Capital	0.20	0.02

*Labor wages in thousands of A$ per year, capital wages in percentage.

Table 5-32 Factor use

	Base*	% change
Formal Skilled	1.43	-0.26
Formal Unskilled	7.39	-0.36
Physical Capital	288.65	-0.26

*Workers in millions of individuals. Capital in billions of Argentinean pesos

Accordingly, the factor income shares change in favour of the formal workers (driven by real wage increases that exceed those of the other factors), and against physical capital, which suffers a fall in its capacity utilization rate without a significant change in its real wage[35].

Table 5-33 Factor income shares

	Base (%)	p.p. change
Formal Skilled	13.2	0.01
Formal Unskilled	37.7	0.01
Informal Unskilled	14.1	0.00
Physical Capital	35.0	-0.02

As a consequence, the distribution of income among representative household groups changes slightly in favour of the skilled. Given that the capitalist household has a higher share of nominally fixed income[36], in a context of falling incomes it loses a smaller share than the unskilled one.

Table 5-34 Household income shares

	Base (%)	p.p. change
Skilled	14.1	0.003
Unskilled	64.6	-0.002
Capitalist	21.3	-0.001

[35] The real wage of physical capital is constant against the GDP deflator, but varies in relation to the CPI.
[36] Interest flows are fixed in this model.

Overall, and by the transmission channels mentioned above, it can be seen that in this version of the real model the tariff reduction leads to a perceivable contraction of the factors use and the activity level and to a slight change in income distribution in favour of the skilled households that did not occur in the original version of the model.

5.2.3 Real Financial Model

When the workings of the financial sphere are included in the model, the real sphere works to a large extent similarly to the real model. The total import ratio increases (0.11 p.p.), public revenues moves downwards (0.65 per cent) and the public deficit moves upwards (1.15 per cent). There are no significant changes in overall factor use, the unemployment rate or real GDP, with the major changes basically affecting output composition, wages and prices, but not the overall output level.

There is some deflation in the domestic economy, and factor reallocation in favour of producing export goods, which together with higher imports contributes to an increase in the degree of openness (0.28 p.p.). Real wages increase, especially for physical capital and informal unskilled workers, again leading capitalist households to increase their income share and skilled ones to decrease theirs, as shown in the following table.

Table 5-35 Household income shares

	Base (%)	p.p. change
Skilled	14.1	-0.01
Unskilled	64.6	0.00
Capitalist	21.3	0.01

In the financial side of the economy, CPI deflation increases real liquidity and leads to a fall in the returns on bank deposits (-0.02 p.p.) and loans (-0.03 p.p.). Primary producers, who increase their share of export output to reduce the pervasive effects of the domestic deflation on their profits, and who benefit from the fall in intermediate input prices, see their profits and equity return increase (+0.03 p.p.). The other sectors also benefit from the fall in input prices but are more harmed by direct import competition and/or a fall in output prices, seeing a fall in their profits and equity returns, as shown in the following table.

Table 5-36 Rates of return

	Base (%)	p.p. change
Bonds	48.7	0.28
Deposits	23.0	-0.02
Equity, primary	20.7	0.03
Equity, industry	20.6	-0.05
Equity, construction	21.2	-0.06
Equity, private services	23.5	-0.08
Loans	35.0	-0.03

The public sector, in order to finance a higher deficit, needs to pay a higher return on its debt (+0.28 p.p.). The changes in returns lead capitalist households to substitute away from non-primary equity into primary equity, public bonds and deposits abroad; and banks to substitute away from loans into deposits abroad.[37] These changes affect the balance of payments with real-sphere consequences: the increase in the return on public bonds augments the net interest payment to non-residents (and residents) who hold domestic public bonds, and the increase in deposits abroad reduces the capital account superavit[38] (as in Shock 1). To compensate for the increase in the payments to non-residents, the economy needs to increase its trade superavit by 3.35 per cent, which calls for a higher fall in domestic prices and a more intense shift to the sectors producing export goods.

Table 5-37 Balance of payments

	Base (B$)	% change
Current Account	-8.46	0.55
Trade Balance	3.44	3.35
Exports of Goods and NFS	21.51	1.21
Imports of Goods and NFS	18.07	0.80
Investment Income	-11.90	-0.58
Interests	-10.91	-0.65
Profits and Dividends	-0.99	0.26
Capital Account	10.62	-0.55
Non-Financial Private Sector	7.50	-0.82
Public Sector	1.99	FIXED
Commercial Banks	1.13	0.28
Balance of Payment Result	2.16	-0.55

[37] Not tabulated.
[38] The additional interest inflow only partially offsets the effects of the increase in the return on public bonds on the net interest payments.

Overall, the real financial model provides a structural adjustment story which is conceptually similar to that of the real model, adding changes in financial portfolios which end up leading to an increase in net exports that affect output composition. There are no significant effects on the activity level, and income distribution changes in a similar way to that in the real model, benefitting capitalist households.

5.2.4 Real Financial Augmented Model

When the productive function of working capital is taken into account, the deflation generated by lower import prices – and corresponding demand substitutions - leads to a small increase in the (real) supply of working capital (0.15 per cent). This allows the economy to increase production only marginally above the level resulting from the previous model (real GDP grows 0.022 per cent instead of 0.015 per cent), given the relatively small share of working capital in value added. With an inelastic demand for working capital[39], the increase in its supply leads in turn to a proportionally larger fall in its real wage (0.18 per cent), as shown in the following table. As in the previous model, the real wages of the other factors shift upwards, especially for informal unskilled workers and physical capital.

Table 5-38 Real wages

	Base	% change
Formal Skilled	16.82*	0.03
Formal Unskilled	9.29*	0.02
Informal Unskilled	9.29*	0.18
Physical Capital	0.20 (%)	0.13
Working Capital	0.35 (%)	-0.18

*In thousands of Argentinean pesos per year per worker.

The fall in the real wage of working capital lowers the financial cost of physical investment more than in the previous model, and induces firms to increase their physical investment, crowding out private consumption and leading in turn to an increased demand for the construction sector. The value-added shares of primary and industrial production increase, through the same transmission channels as in the previous model.

[39] Elasticities in the production function are between 0.2 and 0.8, as explained in the calibration section.

Table 5-39 Sector value added shares

	Base (%)	p.p. change[40]
Primary	7.9	0.02
Industry	18.0	0.01
Construction	5.5	0.01
Private Services	61.6	-0.03
Public Services	7.1	0.00
Total	100.0	0.00

The factor reallocation, as before, makes it possible to increase exports and thus to improve the trade balance, compensating for the capital outflow generated by the generalised fall in the returns on domestic assets, as analysed for the previous model.

Table 5-40 Balance of payments

	Base (B$)	% change
Current Account	-8.46	0.64
Trade Balance	3.44	3.12
Exports of Goods and NFS	21.51	1.20
Imports of Goods and NFS	18.07	0.83
Investment Income	-11.90	-0.44
Interests	-10.91	-0.51
Profits and Dividends	-0.99	0.24
Capital Account	10.62	-0.64
Non-Financial Private Sector	7.50	-0.95
Public Sector	1.99	FIXED
Commercial Banks	1.13	0.25
Balance of Payment Result	2.16	-0.64

To sum up, the effect of including money in the production function on the activity level is of second order, partly due in turn to the small share of working capital in total value added (3.3%). The fall in the cost of financing physical investment shifts this aggregate demand component upwards. The distributional results at the level of representative household groups are similar to those in the previous model, as shown in the following table.

[40] A rounding error avoids the sum of the percentage point changes summing zero.

Table 5-41 Household income shares

	Base (%)	p.p. change
Skilled	14.1	-0.01
Unskilled	64.6	0.00
Capitalist	21.3	0.01

5.2.5 Real Financial Augmented Short-Run Model

When short-run rigidities in the factor markets are accounted for, the fall in factor demands at given nominal wages leads to a generalised fall in factor use. The use of formal skilled workers falls by 0.63 per cent, that of formal unskilled workers by 0.77 per cent, that of physical capital by 0.64 per cent, and that of working capital by 0.09 per cent. This, in turn, generates a significant increase in the unemployment rate (0.49 per cent) and a sizable contraction of the activity level (0.58 per cent).

Table 5-42 Factor use

	Base*	% change
Formal Skilled	1.43	-0.63
Formal Unskilled	7.39	-0.77
Physical Capital	288.65	-0.64
Working Capital	17.15	-0.09

*Workers in millions of individuals. Capital in billions of Argentinean pesos

As in the previous model, the shock leads to a capital outflow which calls for an increase in the aggregate demand share of net exports, which is in turn allowed by a fall in that of private consumption. Besides, as the real wage of working capital falls (0.93%)[41], the cost of physical investment shifts downwards, allowing fixed investment to increase its share in aggregate demand.

[41] Not tabulated.

Table 5-43 Aggregate demand components shares

	Base (%)	p.p. change
Absorption	*98.20*	*-0.18*
Private Consumption	77.35	-0.37
Fixed Investment	15.37	0.14
Public Consumption	5.49	0.05
Exports	11.22	0.25
Imports	-9.43	0.06
GDP (C+I+G+E-M)	*100.00*	*0.00*

At the sector level, the primary sector increases its share consistently with the increase in exports, construction increases its share to satisfy the demand for new physical capital, and the public sector share increases given the combination of fall in domestic output and exogenous public expenditures, as shown in the following table.

Table 5-44 Sector value-added shares

	Base (%)	p.p. change
Primary	7.9	0.08
Industry	18.0	-0.02
Construction	5.5	0.04
Private Services	61.6	-0.13
Public Services	7.1	0.03
Total	100.0	0.00

The increase of the primary sector share in value-added drives the factor demand toward unskilled workers. This, in combination with the increase in the real wage of formal workers (generated by the CPI deflation), allows the unskilled RHG to marginally increase its income share, to the detriment of skilled and capitalist RHGs, as shown below.

Table 5-45 Household income shares

	Base (%)	p.p. change
Skilled	14.1	-0.002
Unskilled	64.6	0.003
Capitalist	21.3	-0.001

To sum up, in the short run the fall in import tariffs leads to a domestic price drop that raises real factor wages. This leads firms to lower their factor use, generating a sizable contraction of the activity level. Furthermore, the domestic price fall in turn reduces profits of domestic enterprises in most sectors, leading to a capital outflow that

generates a real depreciation of the domestic currency and gives producers an incentive to mobilise factors to increase exports. The corresponding sector reallocation, in combination with the increase in real wages for the formal workers –who have nominally fixed wages in the short run – ends up increasing the income share of the unskilled RHG in detriment of that of the remaining RHGs. A diagram with the most relevant transmission channels is laid out in Figure 5-5

5.2.6 Real Financial Augmented Model, Short-Run Version, Endogenous Currency Holdings

As can be seen in Figure 5-4, the results at the macro level are essentially the same than in the version of this model with exogenous currency holdings. Also as in that version, the income distribution changes slightly in favour of the unskilled representative household group. Interestingly, and differently than in the previous model, as the nominal incomes of the households fall (in the range of 0.62 – 0.66 per cent), their currency holdings fall, too (in the range of 0.20 – 0.21 per cent), freeing some financial wealth to enter into the bank in the form of deposits and increase their supply of working capital to firms. However, the increase in working capital is quite small in relative terms (less than 0.1%), and as a consequence the generated fall of the activity level is not too different from the previous version of the model (0.56 per cent here, 0.58 per cent with exogenous currency demand[42]).

5.3 Conclusions

The inclusion of the financial dimension – endogeneising the evolution of a matrix of financial assets and liabilities among institutions and their returns – without either wage rigidities or a working capital channel does not cause the macro results in the real sphere to change significantly in shocks related either to the trade or the capital account of the balance of payments. However, while one would have expected that the inclusion of a transmission channel in the tradition of "money in the production function" by itself would cause the financial outcomes of the capital and trade account shocks to significantly affect the overall level of production and the unemployment rate, this only proved to be the case in the presence of strong wage rigidities. One of the reasons for the insufficiency of the working capital transmission channel, by itself, to significantly affect production, lies in its size, as measured by the contribution of working capital to total value-added in the calibrated model. The other lies in the relative stability of the

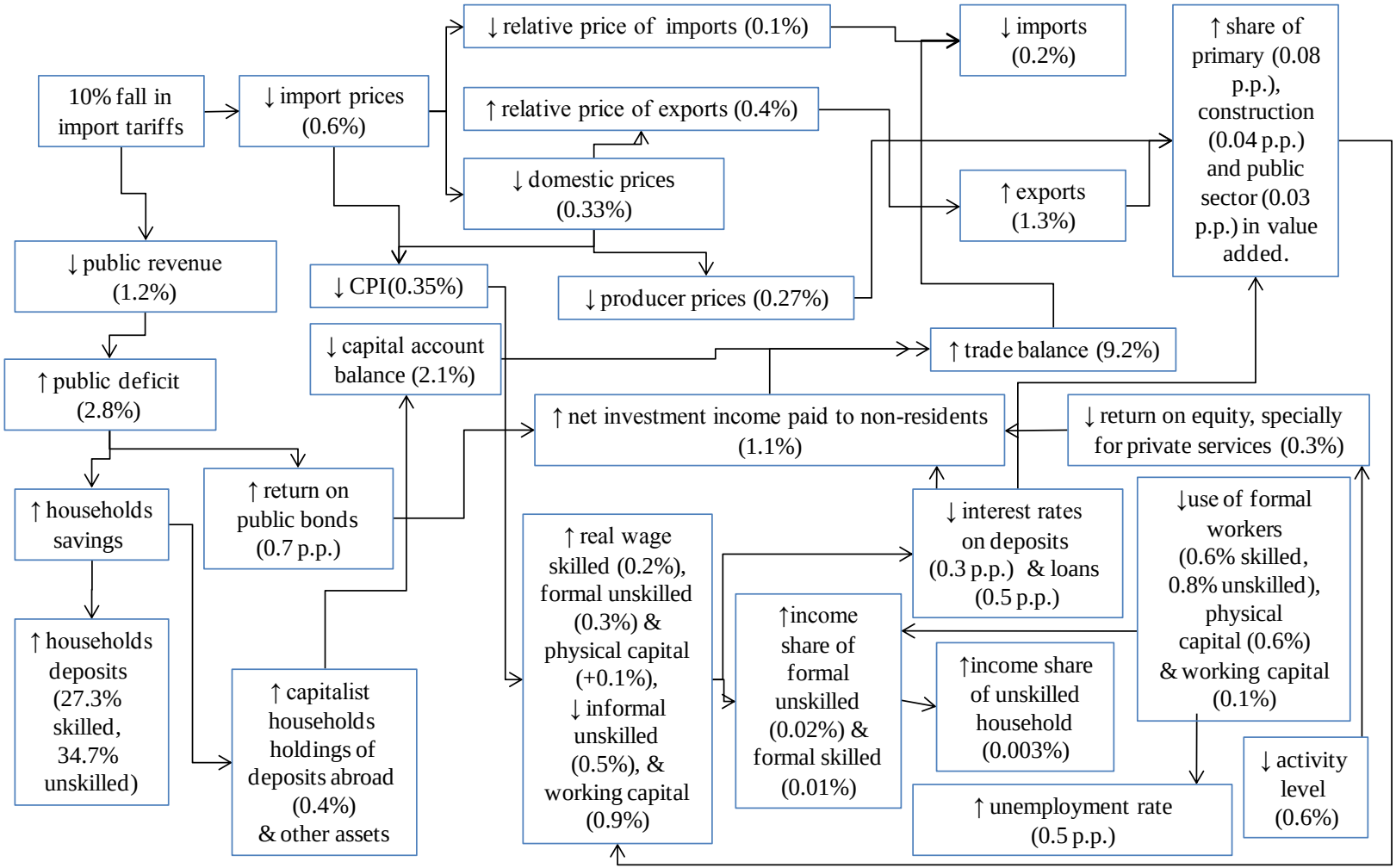
[42] Not tabulated.

endogenous capital flows, as I will show in the next section where, in the context of applying the model to investigate the effects of Argentina's liberalisation experience, I will conduct sensitivity analysis on the elasticity of substitution among assets in the portfolio of the capitalist household.

The incorporation of wage rigidities in the real and the real-financial model lead macroeconomic outcomes (activity level, employment and price level changes) to change in the same direction. However, these changes are significantly smaller in the case of the real model. This is due to the fact that the short-run real model does reflect that when the price level falls, the real wages of the formal workers increase and the employment and output levels fall, but ignores an additional transmission channel that works in the same direction. The mentioned contraction of the activity level tends to reduce the returns of the domestic financial assets, generating capital outflows that call for an improvement of the trade and current balances, which in turn call for a real depreciation in the form of a fall in domestic prices that feeds the increase in real wages and the fall in employment and output levels.

The incorporation of endogenous households' currency holdings along the lines of transactions demand is an interesting variation of the short-run real-financial-augmented model. Its outcomes suggest that, for the case at stake, making currency demand endogenous does not affect in a significant way the models results. Following the principle of Occam's razor, for the rest of this dissertation, and in order to account for the short-run transmission from the volatility of capital flows to that of the activity level during the liberalisation experience in Argentina (St. Fact C_8) in a relatively simple way, I will focus the analysis on the short-run version of the real financial augmented model with exogenous currency demand.

Figure 5-5 Transmission channels for a 10 percent fall in import tariffs in the short run



Short-run application: liberalisation in Argentina

This part applies the final model built in Part I to investigate the effects of liberalisation in Argentina during its currency board (Chapter 6), and links the model to micro-simulations, applying the layered model to investigate the full distributional effects of the capital outflows suffered by Argentina near the end of the currency board (Chapter 7).

Chapter 6 Analysis of the effects of trade and financial liberalization in a CGE framework

In this chapter I seek to shed light on the short-run stresses generated by trade and financial liberalisation in Argentina during the Currency Board (1991-2001), and to derive policy lessons. I do so by providing a concise description of how the Argentinean economy evolved during the Convertibility Plan (April 1991-December 2001), and by identifying in the process a series of stylised facts. After explaining how these facts are accounted for in the model exercise, I conduct a set of experiments investigating the short-run effects of the main external shocks faced by the country during the Currency Board. Besides, I conduct sensitivity analysis on a set of model parameters and validate the model's calibration against econometric estimates for Argentina. I conclude the chapter by summing up the results of the sensitivity analysis, evaluating the effects of the identified shocks in Argentina, and deriving policy implications.

6.1 Argentina's economy during the currency board

Following a history of hyperinflation with annualised four-digit inflation rates during the 1980s, Argentina saw a resurgence of inflation at the beginning of 1991. Given that the nominal exchange rate was perceived as a main signal in the process of local price formation, in order to stabilise the economy the Argentinean authorities responded by implementing a currency board regime, whereby the local currency was pegged to the US dollar (St. Fact C_1). By implementing this peg, the government expected the domestic inflation rate to converge with inflation at the international level and gradually restore the country's international competitiveness.

The government set the parity in February and gave it law status in April 1991[43] under the Law of Convertibility. The Law also prohibited price indexation, allowed contracts and payments in external currency and obliged the national monetary authorities to back the monetary base with international reserves (Cavallo and Cottani 1997)[44] (St. Fact C_2).

[43] In February the conversion rate was fixed at 10.000 australes for 1 dollar. In April 1 the Law 23.298 (self-baptised "Convertibility Law") set a new currency (the Argentinean peso), with a conversion of 1 peso to 10.000 australes, fixing the conversion rate at 1 peso for 1 dollar.

[44] However, room was made for flexibility. The international reserves, which served as the backup of the monetary base, included - with a roof of 20 per cent of the total - external-currency-denominated public debt securities. This allowed the Central bank to issue pesos with a backup of public debt securities. The limit was later increased to 30 per cent with the Tequila crisis (1995).

In this way, the Convertibility Plan severely limited the available macroeconomic policy instruments, affecting the public sector ability to pursue monetary expansion, fiscal deficit monetisation, and exchange rate policies[45]. However, the authorities believed that "years of fiscal and monetary indiscipline had resulted in hyperinflation" (Cavallo and Cottani 1997, p.17), so that the cost of losing some autonomy in the conduct of economic policy was acceptable.

The stabilisation plan was adopted together with a broader package of reforms, which included trade and capital account liberalisation and a series of measures aimed at reducing the interference of the public sector in the economy[46].

Regarding the trade sphere, at the end of the 1980s Argentina had implemented some unilateral liberalisation. In January 1991 the government took further steps to deepen the process by introducing a 22 per cent uniform tariff rate for most of the tariff universe (Berlinski, Kume, and Vaillant 2006, p.10). While trade liberalisation was general, it was more pronounced for the Mercosur area (St. Fact C_3). In March, under the Asuncion Treaty, a free trade area was formed with Brazil, Uruguay and Paraguay (Mercosur area), to take full effect from the beginning of 1995. It was stated in its article 5 that: "during the transition period, the main instruments for the constitution of a Common Market will be: a program of trade liberalisation, which will consist of tariff reduction (…) progressive, linear and automatic, accompanied by the elimination of non-tariff restrictions or measures with equivalent effects, as well as other restrictions to trade among the conforming States". For the area outside Mercosur, a common external tariff was agreed, with multiple exceptions and a convergence path to the common external tariff. The agreed average tariff for the extra zone was, for agricultural products: 10-12 per cent, for capital goods 12-16 per cent, for consumption goods 18-20 per cent (Berlinski 1998, 2004; Berlinski, Kume, and Vaillant 2006). During the process, trade policy also changed in relation to exports, so that initial export taxes became export reimbursements (as detailed in Shock 1).

[45] The scope of use of the former two instruments becomes tightened to the result of the balance of payments. The last instrument becomes only available by modifying the legislation.
[46] A Policy Matrix accounting for the evolution of Capital Account Policy, Other Monetary and Financial Policies, Trade Policy, Fiscal Policy, Privatisations and Deregulations, and Labour Market Policy is displayed in Appendix.

Concerning the financial sphere, its opening included a reduction in restrictions of mobility of all forms of capital, with equal treatment to national and foreign capital; free entry of direct and portfolio investment, elimination of the barriers to the entry of foreign banks, free bank emission of negotiable financial securities in foreign currency and unrestricted entry of foreign capital in pension funds (Bustelo 2002; Damill, Frenkel, and Maurizio 2002) (St. Fact C_4).

Quantitative measures of trade and capital account liberalisation suggest that significant liberalisation occurred in Argentina in the period immediately before and at the outset of the Convertibility Plan. Escaith and Paunovic (2004), expanding work done by Lora (1997) and Morley et al (1999), provide a trade openness index and a capital account openness index for the period. The former is a normalisation of a simple average of the average level of tariffs and the average dispersion of tariffs. The latter is a transformation of the average of four components: i) sector controls on foreign investment, ii) limits on profits and interest repatriation, iii) controls on residents borrowing abroad and iv) controls on capital outflows, with the sources for these components being the IMF's Balance of payments Arrangements and independent information from various World Bank country memoranda. The normalisations mean that the indices are always in the [0,1] interval, with the index increasing with the degree of openness[47]. As acknowledged by Morley et al (1999), these indices are only proxies for actual trade and capital account openness: they neglect non-tariff trade barriers, and subjectively translate verbal descriptions of capital account controls into indices. However, they do look at public sector efforts (rather than outcomes) to implement economic liberalisation. They give a clear indication of the degree of liberalisation in the period surrounding the start of the Convertibility Plan: while the index for trade openness was 0.692 for 1988, it was already 0.917 in 1992 and 0.927 in 2000; while the capital account openness index was 0.400 in 1988, it was already 0.980 in 1992 and 0.982 in 2000.

With regard to the outcomes of the Convertibility Plan, as stated by Dr. Domingo Cavallo, the Ministry of Finance who put the Plan in place, it was a "useful tool to stop

[47] For each dimension (trade and capital account), and with r being the raw indicator, M (m) being the maximum (minimum) raw indicator across the 18 LAC countries considered in the 1970-2000 period, the actual indicator is generated with the I=(M-r)/(M-m) formula.

hyperinflation in Argentina" with "resounding success" (Cavallo and Cottani 1997, p.17). However, together with trade liberalisation, inflation preceding and at the first years of the plan left the economy relatively uncompetitive. As documented by Damill et al (2002, p.19), the real exchange rate at the beginning of the Plan (measured in terms of the domestic and the US CPI) was significantly lower than in the previous period (42 per cent lower than the level prevailing in the 1986-1988 period; 44 per cent lower than that prevailing in the 1986-1990 period; and 83 per cent of that in the 1990 Q4-1991Q1 period), and the domestic currency continued appreciating during the course of the Plan. The relatively appreciated exchange rate, together with trade liberalisation, hurt tradable activities, as acknowledged by Cavallo (Cavallo and Cottani 1997, p.18), leading to a structural shift of production and factors away from tradable goods. It also led to external trade deficits that characterised the Plan from its second year onward. The trade deficit worsened further as a result of capital account inflows, as the latter contributed significantly to the expansion in the level of domestic activity and imports.

During the Plan, the economy was hit by large capital account inflows and outflows (St. Fact C_5) which played a dominant role in the short-run macroeconomic dynamics of the country. These inflows and outflows were largely determined by developments in the international financial markets. During the first three years of the Convertibility Plan, the returns on financial investments in the developed world were low. This and an unusually large IMF loan resulted in large positive private and official capital flows to the country (Damill, Frenkel, and Maurizio 2002, p.22). In turn, these inflows contributed to a significant increase in the levels of external debt which, together with the increasing current account deficits, increased the external financial fragility of the country. With the 1994 US Federal Reserve interest rates increase, the capital inflows were reduced and then reversed. With the significant external loan package coordinated by the IMF in 1995 acting as a catalyst for additional funding (Cavallo and Cottani 1997, p.19), the capital inflow was restarted. Then, with the contagion of other financial crises (East Asian, Russian, Brazilian), the capital inflow was again reduced and then reversed.

The periods of high capital inflows (1991-1994 and 1996-1998) generated positive and negative effects: on the positive side, they allowed to expand the international reserves held by the central bank, the monetary aggregates and domestic credit, lowering the

domestic interest rates and leading through demand and supply channels to expansions of the activity level; on the negative side, they led to a worsening of the international investment position of the country, with expansion of the public and private external debt and foreign holding of firms, and a consequent increase in net investment income paid to non-residents. By appreciating the domestic currency in real terms, capital inflows also led to a worsening of the country's trade deficit (St. Fact C_6). This led to persistent current account deficits (commented above) and increasing net investment income outflows. Then, when the economy was hit by contractions of the capital inflows (and capital outflows), the balance of payment turned into deficit, and the monetary and activity level suffered a contraction. Independently of these cycles, Argentinean firms (especially, small and medium ones) faced tight financial constraints during the whole period (St. Fact C_7) (Fanelli, Bebczuk, and Pradelli 2002).

Overall, during the Convertibility Plan the country received a significant net capital inflow that was partly used to finance the increasing current account deficit and partly for domestic financial deepening. The capital flows were particularly volatile and, in the relative absence of available macroeconomic (fiscal, monetary and exchange rate) instruments to absorb the shocks, the volatility was transmitted to the activity level (St. Fact C_8).

As the external financial fragility of the economy increased, the private sector perceived higher risks in the devaluation of the domestic currency and default of domestic debts. To hedge against currency and country credit risk, the private sector increasingly accumulated external assets in its portfolio (St. Fact C_9), thus reducing devaluation and default risks at the cost of lowering the expected return by investors and reducing the international reserves and liquidity of the country. The domestic financial transactions were increasingly dollarised – thus allowing the holders of foreign-currency-denominated assets to pass the devaluation risk to the liability holders. The dollarisation was asymmetric (i.e. its degree was different on the asset and liability sides of the banks), which meant the emergence of sizeable currency mismatches and thus of costs of leaving the Convertibility Plan, in terms of balance sheet effects. When sustained capital outflows led to unbearable external and internal credit contractions, and in the context of political disturbances, the public authorities were forced to abandon the Plan. It ended in December 2001 when the Finance Minister Domingo Cavallo terminated the

monetary and exchange regime that he had inaugurated ten years before and established controls and restrictions on the foreign exchange transactions.

The two capital flow cycles described above generated corresponding well-defined cycles in the activity level and in employment rates, with the latter accompanied by a significant downward trend. Specifically, the real appreciation of the domestic currency together with trade liberalisation led to a high labour-capital wage ratio, labour being essentially a non-tradable production factor and capital a tradable one. This led to imports and the gradual introduction of physical capital into the production process, implying in turn the adoption of a labour-saving technology characteristic of the developed countries that generated these imports (Altimir and Beccaria 2000; Bisang and Gomez 2000; Damill, Frenkel, and Maurizio 2002). This process reduced labour demand and affected the total hours worked, real wages and labour income. In the relative absence of social safety nets, these changes worsened income distribution. As argued and econometrically tested by Damill et al (2002), the adjustment of the relations between employment and output, which took place during 1991-1996, significantly drove the full-time employment rate down. As suggested by Milanovic and Squire (2005), the mentioned incorporation of technology into the production process was not neutral, biasing the demand for labour toward more educated workers (St. Fact C_{10}).

As described by Altimir and Beccaria (2000) and econometrically tested by Damill et al (2002), wages varied following general patterns across different sectors, strongly influenced by the unemployment rate, in a way consistent with wage curves derivable from insider-outsider or efficiency wage theories (Blanchflower and Oswald 1994). The abovementioned changes in the factor market severely affected income distribution (Goldberg and Pavcnik 2007, p.40). Specifically, the distribution worsened over this period, essentially driven by the increase in the education premium at the tertiary/university level and by the direct and indirect effects of unemployment on labour factor income (Altimir and Beccaria 2000), something not acknowledged by the authorities.

6.2 Stylised facts regarding the country (C_n)

The stylised facts identified above are captured in the model in the following way. The Currency Board (C_1) is captured with a fixed nominal exchange rate. The central bank's backup of the monetary base with international reserves (C_2) is captured in terms of flow in the central bank's portfolio equation (72). The formation of Mercosur (C_3), together with the reduction of import taxes to Extra-Zone and export reimbursements, are captured in Shock 1 (see below). The reduced restrictions on the mobility of all forms of financial capital (C_4) are captured, letting non-residents hold deposits at domestic banks, domestic public bonds and equity and letting some domestic economic agents (banks and capitalist households) change their external asset positions. The presence of capital inflows and outflows (C_5) is captured in Shocks 2 and 3 (below), respectively. The capital inflows impacting negatively on the current account and trade balance (C_6) is captured in the equation relating the current and the capital account of the balance of payments (107). The binding character of working capital (C_7) is captured by including working capital in the production function with a relatively low minimum wage. The volatility of capital flows being transmitted to the activity level (C_8) is captured in the model, as capital flows are linked to the volume of bank loans, which – via the working capital channel – affect the activity level. The increase in external assets held by economic actors as the Currency Board Plan approached its collapse (C_9) is captured in Shock 3. Finally, the model captures the complementarity between skilled labor and physical capital in the production function. However, given the static nature of the application, the physical capital stock is not allowed to vary, hence the corresponding increase in the skilled premium (C_{10}) is not captured[48].

6.3 Shocks reflecting the main external shocks affecting Argentina

To represent the main external shocks that hit Argentina during the Currency Board Regime, the following shocks are considered: 1) trade liberalisation with export reimbursement; 2) an increase in non-residents' holdings of domestic assets; and 3) an increase in the perceived probability of default on domestic assets. The purpose of the experiments is to identify their main effects on welfare in Argentina (including the activity level and income distribution) and derive implications for the use of policy

[48] Making the model dynamically recursive is out of the scope of the dissertation.

instruments, including the use of conventional macro policy instruments and the regulation of capital movements.

6.3.1 Shock 1: Trade liberalisation with export reimbursement

This shock comprises a combination of import tariff elimination (to Mercosur), import tariff reduction (to Extra-Zone), and conversion of export taxes to the Extra-Zone into export subsidies. The tariff rates at the beginning and end of the period are proportionately adjusted to be consistent with the SAM values. Specifically, they are adjusted to reflect the fact that the implicit tariff rate as derived from the ratio between import tariff revenue and import value in the SAM is 5.7 per cent, and that between export tax revenue and export value in the SAM is 1.8 per cent for primary goods and 5.9 per cent for industrial goods. Tariffs are completely eliminated for imports from Mercosur. The Extra-Zone import tariff rates become 0.8 per cent for primary goods and 4.5 per cent for industrial goods. At the start, taxes to exports only are applied to the Extra-Zone. Exports to the Extra-Zone later became subsidised, at 0.8 per cent for primary goods and 3.8 per cent for industrial goods.

The changes in trade taxes generate falls in public revenue (5.5 per cent) and in import prices - especially for Mercosur imports. Extra-Area export prices - as perceived by producers - increase, especially for industrial goods, which witness the highest export reimbursements. As export prices increase and a higher share of production is allocated to exports, the market of domestic goods witness excess demand and the prices of domestic goods rise, although still allowing for an increase in the relative price of exports (4.5 per cent). The increase in domestic prices generates a rise in the CPI (1.5 per cent) which, together with the increase in export prices, shifts the producer prices and in turn the GDP deflator upwards (2.5 per cent).

The fall in public revenue increases - by 3.9 p.p. - the rate of return that the government needs to pay to finance its debt, generating in turn an increase in its payments to residents and non-residents which opens a savings gap that is filled by households. Households increase their savings by sacrificing consumption. Skilled and unskilled households channel their savings into deposits at domestic banks, allowing banks to increase their loans. Capitalist households increase their holdings of equity, bonds and

deposits abroad, reducing their deposits in domestic banks and generating a capital outflow from Argentina. As the country witnesses a capital outflow and payments to non-residents of dividends and interest increase, binding foreign reserves force the country to significantly increase its trade superavit (by 40.1 per cent).

Table 6-1 Balance of payments

	Base (B$)	% change
Current Account	-8.46	0.60
Trade Balance	3.44	40.13
Exports of Goods and NFS	21.51	21.66
Imports of Goods and NFS	18.07	18.15
Investment Income	-11.90	-11.18
Interests	-10.91	-11.71
Profits and Dividends	-0.99	-5.34
Capital Account	10.62	-0.60
Non-Financial Private Sector	7.50	-1.11
Public Sector	1.99	FIXED
Commercial Banks	1.13	1.72
Balance of Payment Result	2.16	-0.60

The increase in producer prices has a series of effects on the factor markets: the increase in the relative price of industrial exports shifts factors to the industrial sector, raising its share of production, as shown in the following table. The share of the private service sector is especially reduced, given that a high share of private consumption (which shrinks) is allocated to it.

Table 6-2 Sector value added shares

	Base (%)	p.p. change
Primary	7.9	-0.11
Industry	18.0	0.53
Construction	5.5	-0.12
Private Services	61.6	-0.23
Public Services	7.1	-0.06
Total	100.0	FIXED

These producer price increases also lead to an increase in factor demands at given nominal wages which generates an increase in the level of use of formal workers, in turn allowing the unemployment rate to fall (1.70 p.p.) and real GDP to increase (1.1 per

cent); and an increase in the nominal and real (CPI-deflated) wages of informal unskilled workers, physical capital and working capital. The increase in the CPI and the capital outflows reduce the availability of working capital in real terms. As mobile factors move to the industrial sector, the demand for physical capital falls in the other sectors, making the capacity utilisation of physical capital in these sectors fall, leading to an overall fall in capacity utilisation of 0.1 per cent. This only partially offsets the effect of the increase of the employment level on the activity level, with a final increase of the activity level of 1.1%.

Table 6-3 Factor use

	Base*	% change
Formal Skilled	1.43	0.86
Formal Unskilled	7.39	2.93
Physical Capital	288.65	-0.11
Working Capital	17.15	-2.38

*Workers in millions of individuals. Capital in billions of Argentinean pesos

Table 6-4 Real wages

	Base	% change
Formal Skilled	16.82*	-1.24
Formal Unskilled	9.29*	-1.31
Informal Unskilled	9.29*	2.03
Physical Capital	0.20 (%)	3.48
Working Capital	0.35 (%)	7.54

*In thousands of Argentinean pesos per year per worker

Income distribution shifts in favour of those factors whose real wages increase more (physical and working capital) and against formal workers. With these increases in the income shares of physical and working capital, the income share of the capitalist RHG shifts upward.

Table 6-5 Factor income shares

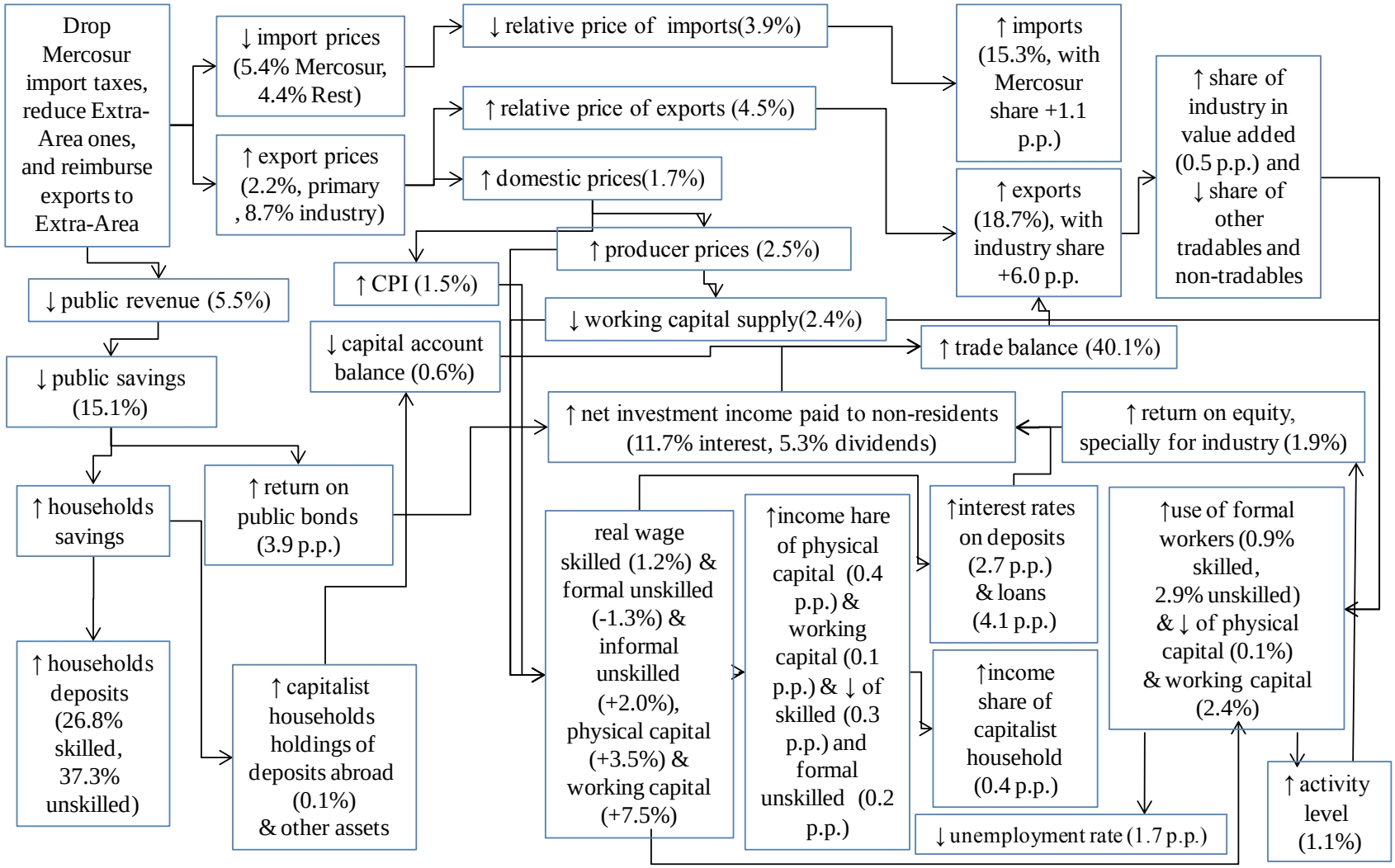
	Base (%)	p.p. change
Formal Skilled	13.2	-0.32
Formal Unskilled	37.7	-0.18
Informal Unskilled	14.1	0.00
Physical Capital	31.7	0.41
Working Capital	3.3	0.09
Total	100.0	FIXED

Table 6-6 Household income shares

	Base (%)	p.p. change
Skilled	14.1	-0.27
Unskilled	64.6	-0.11
Capitalist	21.3	0.38

In short, and by the transmission channels just described, diagrammed in Figure 6-1, in the short run trade liberalisation cum export reimbursements allowed the activity level to shift upwards (1.1%). However, it also increased the current deficit of the public sector (15.1%), led to capital outflows that worsened the balance of payments with non-residents (0.6%), generated some inflationary pressures and allowed the capitalist RHG to increase its share in national income (by 0.4 p.p.).

Figure 6-1 Transmission channels for trade liberalisation with export reimbursement



6.3.2 Shock 2: Increase in non-residents holdings of domestic assets

Non-residents' holdings of domestic assets increased dramatically during the Currency Board regime. Those of domestic bonds increased from an initial value of 27.2 B$ to a final one of 87.2 B$; those of deposits at domestic banks from 7.9 B$ to 22.8 B$; and those of equity in domestic firms from 11.0 B$ to 38.9 B$, as derived from the country's Balance of payments with non-residents for the 1991-2001 period.[49] The associated percentage changes are captured in this shock. Given that the model was calibrated using yearly flows (and not those for a decade), the percentage changes in the endogenous flows of the model resulting from the shock overestimate the actual effect which one would expect to observe during a given year. However, the results are useful for the purpose of understanding the main stresses generated by the abundant capital inflows entering the Argentinean economy during this period. This shock increases the level of net capital inflows, which contributes significantly to the accumulation of international reserves of the central bank and allows the economy to temporarily finance a significant current account deficit.

Table 6-7 Balance of payments

	Base (B$)	% change
Current Account	-8.46	-1,230
Trade Balance	3.44	-2,686
Exports of Goods and NFS	21.51	-81
Imports of Goods and NFS	18.07	414
Investment Income	-11.90	-97
Interests	-10.91	-23
Profits and Dividends	-0.99	-915
Capital Account	10.62	1,230
Non-Financial Private Sector	7.50	856
Public Sector	1.99	2,918
Commercial Banks	1.13	746
Balance of Payment Result	2.16	1,230

With the nominal exchange rate fixed, the increase in the current account deficit is made possible through domestic inflation (the price of domestic goods increases by 51 per cent), which causes an appreciation of the real exchange rate and leads to a shift in the

[49] Not tabulated.

country's foreign trade from an initial trade superavit position to a large trade deficit: the export value falls, and the import value increases, causing the aggregate demand share of net exports to fall and leaving scope for an increase in final consumption.

Table 6-8 Aggregate demand component shares

	Base (%)	p.p. change
Absorption	98.20	30.09
Private Consumption	77.35	31.81
Fixed Investment	15.37	-0.54
Public Consumption	5.49	-1.18
Exports	11.22	-9.99
Imports	-9.43	20.11
GDP (C+I+G+E-M)	*100.00*	*0.00*

With export prices fixed, producer prices increase proportionately less in the tradable sectors, providing incentives for the economy to mobilise resources out of the sectors producing tradable commodities towards non-tradables, especially private services, which have a high share in final consumption.

Table 6-9 Sector value added shares

	Base (%)	p.p. change
Primary	7.9	-4.16
Industry	18.0	-3.16
Construction	5.5	0.17
Private Services	61.6	7.39
Public Services	7.1	-0.24
Total	100.0	FIXED

These capital inflows significantly expand the working capital available in the economy, causing a rise in the productivity of, and demand for, the real factors. With the nominal wages of the formal workers essentially fixed, the price increases drive their real wages down and increase their use. As the mobile factors move out of the tradable sectors, the oldest vintages of the physical capital stock in the tradable sectors stop being utilised, lowering the overall rate of capacity utilisation of the physical capital stock by 6.3 per cent, only partially offsetting the growth of the activity level. The producer price increases lead to an increase in the demand for, and the wages of, informal unskilled

workers and physical capital, with physical capital demand being increased in the expanding non-tradable sectors.

Table 6-10 Factor use

	Base*	% change
Formal Skilled	1.43	4.35
Formal Unskilled	7.39	20.27
Physical Capital	288.65	-6.26
Working Capital	17.15	81.42

*Workers in millions of individuals. Capital in billions of Argentinean pesos.

Table 6-11 Real wages

	Base	% change
Formal Skilled	16.82*	-16.36
Formal Unskilled	9.29*	-10.45
Informal Unskilled	9.29*	5.71
Physical Capital	0.20 (%)	41.23
Working Capital	0.35 (%)	-61.93

*In thousands of Argentinean pesos per year per worker.

The changes in factor use lead to a significant reduction in the unemployment rate (11.6 p.p.) and a significant increase in the activity level (6.6 per cent).

Table 6-12 Macro indicators

	Base	Change
Real GDP	189.86*	6.56
Unemployment rate **	14.0	-11.58
CPI	1.00	46.34

* In billions of Argentinean pesos
** Base in %, change in percentage points

The expansion of the economy contributes to an increase in firms' profits and in the return on equity in every sector, as shown in Table 6-13. The capital inflow, by significantly increasing the supply of working capital, leads to a significant fall in its real wage, generating a reduction in the nominal remuneration of bank loans (5.2 p.p.) and deposits (3.4 p.p.). As commented below, the public revenue increases with the expansion of the economy, thus contributing to a lowering in its deficit and its supply of public bonds, leading in turn to an increase in the price of bonds and hence a fall in their return.

Table 6-13 Rates of return

	Base (%)	p.p. change
Bonds	48.7	-33.47
Deposits	23.0	-3.42
Equity, primary	20.7	11.03
Equity, industry	20.6	24.99
Equity, construction	21.2	40.75
Equity, private services	23.5	55.71
Loans	35.0	-5.21

Income distribution among factors and households is driven by the outstanding increase in the real wage of physical capital, which lifts the income share of physical capital by 6.0 p.p.[50] and the income share of capitalist households by 4.0 p.p., with the fall in the real wage of working capital only partially offsetting the growth of the latter.

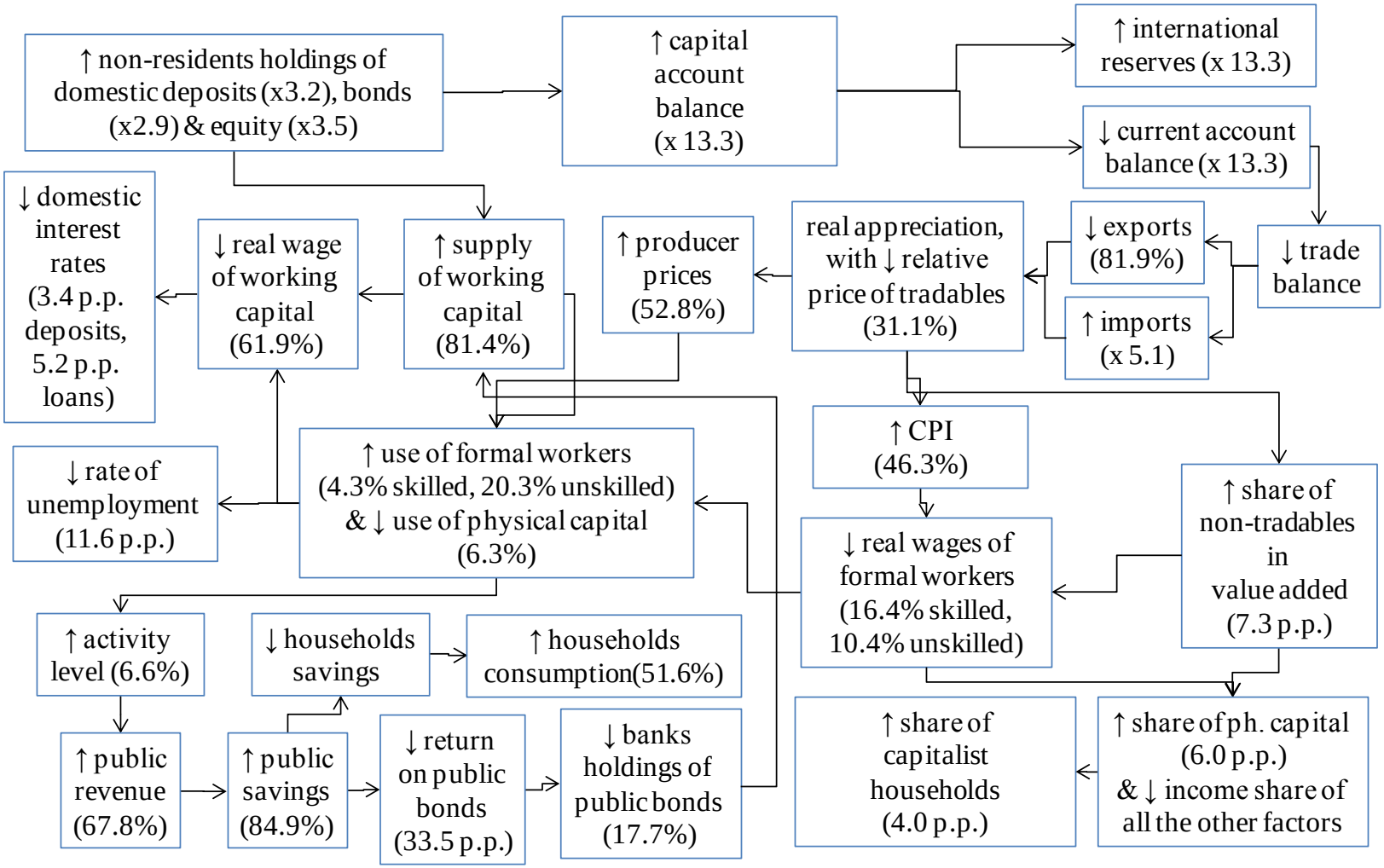
Table 6-14 Household income shares

	Base (%)	p.p. change
Skilled	14.1	-2.48
Unskilled	64.6	-1.50
Capitalist	21.3	3.98

To sum up, the model captures how the set of capital inflows received by the Argentinean economy during its Currency Board allowed the economy to boost its activity level (6.6%) at the expense of a real exchange rate appreciation (31.1%) that reallocated factors in the production of non-tradables, leading to worsen the trade and the current account balances of payments with non-residents. The inflow allowed financing temporarily the public sector deficit. In the distributional sphere, it led to increase the income share of the capitalist RHG (4.0 p.p.). The transmission channels are diagrammed below in Figure 6-2.

[50] Not tabulated.

Figure 6-2 Transmission channels for an increase in the non-residents holdings of domestic assets



6.3.3 Shock 3: Increase in the perceived probability of default on domestic assets

This shock captures the increase in the probability of default on domestic assets perceived by domestic actors.[51] By attributing the observed difference between the return on public bonds and the risk-free world interest rate as the probability of default on domestic bonds, the probability of default increased by 78 p.p. during the period.[52] The shock is captured as a 60 p.p. increase, giving that larger values make the model crash[53] and that part of the observed excess in the return on public bonds over world interest rate may be due to the presence of expected devaluation in the case of local-currency denominated bonds.

Given that the relevant transmission channels for this shock are similar to those described for the first shock of Chapter 5 (where the same parameter increases by 30 p.p.), I describe very concisely here the results. The diagram of the transmission channels for the present shock is laid out in Figure 6-3, including the magnitudes involved. It suggests that the non-linearities present in the CGE model play an important role in the generation of the results: the endogenous variables here tend to move in the same direction than in Chapter 5, but with the associated changes more than doubling the previous ones.

An increase of 60 percentage points in the perceived probability of default on domestic assets leads to a strong change in capital flows (the capital account superavit shrinks by 48.9%) and a real devaluation (with a 2.4% fall in the CPI) that allows the trade and the current account balance to improve. The shock causes international reserves to fall, reducing the monetary base and the supply of working capital in the economy. With fixed nominal wages for formal workers, their real wages rise, leading the employment level to fall, and the rate of unemployment to increase by 4.8 percentage points. The fall in factor use generates a contraction of the activity level (of 6.0%), which in turn hits negatively the public sector revenue (by 7.7%). Given the change in the structure of

[51] The capital flows determined by non-residents are exogenous in the model.
[52] Obtaining $\Delta pdef = pdef_{2001} - pdef_{1991}$ with $rb_t*(1-pdef_t)=rw_t$, with t=1991, 2001; pdef=perceived probability of default; rb=return on domestic public bonds; rw=risk-free world interest rate.
[53] The reason seems to relate to the neoclassical nature of the model, which makes the model crash when price changes are insufficient to re-establish market equilibria.

production associated to the real depreciation and the increase in the real wages of formal workers, the income share of the unskilled RHG rises 0.16 p.p., to the detriment of the share of the capitalist RHG.

6.4 Sensitivity analysis

This sensitivity analysis is performed with the dual purpose of assessing the model's robustness and validating it against econometric estimates. For an increase in the perceived probability of default on domestic assets, I vary the elasticity values in the capitalist household portfolio, the import-domestic Armington, and the export-domestic CET functions, as shown in the following table. The model is shown to be robust to elasticity changes for small shocks, but when the model is hit by strong shocks, i.e., the enormous capital inflows witnessed by the country as captured in Shock 2, the model has a strong tendency to crash when elasticity values are varied. Either lowering the Armington or the CET elasticity values or increasing the capitalist household portfolio elasticity values tends to make the model crash, something which does not happen with the original version of the RFA model, which suggests the possibility that the wage rigidities imposed here to capture the short-run reaction of the economy may be compromising its robustness.

The following table shows the effects on selected variables of an increase of 30 percentage points in the perceived probability of default on domestic assets, varying the elasticity of the financial portfolio shares of the capitalist household (originally at 1.05), that of the export-domestic destination CET function, and that of the domestic-import Armington function (both originally at 4.5).

Table 6-15 Sensitivity analysis on a set of elasticities for an increase in the perceived probability of default on domestic assets

Changes*	Capitalist portfolio elasticity			CET elasticity			Armington elasticity		
	1.001	**1.05**	**2.0**	**0.5**	**2.25**	**4.5**	**0.5**	**2.25**	**4.5**
Exports	0.23	2.96	-48.91	..	1.84	2.96	6.25	4.17	2.96
Imports	-0.56	-6.22	-85.86	..	-10.64	-6.22	-5.76	-5.96	-6.22
Capital account NFPS	-1.10	-23.88	-56.99	..	-29.76	-23.88	-31.01	-26.39	-23.88
Price of domestic goods	-0.07	-0.80	16.20	..	-1.51	-0.80	-1.66	-1.12	-0.80
Real GDP	-0.18	-1.82	4.31	..	-2.93	-1.82	-3.34	-2.36	-1.82
Tradable value-added shares									
Primary	0.02	0.26	-1.70	..	0.31	0.26	0.47	0.33	0.26
Industry	0.00	0.00	1.67	..	0.01	0.00	-0.14	-0.05	0.00
Implicit elasticities with respect to real exchange rate									
Exports	3.45	3.72	3.02	..	1.22	3.72	3.77	3.73	3.72
Imports	8.43	7.79	-5.30	..	7.05	7.79	3.47	5.33	7.79

* Changes in percentage terms, except for shares, which are in percentage points.

If the elasticity in the financial portfolio is reduced, the effect of the relative drop in the expected return on domestic assets in the capital account balance shrinks, together with its effect on trade flows, domestic prices, activity level and sector shares. Increasing this elasticity changes the model results dramatically and is "out of the domain" of the model in the sense that it leads to sign reversals in relevant model results and to fail in the intent to reflect that capital outflows end up generating falls in the activity level, as mentioned in Chapter 1, Section "Effects of capital account openness on growth". When the elasticity in the financial portfolio of the capitalist household takes a value of 2, the magnitude of the capital outflow increases substantially and the supply of working capital falls significantly. The latter generates increases in the remuneration of working capital and in the price at which output is produced and sold. In turn, the increase in the output price leads to raise the demand and the use of formal workers and allows the overall supply of goods to increase. The increase of the remuneration of working capital generates some sector re-allocation of production. In particular, given the relatively intensive use of working capital by the primary sector vis-à-vis the industrial one, the production cost increases ceteris paribus more in the former, and factors and production move out of the primary sector and into the industrial one. With the primary sector being more export-intensive than the industrial one and the industrial sector being more import-

intensive than the primary one, the production reallocation ends up improving the trade balance via import-substitution instead of via raising exports.

If the elasticity in the CET function is reduced, the outflow calls for a higher real depreciation, in the form of a drop in domestic prices, with a higher positive effect on real wages and hence a larger negative effect on the activity level, and a shift of part of the adjustment in the trade balance from exports expansion to imports contraction. Finally, a fall in the Armington elasticity also increases the real depreciation, exacerbating the negative effect on the activity level, and shifting the bulk of the adjustment, in contrast, from import contraction to export expansion, with associated changes in the share of the primary sector (export intensive) and the industrial sector (import intensive) in domestic value-added.

The implicit elasticity of imports and exports to changes in the real exchange rate is calculated, dividing the endogenous percentage changes in each by those in the real exchange rate. It is clear that the elasticity in the Armington function affects the implicit elasticity of imports to changes in the real exchange rate. However, it is also clear that for a given Armington elasticity, this implicit elasticity depends on parameters which are extraneous to the import function: with an Armington elasticity of 4.5, different elasticities in the CET function and the capitalist portfolio asset shares generate implicit elasticities of imports for the real exchange rate in the [-5.30, 8.43] range. Most of the resulting values greatly exceed econometric estimates for the country during the Convertibility Plan: Damill et al. (2002, p.38) reports an elasticity of 0.244, and Catao and Falcetti (2002) report elasticities in the [0.7, 0.8] range. This could indicate that the elasticity parameters in the model should be revised downward. However, this excess of import elasticity in the model compared to the econometrically estimated version may be also due to the lack of use in these regressions of a system of simultaneous equations, which would have accounted for the endogeneity of the variables explaining imports. Besides, it remains unidentified which of the elasticity parameters present in the model should eventually be revised, as different combinations of elasticity parameters would provide it with an import elasticity matching an econometrically estimated one.

6.5 Conclusions

It has been shown that the model is highly responsive to the elasticities in the import-domestic Armington function, in the export-domestic CET function, and in the portfolio demand of the capitalist household, and that it tends to generate implicit elasticities of imports to changes in the real exchange rate that exceed those estimated with econometric tools, with part of the excess probably reflecting that the general equilibrium effects are ignored in these econometric estimations.

Trade liberalisation–cum-export reimbursement and capital inflows (Shocks 1 and 2) have expansionary effects on the activity level, and capital outflows (Shock 3) contracting ones. The main transmission channels are 1) shifts in labour demand derived in turn from a change in real wages in the formal labour market, with labour demand increasing in shocks 1 and 2 and falling in shock 3; and 2) shifts in the availability of working capital – rising in shock 2, and shrinking in shock 3. Given that Argentina received an overall net capital inflow during the Currency Board, liberalisation seems to have had a positive cumulative effect on the activity level in Argentina. However, the model also suggests that the volatility of capital flows was significantly transmitted in the short run to the activity level, so that capital account liberalisation seems also to have led to an increase in the volatility of social output in Argentina.

Regarding the effect on income distribution, trade liberalisation and capital inflows in the short run increased the income share of the capitalist RHG, while capital outflows had the opposite effect. Given the net capital inflow received by the country, one would expect the share of the capitalist RHG to have increased overall due to liberalisation, leading to increased inequality, at least with measures that give a greater weight to the incomes in the upper part of the income distribution (e.g. GE_2).

When trying to compare the results to those from other CGE models, it can be seen that the IMMPA model was not applied to Argentina. It was applied in Brazil, but given that

it assumes that the supply of foreign capital is perfectly elastic – something that does not seem to be a realistic assumption for Argentina - the comparison is not straightforward. In that application of IMMPA (Agénor et al. 2003), the central bank lifted the interest rate on rediscounts, generating a similar increase in the cost of funds, where the main transmission channel is a fall in labour demand and hence a fall in the income share of the non-capitalist RHGs, and a lift in that of the capitalist RHG. In other words, in the IMMPA model capitalists are able to avoid most of the burden of the economic contraction. As I will show in the next section, this result is also found in the present model when it is linked through the factor market to microsimulations, bypassing the use of RHGs in the generation of distributional indicators.

Carolina Diaz Bonilla's thesis (2005) investigates the effects of trade liberalisation on income distribution in Argentina during the Convertibility Plan, but in her model the capital income is not used to classify households into RHGs, which means that the change in income shares between capitalists and other households is not investigated. In any case, the distributional results seen when using a CGE model with representative households are not detailed, and it seems worthwhile to link the CGE model with a household income model using household-level data, as is done in next section.

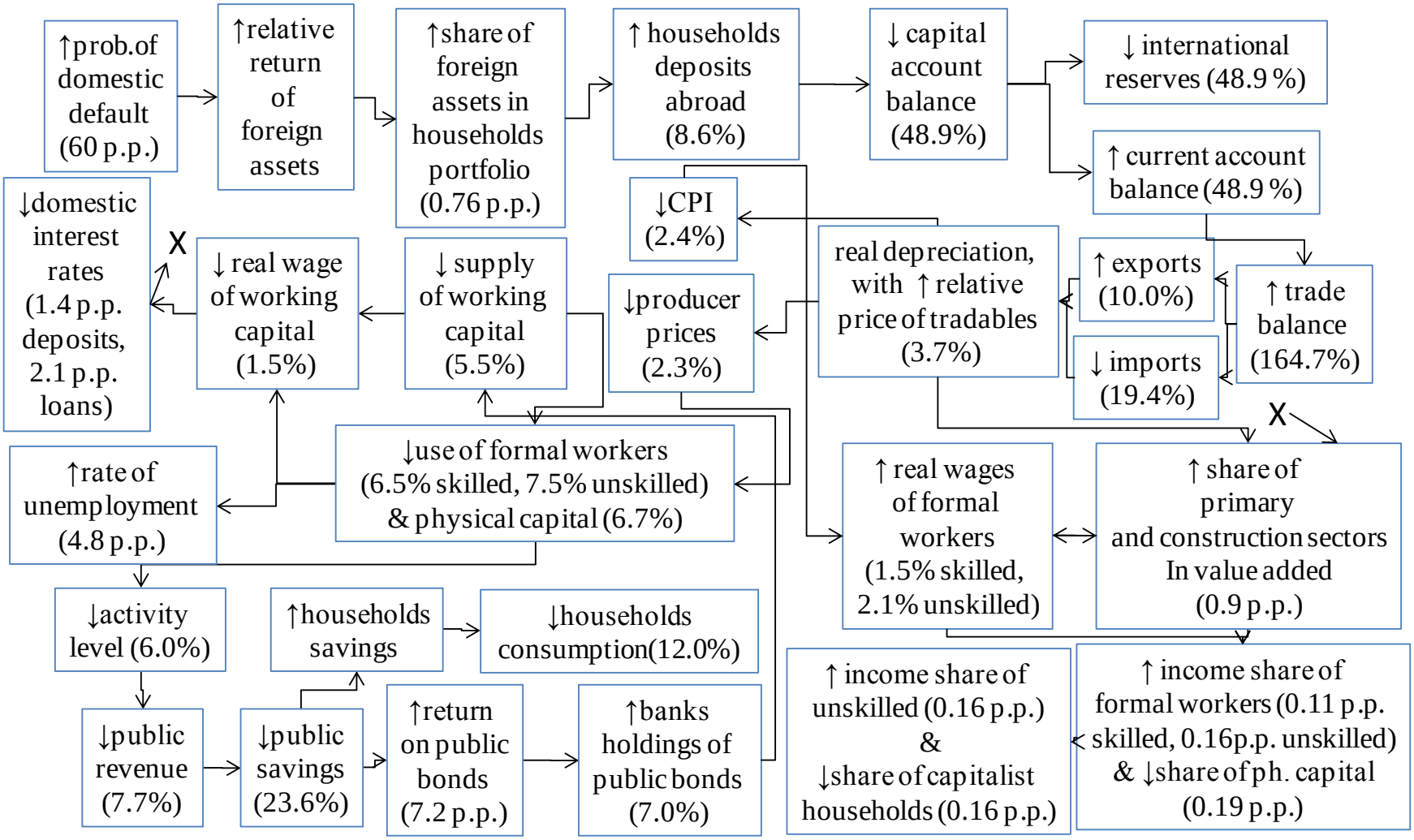
The above analysis leads to a set of policy implications. To mitigate the volatility of capital flows, which is transmitted to the activity level, the costs and benefits of regulating international capital flows should be investigated, taking stock of the available theoretical and empirical evidence, including that surveyed by John Williamson, Stephany Griffith-Jones and Ricardo Gottschalk (2005) and Neil McCulloch and Gracia Pacillo (2010).

To avoid long-lasting current account disequilibria with non-residents, as derived in the model from capital inflows and observed in the country during the Currency Board, the country's authorities need to preserve the exchange rate and fiscal and monetary policies in their set of available instruments. This is a lesson which Argentina learned late in 2001 when, after facing a series of external crises, its authorities decided to derogate the

Convertibility Law, moving into an administered exchange rate regime which has allowed the country to significantly raise its competitiveness, and making discretionary use of monetary policy to counteract the effect of international capital flows on the activity level, even at the cost of generating inflationary pressures.

Last, to the extent that trade liberalisation and other shocks cause the productive structure of the economy to change, the reallocation of workers formerly employed in shrinking sectors may take time. This is not acknowledged in the model, which assumes full mobility of workers among segments. Yet in practice (as observed in Argentina) structural changes may generate employment problems, and during the transition it may be necessary to implement an extensive unemployment benefit program for which the public sector needs to assure resources in advance.

Figure 6-3 Transmission channels for a 60 p.p. increase in the perceived probability of default on domestic assets



Chapter 7 Analysis of the effects of capital outflows in a top-down CGE-microsimulations framework

7.1 Introduction

The CGE model used in the previous chapter was based on representative household groups (RHGs). As such, on its own, and as argued by Anne-Sophie Robilliard, François Bourguignon and Sherman Robinson (2008)[54] – RBR from now on – it does not allow us to fully account for the observed households and individuals' heterogeneity or to evaluate changes regarding the full income distribution.

To overcome these limitations, in this chapter I link the CGE model with a microsimulation model (MSM), thereby incorporating households and individuals' heterogeneity and thus allowing for a better distributional analysis. As described by Bourguignon and Spadaro (2006, p.78), the seed of microsimulation as an instrument for economic analysis was planted by Orcutt (1957), and since the early 1980s the use of MSMs has been encouraged by the rise of large and detailed datasets on individual agents and the continuing increases in, and falling costs of, computing power. As explained by Carolina Diaz Bonilla (Diaz Bonilla 2005, p. 87-89), early microsimulation studies were mainly focused on wage distributions: Almeida dos Reis and Paes de Barros (1991) considered the effect of education on wage distribution in Brazil; Juhn et al. (1993) looked at wage differentials in the US from 1963 to 1989 and Blau and Khan (1996) sought to explain why US wage differentials systematically exceeded those of other OECD countries during the 1980s. The next stage of microsimulations was focused on broadening their application beyond wage distributions – as did Bourguignon and Ferreira (2003), who analysed the impact of different taxes on income distribution at household level. In the third (present) stage, household data is combined with data at a higher level (sector, market, or economy-wide) allowing, among other things, to simulate the effects of policies and other shocks on a sample of economic agents (individuals,

[54] I especially thank Anne-Sophie Robilliard for providing me with the Stata code developed by her and Vivi Alatas for the microsimulations module of the mentioned paper on Indonesia.

households, firms) at the individual level, thereby permitting the evaluation of the full distributional impact of these shocks.

At present, efforts to link CGE models to microsimulations to study the distributional consequences of macroeconomic shocks and policies are an area of great interest (Davies 2009, p.49). The link can be made either by fully integrating them – as in Cogneau and Robilliard (2006) and Cockburn (2006), where information on sampled agents is integrated into the CGE model – or by "layering" the two models in what is called the "top-down" approach, whereby the CGE model (a level above actual individuals and households) is allowed to inform the microsimulation model. As Davies suggests, while the integrated approach is theoretically more transparent, the layered approach is also interesting and promising, and has a relative advantage when the concern is with short-term distributional impacts in a setting where realism is at a premium and theoretical niceties are less important (Davies 2009, p.53 and 56). Besides, the layered approach allows us to by-pass the problem of identifying the heterogeneity of factor endowments and preferences at the level of single households or individuals (Bourguignon, Robilliard, and Robinson 2004, p.3).

As explained in RBR, layered microsimulation models can be subdivided into arithmetic and behavioural. Arithmetic ones assume that the distribution of income within (RHG) groups is exogenous and constant, and ignore behavioural responses. Behavioural microsimulations account for the changes in both between- and within- (RHG) groups' inequality and consider behavioural responses (typically, consumption demand and labour supply). The usefulness of the latter in the analysis of public policies and shocks mainly involves their ability to fully take into account the heterogeneity of the economic agents observed in micro-datasets. They allow us to investigate the effects on individuals and households with existing combinations of characteristics that cannot be apprehended through typical cases. They help to identify with precision who are likely to be winners and losers following a reform or shock, thus providing crucial information on welfare effects.

In this layered behavioural approach, Ganuza, Paes de Barros and Vos (2001) build a micro-simulation model that selects at random the individuals who change labour status and/or sector. In contrast, RBR build a micro-simulation model that econometrically (and not fully randomly) model the way rationing occurs in the labour market – that is, as a function of the observed and unobserved characteristics of the individuals supplying labour. In RBR, then, the main purpose of the MSM is to select individuals who are barred from (or let into) jobs, thus allowing selection to depend on individuals' heterogeneity.

In this chapter I link, in a layered way, the CGE model with a partly econometric microsimulation model. The latter includes a household income generation model that follows the specification of the CGE model. The macro-level CGE results for a given shock provide updates for the levels of employment in each labour market segment, average wages in these segments, relative prices, and capital incomes[55]. The macro-level results are transferred down to the micro-level household income generation model, providing new individual employment status, wages and capital incomes, which in turn inform distributional indicators and figures that can be evaluated. As in RBR, the selection of the individuals who are fired (or hired) when there is a change in labour demand is based on econometric analysis.

Carolina Diaz Bonilla (2005) models the sector allocation of individuals in ways that depart from the RBR model. This chapter follows RBR in that it compares the microsimulated distributional results by applying different techniques (behavioural and arithmetic microsimulations, as RBR do). However, it departs from RBR's methodology due to two extensions: capital incomes, which are exogenous and fixed in RBR MSMs, are endogeneised here, and the transmission channels communicated from the CGE model to the microsimulation module (joint in RBR) are separated into 1) employment, 2) wages and prices and 3) capital income effects.

[55] Differently than in Diaz Bonilla (2005), I have chosen to endogenise capital income even though these incomes are perceived to be underestimated in the Argentine Permanent Household Survey. Letting capital income be exogenous would have led us to ignore a channel which, in this case, is relevant from a distributional point of view.

To illustrate the approach, I look at the distributional effects of the capital outflow suffered by Argentina in the period surrounding the end of the Convertibility Plan. Specifically, I capture the distributional effects of the drop in non-residents' deposits at domestic banks, amounting to 35.0 per cent in the period December 2000 – December 2001, from 32.9 billion dollars to 21.4 billion dollars, and separate the transmission channels involved. This shock is especially interesting given that the large and sustained capital outflows led the Argentinean government to abandon the Convertibility Plan – first by devaluing the exchange rate (December 2001) and then by letting the local currency float (February 2002) – and led to an economic crisis that included a short-run worsening of social indicators, including unemployment rates and the poverty and inequality indices (Frenkel and Rapetti 2006).

Departing from the work of RBR, I improve the process of determining the unobservables affecting the selection of who is fired (or hired) when labour demand changes occur; I take account of sample selection bias in the wage equations by adapting the two-step Heckman procedure for consistency with the logit function used to explain employment; I improve the Newton algorithm process used to adjust the household income model after a macro shock, by allowing it to get closer to the macro target without sacrificing speed and, for the evaluation of poverty and distributional changes, I extend the set of indicators and graphs used. Specifically, I use international and national methodologies for setting the poverty line, include Lorenz Curves at household level, and graphically consider the changes in household per-capita income by classifying the households not only in percentiles but also in ventiles, and by comparing their results.

In the microsimulations, the following steps are followed: 1) a household income model is specified consistent with the CGE model; 2) the specified model is estimated; 3) specific CGE macro outcomes are generated and communicated to the model; 4) these CGE outcomes are attributed at the micro level using behavioural and arithmetical microsimulations, which generates new distributions of employment status, wages, capital incomes and household incomes; 5) distributional indicators and graphs are

prepared and evaluated, throwing light on the magnitude of the channels illuminated by the behavioural (as opposed to the traditional arithmetical) approach, and the distributional effects of capital outflows in Argentina.

7.2 The household income model

The household income model defines the total nominal income of each household as a non-linear function of the observed and unobserved characteristics of the household and its members. The model is composed of a household income identity, which separates out labour and non-labour income; an indicator function that determines the labour status of the individuals supplying labour; an equation that determines wages for the individuals at work; and an equation that sums up the non-labour income components. Next, I will discuss the specification of these equations, explaining its consistency with the modelling of the factor markets in the CGE model in question.

7.2.1 Household income identity

Nominal household income is simply the sum of nominal labour and non-labour income of the individuals in the household.

$$YH_h = \sum_{i \in h} (W_i IW_i + Y_{0i}) \qquad (1)$$

where:

YH_h: nominal income of household h

IW_i: dummy variable identifying labour status (1 for employed, 0 otherwise) of individual i in household h

W_i: nominal wage of working individual i in household h

Y_{0i}: non-labour income of individual i in household h

7.2.2 Employment status of individuals supplying labour

For the MSM to be consistent with the modelling of the labour market in the stylised macro CGE model to which it is linked, the characteristics of the latter need to be consistently translated into the former. This task is undertaken as described in the following table:

Table 7-1 Consistency between the macro and micro models

Macro model	Micro model
The labour market is segmented into formal skilled, formal unskilled and informal unskilled components, with no mobility among them in the short run.	Individuals supplying labour are assigned to one of these segments and once assigned remain there.
The labour supplies are exogenous and fixed in the short-run period under analysis.	Only individuals supplying labour in the base simulation supply labour after the simulations.
In the informal segment there is full employment.	All individuals informally employed remain so.
In the formal segments there is some unemployment.	The unskilled unemployed individuals are located into the formal segment. Individuals supplying labour in the formal segments need to be assigned among employed and unemployed alternatives in each simulation.

For individuals supplying labour in the formal labour segments, the assignment in terms of employed vs. unemployed is done according to some criterion the value of which is specific to the individual (CV_i^W). As in RBR, a view of the labour market as rationed suggests we refrain from calling this criterion value "utility", since employment and unemployment are not outcomes depending on a free decision taken by the individuals supplying labour, but an outcome of the job rationing in the labour market. For a given individual, his/her criterion value of being employed must exceed that of being unemployed in order to become employed. As there, the criterion value follows the

additive random utility model (ARUM): it has a deterministic (observed by the analyst) and a random component, both being completely known by the individuals[56]:

$$IW_i = Ind\left(CV_i^W > \overline{CV}^U\right) = Ind\left(\alpha^s + Z_i\beta^s + u_i > \overline{CV}^U\right) \quad (2)$$

where: (Amemiya and Shimono 1989, p.14)

IW_i: dummy variable identifying labour status (1 for employed, 0 otherwise)

Z_i: observed characteristics of labour suppliers affecting employment status

α^s: intercept affecting the criterion value of being employed in segment s

β^s: slopes in effect of observed characteristics on criterion value of being employed in segment s

u_i: unobserved determinants of employment status[57]

CV_i^W: criterion value for the employment alternative of individual i

$\overline{CV}^U$: criterion value for the unemployment alternative

7.2.3 Wage determination

Wages of employed individuals (strictly, their logs) are explained as a function of personal and household characteristics, with a residual capturing unobserved earning determinants and, probably, measurement errors. The coefficients of the equations are allowed to differ by labour segment, allowing observable characteristics to affect wages in different magnitudes across segments.

$$logW_i = a^s + X_i b^s + v_i \quad (3)$$

where:

W_i: nominal wage of working individual i

X_i: characteristics of working individual i and his/her household

a^s: intercepts in log-wage earning equation in segment s

b^s: slopes in log-wage earning equation in segment s

v_i: unobserved determinants of log-wage of individual i[58]

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[56] In Amemiya and Shimono, where the focus is on the labour supply decision, "utility is completely known to the individual but is a random variable for the econometrician" (Amemiya and Shimono, 1989, p.14). Here, as in RBR, "utility" is replaced by a "criterion value", as the focus is on whether the individual gets a job given his/her labour supply.

[57] Assuming absence of measurement errors.

[58] Assuming absence of measurement errors.

7.2.4 Non-labour income

Non-labour income is the sum of dividend earnings, the net interest flow earned, and a residual element ($\overline{OTHY_i}$) that captures all other sources of income, all in nominal terms. With $\overline{OTHY_i}$ being exogenous and fixed in the CGE, it is kept as such in the micro model.

$$Y_{0i} = DIVD_i + FINT_i + \overline{OTHY_\iota} \qquad (4)$$

where:

Y_{0i}: non-labour income of individual i

$DIVD_i$: dividend earnings of individual i

$FINT_i$: net interest flow earned by individual i

$\overline{OTHY_\iota}$: other incomes of individual i

This completes the specification of the household income model consistently with the modelling of the factor market in the CGE model for Argentina.

7.3 Estimation of the model

Every element in the household income model must be determined, which implies the sequential observation of variables in the household survey ($YH_h, IW_i, W_i, Y_{0i}, Z_i, X_i$, $DIVD_i, FINT_i$ and $\overline{OTHY_\iota}$), econometric estimation of the parameters in the employment (α^s and β^s) and wage (a^s and b^s) equations, and attribution of unobservables in those equations ($u_i, CV_i^W, \overline{CV}^U$ and v_i).

7.3.1 Observation of variables in the household survey

The household survey used to gauge labour and non-labour incomes, employment status, and covariates for the employment and wage equations, is the October 2001 wave of the Permanent Household Survey (PHS, "EPH") carried out by the National Institute of Statistics and Census (INDEC), which gathers information on individual socio-demographic characteristics, income sources and labour indicators, and provides sample weights indicating the number of individuals or households represented by each

individual or household in the sample, once corrected for missing data. This wave of the survey covers 29 urban areas (all the urban areas with more than 100,000 inhabitants), accounting for 87.2 per cent of the country's population.

The survey classifies individuals into employed, unemployed or inactive (i.e. neither working nor actively searching for a job). It thus allows for the identification of individuals at work and individuals supplying labour (including the employed and the unemployed). The survey has also information on gender, education (completed level and years of education), age, marital status[59], regional dummies, a household head indicator and number of children (individuals with age not exceeding 14 years old), which potentially affect the employability of the individuals and so are useful to provide covariates for the employment status equation (Z_i). Z_i includes work experience of the individual, which is proxied by the age minus the years of education minus the obligatory age of start of education. X_i is given by Z_i once the household head indicator and the number of children have been excluded, variables which are perceived as affecting the employability of labour suppliers but not having an effect on the wages of the individuals at work, and provide reasonable instruments for testing the presence of sample selection bias due to incidental truncation, as explained in next section[60]. The survey allows for the categorisation of individuals into skilled and unskilled, the former being those who have completed high school. Formal workers are identified as those contributing to social security, with work risk insurance and/or compensation if they are fired. Finally, each sampled household is categorised into one of the representative household groups (RHG): households whose capital income exceeds labour income are classified as capitalist (C). Non-capitalist households whose household head finished secondary school are categorised as skilled[61](S). The rest of the households are categorised as unskilled (U). (Gray 1997; Korenman and Neumark 1991)

[59] Marital status is reported to affect performance and wages by Korenman (1991, p.282) when analyzing evidence on white males. One of the most robust findings in human capital wage equations has been that married men earn more than men who never marry (Gray, F, 1997, p. 482).
[60] Finding a perfect instrument is virtually impossible given that observed variables tend to affect labor demand both in relation to whether an individual is hired and how much he or she is eventually paid.
[61] In the case of missing information for the household head, the skill level of other members of the household was evaluated, starting with the partner of the household head.

7.3.2 Econometric estimation of the parameters in the model

To estimate the effect of the mentioned covariates (Z_i and X_i) on employment status and (log) wages, respectively, econometric estimations are conducted, determining the values of the (α^s, β^s, a^s and b^s) parameters in the model.

Parameters in the employment equation. Parameters α^s and β^s in equation (2) are estimated using segment-specific binomial logit functions in the formal labour market, i.e. assuming that, in each of these segments, the unobservables are identically and independently distributed (IID) and come from a logistic pdf. Logit is preferred to probit given the property satisfied only by the former, by which the average in-sample predicted probability equals the sample frequency, which makes the link between the coefficients in the segment-specific logit functions and employment rates at macro level more direct. Unemployment is taken as the base category for conducting the binomial logit estimation.

From the original 15,221 formal skilled and 7,238 formal unskilled workers present in the micro database, the model is run on 14,574 skilled and 6,858 formal unskilled workers, the reduction in observations by and large due to missing data on years of education. In both segments, the overall significance of the model is not rejected and completed education level, experience, marital status, household head and number of children in the household are significant determinants of the employment status at the 1% level. Their effects are positive, except for number of children in the household, which has a negative effect. The positive effect of experience is reduced with each increase in its value.

As a by-product of the estimation of this equation for the household income model, impact and marginal effects are estimated, with benchmarks being married males heading households in Great Buenos Aires who have not completed the educational level achievable inside their skill categories[62] and have mean experience (17.7 years for the skilled, 25.9 years for the unskilled). The probability of being employed is 90.2 per cent for the skilled benchmark and 55.5 per cent for the unskilled one. Providing both

[62] This level is primary for unskilled and university for skilled.

individuals in the benchmark with covariates with positive effects on their employment status reduces the gap between their employment probabilities. For example, *ceteris paribus*, completing education level (primary school for the unskilled, university for the skilled) increases the probability of being employed by 17.6 p.p. for the unskilled and 5.8 p.p. for the skilled, closing the probability gap by 11.8 p.p. An additional year of experience increases the probability of having a job by 2.5 p.p. (unskilled) and 0.8 p.p. (skilled). Heading a household increases the probability of being employed by 14.6 p.p. (unskilled) and 2.7 p.p. (skilled). Being married increases it by 15.7 p.p. (unskilled) and 4.3 p.p. (skilled). Belonging to a larger household is associated with a lower probability of being employed (1.1 p.p., unskilled and 0.5 p.p., skilled)[63]. There are regional differences in both labour segments: for skilled individuals, the probability of being employed is smaller in La Pampa and Great Buenos Aires; for unskilled individuals, the employment prospect is (20.7 p.p.) better in Patagonia than in Great Buenos Aires. Being male significantly increases the likelihood of being employed only for the unskilled (5.8 p.p.).

Parameters in the wage equation. Separate regressions are run to estimate the parameters of the wage equation for each labour market segment. In the labour segments where unemployment is allowed (the formal ones), the wage equation is potentially subject to the presence of sample selection bias, by which the unobservables in the OLS estimation of the wage equation are correlated with those in the employment status equation, hence biasing the OLS estimates of the wage equation. This form of sample selection bias is known as "incidental truncation" (Wooldridge 2003,p560-2), by which we observe log-wages only for those at work i.e. the truncation of observed wages is incidental in the sense that it depends on another variable: employment status.

[63] This is consistent with the World Bank 1999 Poverty Assessment on Argentina finding that poor households tend to be larger.

Table 7-2 Explanation of employment status in formal labour market segments

Binomial Logit CDF: $P(IW_i = 1|Z_i) = \frac{e^{\alpha^S + Z_i\beta^S}}{1+e^{\alpha^S + Z_i\beta^S}}$

Variable	Formal skilled		Formal unskilled	
	Coef	dy/dx[M]	Coef	dy/dx[M]
Male[D]	0.0393	0.0035	0.2333	0.0581
	(0.0560)	*(0.0050)*	*(0.0651)* ***	*(0.0162)*
Married[D]	0.4145	0.0431	0.6360	0.1573
	*(0.0643)***	*(0.0071)*	*(0.0586)* ***	*(0.0142)*
Household Head[D]	0.2747	0.0270	0.5901	0.1462
	*(0.0691)***	*(0.0071)*	*(0.0666)* ***	*(0.0161)*
Completed Education Level[D]	0.9702	0.0583	0.7799	0.1762
	*(0.0705)***	*(0.0054)*	*(0.0825)* ***	*(0.0204)*
Experience	0.0900	0.0079	0.0997	0.0246
	*(0.0072)***	*(0.0008)*	*(0.0083)* ***	*(0.0020)*
Experience squared	-0.0013	-0.0001	-0.0014	-0.0003
	*(0.0001)***	*(0.00001)*	*(0.0001)* ***	*(0.00003)*
Number of children	-0.0613	-0.0054	-0.0483	-0.0119
	*(0.0133)***	*(0.0012)*	*(0.0116)* ***	*(0.0028)*
Region Northwest[D]	0.1752	0.0144	0.1277	0.0313
	*(0.0830)**	*(0.0069)*	*(0.0884)*	*(0.0216)*
Region Northeast[D]	0.3896	0.0293	0.0793	0.0195
	*(0.1037)***	*(0.0077)*	*(0.1052)*	*(0.0258)*
Region Cuyo[D]	0.3618	0.0275	0.1742	0.0425
	*(0.1060)***	*(0.0079)*	*(0.1057)*	*(0.0257)*
Region Pampa[D]	0.0674	0.0057	-0.0770	-0.0190
	(0.0749)	*(0.0065)*	*(0.0800)*	*(0.0198)*
Region Patagonia[D]	0.6654	0.0449	0.9434	0.2071
	*(0.1056)***	*(0.0072)*	*(0.1000)* ***	*(0.0220)*
Constant	0.5730		-2.5913	
	*(0.0996)***		*(0.1637)* ***	
N	14,574		6,858	
McFadden-R^2	0.0952		0.1252	
Prob > χ^2	0.0000		0.0000	

Base category: unemployed. Standard errors between parenthesis.

*: significant at 10% level. **: significant at 5% level. ***: significant at 1% level.

[D]: dummy variables
[M]: marginal and impact effects reported by segment for a married male heading a household in Great Buenos Aires who has not completed education level corresponding to his skill category (primary for unskilled, university for skilled) and has mean experience (25.9 years for unskilled, 17.7 years for skilled).

In the case of employment status being explained by a probit model, the standard OLS regression $log\ W_i = a^s + X_i b^s + v_i$, $E(v_i|X_i) = 0$ becomes $log\ W_i = a^s + X_i b^s + \lambda(\theta_i)\rho + v_i$, where $\lambda(\theta_i)$ is the inverse Mills ratio coming from the probit model i.e. minus the ratio of the standard normal pdf and cdf valued at the index function for each

individual ($\theta_i = \alpha^s + Z_i\beta^s$), and where ρ is its associated coefficient in the log-wage equation. To detect and eventually correct for the selection bias, the widely used two-step Heckman procedure 1) computes $\lambda(\theta_i)$ using probit and 2) includes it as a regressor in the OLS equation to test the significance of the sample selection bias. If the null of lack of significance of sample selection bias ($H_0: \rho = 0$) is rejected, the additional regressor $\lambda(\theta_i)$ is included in the OLS regression to avoid the mentioned bias in the OLS estimates.

In this case, the 2-step Heckman procedure is adapted since the logistic distribution function (rather than the normal distribution) was used to estimate the employment status equation. The inverse Mills ratio is substituted by minus the ratio between the logistic pdf and cdf. Its cdf is given by $\frac{e^{\theta_i}}{1+e^{\theta_i}}$. Its pdf is the derivative of the cdf respect to θ_i. Hence, $pdf = \left(\frac{e^{\theta_i}}{1+e^{\theta_i}}\right)' = \frac{\left(e^{\theta_i}\right)'\left(1+e^{\theta_i}\right)-e^{\theta_i}\left(1+e^{\theta_i}\right)'}{\left(1+e^{\theta_i}\right)^2} = \frac{e^{\theta_i}(1+e^{\theta_i})}{(1+e^{\theta_i})^2} - \frac{(e^{\theta_i})^2}{(1+e^{\theta_i})^2} = cdf_i - cdf_i{}^2 = cdf_i(1-cdf_i)$. Then the analogous to the inverse Mills ratio becomes $\lambda^{LOGIT}(\theta_i) = -\frac{cdf_i(1-cdf_i)}{cdf_i} = -(1-cdf_i) = -pr_{0,i}$ with $pr_{0,i}$ being the predicted probability of the base outcome (unemployment) for each individual.

From the original 13,226 skilled, 3,732 formal skilled, and 10,559 informal unskilled employed individuals, the model is run on 10,627 skilled, 3,386 formal unskilled and 8,636 informal unskilled, again the reduction in observations by and large due to lack of data on years of education. In all segments the overall significance of the model is not rejected. Sample selection bias in the wage equation of the formal segments could not be rejected and thus was corrected for by the adoption of the two-step procedure[64]. There are significant regional differences in wages. For example, a skilled individual working in La Pampa would expect to earn 3.38 per cent less than someone with the same observable characteristics working in Great Buenos Aires. In every labour segment, *ceteris paribus*, males earn more than women, and those who have completed education level enjoy higher wages than the rest, with the differences being statistically significant though quite

[64] The same result showed up when checking using the traditional 2-step Heckman procedure.

tiny. For example, for a skilled individual, keeping other characteristics constant, being male increases the predicted wage by 0.35 per cent on average. Experience has a premium only in the formal skilled and informal unskilled segments, which decrease on it, with the maximum being around 35 years of experience for the skilled and 41 years of experience for the informal unskilled[65]. There is a significant marital status premium in the skilled and informal unskilled segments.

7.3.3 Attribution of unobservables.

The unobservables in the employment equation and the wage equation (u_i, CV_i^W, $\overline{CV}^U$ and v_i) need to be attributed in order to complete the determination of the elements in the household income model.

To impute the unobservables u_i and CV_i^W, u_i values need to be drawn randomly from the inverse of a logistic pdf and be consistent with the observed employment status: the u_i for every employed individual should be such that his/her criterion value for employment exceeds that for unemployment ($CV_i^W = \hat{\alpha}^s + Z_i\hat{\beta}^s + u_i > \overline{CV}^U$) and for every unemployed individual his/her criterion values of employment does not exceed that limit, ($CV_i^W = \hat{\alpha}^s + Z_i\hat{\beta}^s + u_i \leq \overline{CV^U}$). In RBR Stata code, the u_i are drawn randomly from the mentioned pdf, but the consistency with the observed employment status is not assured. I extended the code following Fields and Soares (2004,p249-250) explanation in their application to Malaysia: for individuals whose criterion value implied by the randomly generated residual is inconsistent with the observed employment status, their unobservables $u_i$are generated again, and the process is repeated until all individuals have criterion values consistent with their observed labour status[66].

[65] This comes from maximising log W = a.EXP + b.EXP^2 + C respect to EXP, with W being wage, EXP being experience, a and b being the estimated coefficients of experience and its square for each labour segment, and C being all other log-wage determinants.

[66] The randomness at stake does have an impact on the distributional result of the microsimulation. The impact proved to be rather small, what is consistent with the variability of the criterion values tending to be dominated by that of its deterministic component, as coming from comparing the standard deviations of CV_i^W (1.93) and u_i (1.60).

Table 7-3 Explanation of log wages by labour market segment

$$logW_i = a^s + X_i b^s + \lambda(\alpha^s + Z_i\beta^s)\rho + v_i \qquad (3)$$

Variable	Formal skilled	Formal unskilled	Informal unskilled
Male	0.3538	0.1800	0.4347
	*(0.0140)***	*(0.0241)* ***	*(0.0164)* ***
Completed Education Level	0.3692	0.1027	0.2563
	*(0.0229)***	*(0.0365)***	*(0.0223* ***
Experience	0.0209	0.0033	0.0406
	(0.0031) ***	*(0.0045)*	*(0.0021)* ***
Experience squared	-0.0003	-0.00001	-0.0005
	(0.0005) ***	*(0.00006)*	*(0.00003)***
Married	0.0594	-0.0386	0.1753
	(0.0166) ***	*(0.0251)*	*(0.0175)* ***
Region Northwest	-0.5441	-0.2794	-0.3334
	(0.0226) ***	*(0.0273)* ***	*(0.0273)* ***
Region Northeast	-0.6392	-0.3000	-0.4162
	(0.0273) ***	*(0.0324)* ***	*(0.0308)* ***
Region Cuyo	-0.5720	-0.2731	-0.3440
	(0.0283) ***	*(0.0333)* ***	*(0.0319)* ***
Region Pampa	-3.3764	-0.1500	-0.1115
	(0.0214) ***	*(0.0253)* ***	*(0.0261)* ***
Region Patagonia	-0.0891	0.0713	0.2595
	(0.0277) ***	*(0.0374)* *	*(0.0320)* ***
Inverse Mills Ratio	2.3143	0.8279	
	(0.1990) ***	*(0.1296)* ***	
Constant	6.2963	6.2981	4.4198
	(0.0705) ***	*(0.1614)* ***	*(0.0420)* ***
N	10,627	3,386	8,636
R^2	0.3182	0.2240	0.2109
Prob>F	*0.0000*	*0.0000*	*0.0000*

*: significant at 10% level. **: significant at 5% level. ***: significant at 1% level. Standard errors between parentheses.

The criterion value associated with unemployment can be set arbitrarily: while RBR and Fields and Soares (2004) set the criterion value for the "unemployed" alternative at zero ($\overline{CV}^U = 0$), I set it for convenience at the mean of the index function of the employed alternative ($\overline{CV}^U = E(\hat{\alpha}^s + Z_i\hat{\beta}^s)$). This meant that instead of waiting for hours without Stata getting a set of consistent criterion values, the process was successfully completed with less than 100 iterations.

Unobservables v_i affecting the log wage are needed to impute potential wages for all the active individuals, and were imputed strictly following RBR. For individuals at work with a positive reported wage, it is imputed as the residual of the OLS regression (once sample selection bias was accounted for). For those unemployed or at work with a reported null wage, it is randomly attributed from a normal distribution with mean zero and a standard deviation which is given by the estimated residuals of the OLS regression.

7.4 Communication of CGE macro outcomes

At this stage, the household income model is ready to receive macro information from the macro CGE model. I turn now the attention to the CGE model. Given the focus of this chapter, I will explain briefly how the macro shock is simulated, the main transmission channels at stake and how the communication from the CGE model to the household income model is made.

The real-financial-augmented-short-run (RFAS) CGE model previously developed, which explicitly models the financial mechanisms and accounts for short-run wage rigidities, is calibrated for the year 2001. In doing this, the 1991 already built SAM is updated to 2001 by imposing data available for 2001 on nominal GDP, aggregate demand components, activity shares in value added and tax receipts – to value added, labour payments, profits, import taxes and export taxes – as informed by the National Accounts 2001. The SAM is then made consistent by using the cross-entropy programme developed by Sherman Robinson and Scott Mc Donald, which treats every cell in the SAM as being specified with an error support set, and specifies a prior for each error distribution. Figures for labour supplies and unemployment rates in the different segments of the labour market, Rates of return on financial assets, and the currency supply – which are not in the SAM, which only captures flows – were also updated to 2001.

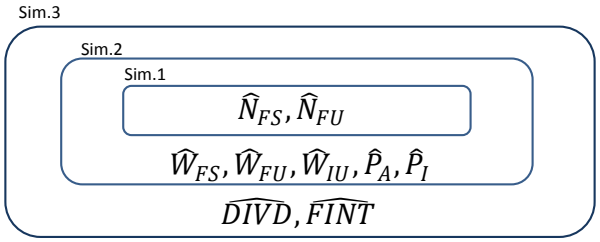
The capital outflow is then simulated, the main transmission channels at stake highlighted and estimates of changes in relevant macro variables presented for subsequent communication to the micro model. Deposits of non-residents at domestic banks fell

approaching the end of the Currency Board regime by 35.0 per cent, from 32.9 billion dollars (December 2000) to 21.4 billion dollars (December 2001). The transmission channels are shown in the diagram below, and are similar in general to those found for an increase in the perceived probability of default on domestic assets in the previous chapter. The shock essentially leads to a contraction of the economy, with falls in the use of formal skilled and unskilled labour ($\widehat{N}_{FS} = -6.17\%, \widehat{N}_{FU} = -6.54\%$), falls in labour nominal wages for formal skilled, formal unskilled and informal unskilled ($\widehat{W}_{FS} = -0.39\%, \widehat{W}_{FU} = -0.05\%, \widehat{W}_{IU} = -7.21\%$), and falls in the price of primary and industrial goods ($\hat{P}_A = -4.01\%, \hat{P}_I = -2.32\%$), tiny falls in dividends earned by residents ($\widehat{DIVD} = -0.07\%$) and net interest earned by domestic households ($\widehat{FINT} = -0.04\%$). All the RHGs (skilled, unskilled and capitalist) suffer nominal incomes losses: ($\widehat{YH}_S = -5.77\%, \widehat{YH}_U = -4.56\%, \widehat{YH}_C = -8.89\%$)[67].

To decompose the behavioural microsimulation effects in order to understand the cumulative effects of the macro changes in the employment level, relative prices and capital incomes and then to compare the results against traditional arithmetic microsimulations, first the CGE model is allowed to increasingly inform the microsimulation model in different simulations as shown in the following figure: it communicates macro changes in 1) the employment levels in the formal segments, 2) nominal wages and prices and 3) capital incomes. The CGE also informs RHGs incomes changes ($\widehat{YH}_S, \widehat{YH}_U, \widehat{YH}_C$), thus allowing to conduct traditional arithmetic microsimulations (Sim.4, RHG) which provide a comparison point for the behavioural microsimulations.

[67] The relatively large fall in the income of the capitalist RHG is an unintended result of the model described in a previous chapter. The capital outflow reduces the money base and, for the banks' reserve ratio to remain constant, the deposits of the capitalist households turn negative. This makes the interest flowing from the banks to them on their deposits become negative, and their total income fall significantly. The behavioural microsimulations conducted here allow us to avoid this problem with the generation of household income counterfactuals.

Figure 7-1 Behavioural microsimulations



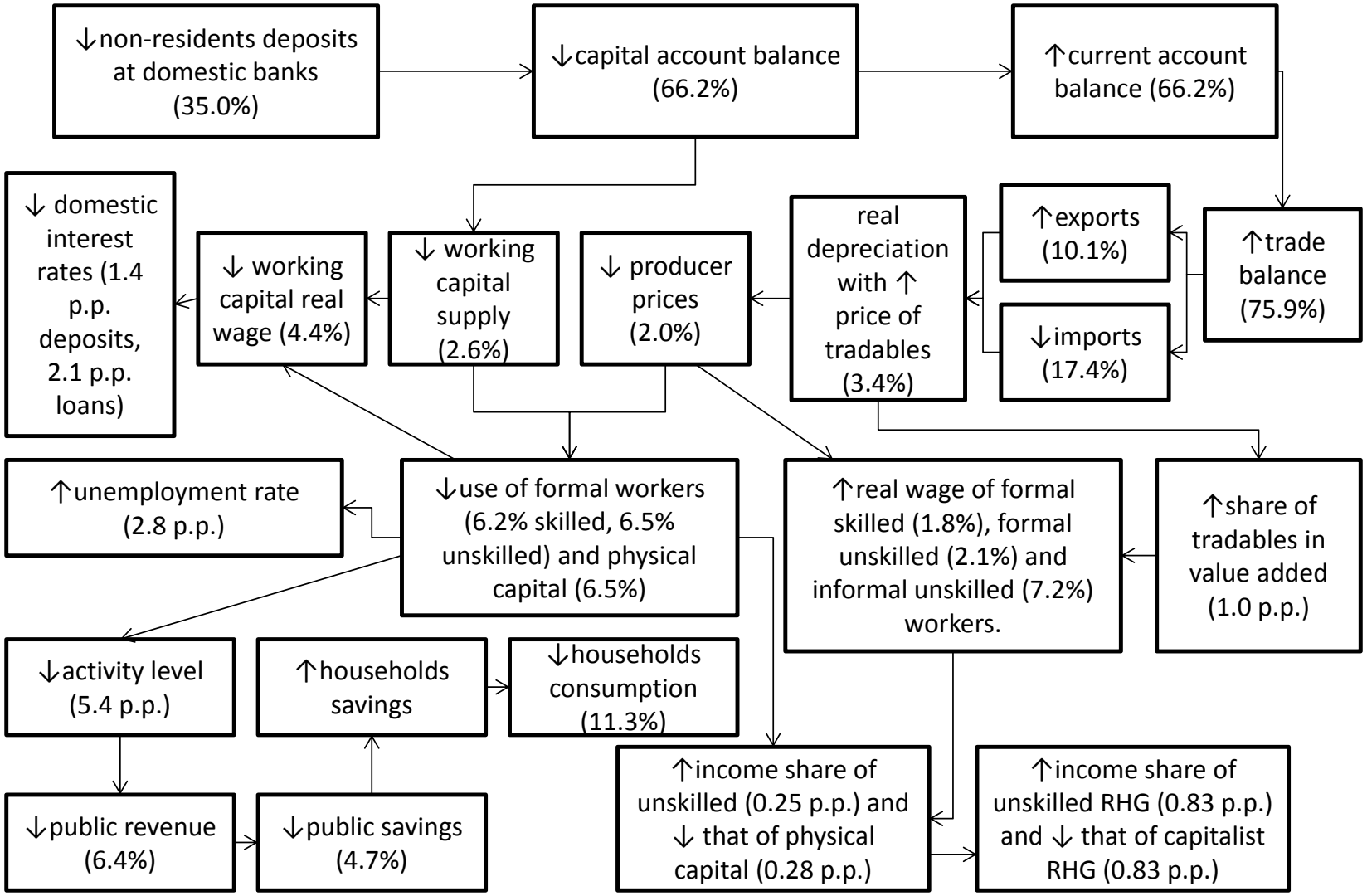
7.5 The attribution of the changes at micro level

Changes are first attributed for employment and wage changes (Simulations 1 and 2), then also for capital income changes (Simulation 3), and finally for household income changes (Simulation 4).

7.5.1 Simulations 1 and 2

The household income model is used to generate micro changes consistent with the set of macro changes communicated from the CGE model. Households' and individuals' observed and unobserved characteristics need to remain unchanged. However, the parameters in the household income model need to change in order to generate micro results consistent with the equilibrium of aggregate markets in the CGE model in terms of employment levels and average wages (Simulations 1 and 2). Following the methodology designed by RBR, the changes in the parameters are made assuming "neutrality" with respect to individual characteristics i.e. changing the intercepts of the equations (2) and (3) of the household income model. The neutrality holds in the following sense: changing the intercepts α of the log wage equations generates a proportional change of all wages in each labour-market segment, and changing the intercepts α of the logit model implies that, for each individual, the relative change in his/her ex-ante probability of being employed depends only on his/her initial ex-ante probability rather than on his/her individual characteristics.

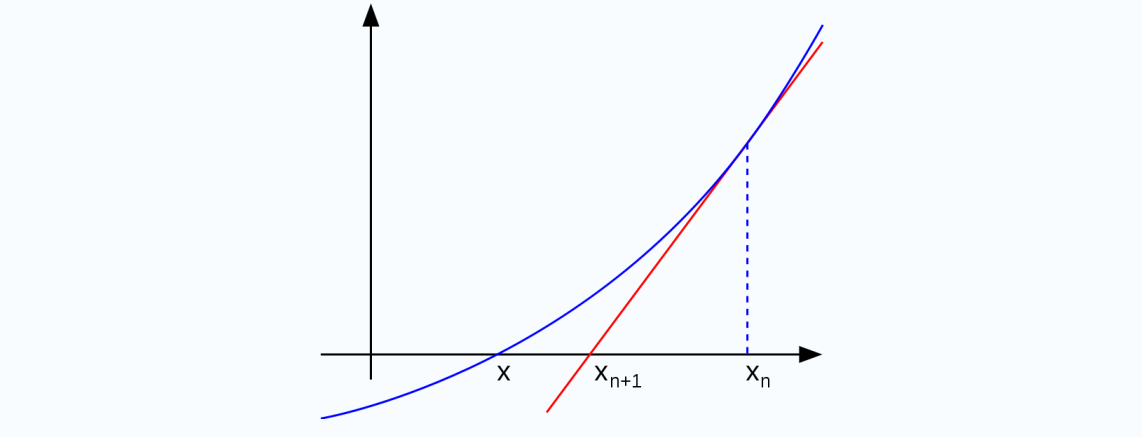
Figure 7-2 Transmission channels for a 60 per cent fall in the domestic deposits held by non-residents



To implement the needed changes in the equation intercepts, let us call the set of intercepts row vector $x = (\alpha_{FS}\ a_{FS}\ \alpha_{FU}\ a_{FU}\ a_{IU})$, the original macro figures $f(x) = (N_{FS,0}, N_{FU,0}W_{FS,0}, W_{FU,0}W_{IU,0})$, the macro targets column vector $f^*(x) = (N^*_{FS}, N^*_{FU}W^*_{FS}, W^*_{FU}W^*_{IU})$', with its elements given by $N^*_f = N_{f,0}.(1 + \widehat{N}_f)$ and $W^*_f = W_{f,0}.(1 + \widehat{W}_f)$, $N_{f,0}$ and $W_{f,0}$ being the employment rate[68] and the average nominal wage for each labour market segment in the sample once sample weights have been accounted for, and $\widehat{N}_f$ and $\widehat{W}_f$ the associated percentage changes coming from the CGE model.

The problem is to find an x vector consistent with the $f^*(x)$ macro target vector. This leads to a system of non-linear equations with as many equations as unknowns (5). The solution can be searched using the Newton's (also known as Newton-Raphson's) method, which works by finding successively better approximations to the root of a real-valued function or system of equations that is continuous and differentiable in the interval going from the initial guess to the root (Iserles 1996,p95-6). For a real-valued function with only one argument, as illustrated in the following graph, one starts with an initial guess (x_n) which should be reasonably close to the true root (x). The value of the function and its derivative are evaluated there ($f(x_n)$ and $f'(x_n)$) and used to get a new guess x_{n+1} given by the x-intercept of the tangent to the function evaluated at x_n. Algebraically, the new guess is given by $x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}$. The process is iterated until convergence to the root is reached.

Figure 7-3 Newton's method



[68] Defined as the ratio between employed individuals and individuals supplying labor in the segment.

In the present case, the Newton's method is used to solve not one equation but a system of equations, which amounts to finding the zeroes of continuously differentiable functions $f(x)$: $R^5 \rightarrow R^5$. Instead of a simple derivative, one needs to get a Jacobian matrix J with all the possible combinations of partial derivatives of the elements of $f(x)$ respect to the elements of x:

$$J = \begin{bmatrix} \frac{\partial N_{FS}}{\partial \alpha_{FS}} & \frac{\partial N_{FS}}{\partial a_{FS}} & \frac{\partial N_{FS}}{\partial \alpha_{FU}} & \frac{\partial N_{FS}}{\partial a_{FU}} & \frac{\partial N_{FS}}{\partial a_{IU}} \\ \frac{\partial W_{FS}}{\partial \alpha_{FS}} & \frac{\partial W_{FS}}{\partial a_{FS}} & \frac{\partial W_{FS}}{\partial \alpha_{FU}} & \frac{\partial W_{FS}}{\partial a_{FU}} & \frac{\partial W_{FS}}{\partial a_{IU}} \\ \frac{\partial N_{FU}}{\partial \alpha_{FS}} & \frac{\partial N_{FU}}{\partial a_{FS}} & \frac{\partial N_{FU}}{\partial \alpha_{FU}} & \frac{\partial N_{FU}}{\partial a_{FU}} & \frac{\partial N_{FU}}{\partial a_{IU}} \\ \frac{\partial W_{FU}}{\partial \alpha_{FS}} & \frac{\partial W_{FU}}{\partial a_{FS}} & \frac{\partial W_{FU}}{\partial \alpha_{FU}} & \frac{\partial W_{FU}}{\partial a_{FU}} & \frac{\partial W_{FU}}{\partial a_{IU}} \\ \frac{\partial W_{IU}}{\partial \alpha_{FS}} & \frac{\partial W_{IU}}{\partial a_{FS}} & \frac{\partial W_{IU}}{\partial \alpha_{FU}} & \frac{\partial W_{IU}}{\partial a_{FU}} & \frac{\partial W_{IU}}{\partial a_{IU}} \end{bmatrix}$$

The departure point for the implementation of the Newton algorithm was given by the code used in RBR. The original code presented a problem: once the macro target was relatively close (but the distance to it exceeded the tolerance), the intercepts started to move up and down without reducing with each simulation the distance to the target. To avoid this problem, I adjusted the algorithm so that it is able to approach the target at a relatively high speed but when the target is passed, i.e. when the macro figure is below (above) the target before the step, but above (below) it after the step, the algorithm reduces the step by which the intercept in the equation is adjusted.

In more detail, the Newton algorithm was conducted in the following way:

1. The maximum number of iterations for the algorithm $imax$ was set, as well as the tolerance Euclidean distance tol between the final $f(x)$ and the target $f^*(x)$ macro figure, and a $dump$ diagonal matrix which regulates the size of the steps given when changing the different intercepts in each iteration.
2. $f(x)$ was computed for the original intercepts x.
3. $f^*(x)$ target was assigned using the CGE outcomes.

4. A vector $diff = f(x) - f^*(x)$ was computed, as well as its Euclidean distance to the origin: $dist = \sqrt{diff' * diff}$.
5. If $dist$ exceeds tol and while number of iterations is below or equal to $imax$:
    a. Compute the Jacobian matrix J and its inverse JI
    b. Compute vector $jdif = dump * JI * diff$
    c. Decrease x by $jdif$
    d. Compute $f(x)$
    e. Calculate $diff$ and $dist$
    f. If $dist$ changes sign (i.e. if the target was "missed"), half the $dump$ diagonal matrix element
6. The outcome intercepts x and the Euclidean distance of macro values to target $dist$ are reported, as well as the labour income of each individual (zero for those unemployed).

As pointed out by Iserles (1996,p95-6), the computation of a Jacobian matrix and the solution of a linear system in each iteration makes the Newtonian technique costly. However, for small systems of equations as the one at stake, the solution is reached relatively fast. With the commented adaptation in the algorithm, a maximum of 100 iterations allowed, an original dump factor of 0.5, and a tiny target distance ($1*10^{-6}$), the algorithm hits the iteration limit (100 iterations) in less than 5 minutes per simulation, arriving at simulated intercepts that allow the percentage variations in employment rates and average wages to be replicated at two decimal points of precision. As expected, α_{FS} and α_{FU} fall to allow employment levels to shrink. However, α_{FS}, α_{FU} and α_{IU} do not fall systematically, which reflects that some individuals with wages exceeding the average wage in the associated labour segments are fired, making the average wage fall, *ceteris paribus*, and calling for wage increases for those still employed in order for the average wages not to fall more than is indicated by the macro target.

Table 7-4 Estimated and simulated intercepts of labour and wage equations

Intercept	Regression	Simulation 1	Simulations 2 & 3
α_{FS}	0.5730	0.4746	0.4746
a_{FS}	6.2963	6.2942	6.2903
α_{FU}	-2.5913	-2.6634	-2.6634
a_{FU}	6.2981	6.2941	6.2935
a_{IU}	4.4198	4.4198	4.3450

7.5.2 Simulations 3 and 4

The adjustment of individual capital incomes (Simulation 3) and household incomes (Simulation 4) is pretty straightforward, as it is performed arithmetically. The capital incomes are adjusted in simulation 3 using the percentage changes $\widehat{DIVD}, \widehat{FINT}$ coming from the CGE model. For simulation 4, the income of each sampled household is adjusted using the income change of the RHG associated to that household ($\widehat{YH_S}, \widehat{YH_U}$ or $\widehat{YH_C}$).

7.6 Income distribution, poverty and welfare effects at household level

For microsimulations regarding individual incomes (SIM1-SIM3), simulated incomes at the individual level are translated at the household level making use of the household income identity (1) and -before- of the non-labour income equation (4). Then, to evaluate the income distribution, poverty and welfare effects of the capital outflow using household level data, I use the following set of tools: an average income indicator, inequality indicators (Gini and General Entropy), poverty indicators (Foster-Greer-Thorbecke using different poverty lines) and graphs looking at the percentage changes in income by ventiles and percentiles of household per capita income, taking account of sample weights[69].

Four different poverty lines are used to calculate the FGT indicators: the dollar-a-day and 2-dollar-a-day poverty lines, and those used by the National Statistics Office in Argentina (INDEC): extreme and moderated poverty lines. In the base scenario, where

[69] Original frequency weights are proportionately adjusted upwards keeping the total sum of weigths constant given that some households are dropped from the sample, as explained below.

the dollar and the Argentinean peso are traded in a one-to-one relation, household specific dollar-a-day and 2-dollar-a-day poverty lines are computed as 30 times the household size, given that the recollection period is one month.

INDEC's methodology to define the poverty line is based on adult equivalents in the households and estimated consumption needs. The number of adult equivalents in each household is calculated by summing the adult equivalent of each individual in the household, which is in turn a function of the gender and age of the individuals (an "Adult Equivalent" table provided by INDEC was used). The household-specific INDEC poverty lines are then generated reflecting constant economies of scale in consumption (as INDEC methodology states), by simply multiplying the number of adult equivalents in the household times the value of the poverty lines per adult equivalent as informed by INDEC for October 2001 (A$ 61.02 for the extreme one and A$ 150.11 for the moderated one).

The poverty lines are adjusted in simulations 2 to 4 in the light of changes in commodity prices $\hat{P}_A, \hat{P}_I$, which affect the value of the INDEC poverty lines, weighting the price changes following the official poverty line methodology (27.5 per cent for A and 72.5 per cent for I)[70].

The indicators and graphs are then prepared for the income distribution vector in the benchmark and the simulations, adjusting for sample frequency weights. By analysing the simulated incomes based on the 21.795 of the 22.991 households that were originally in the database[71], and using their associated sample weights, it is found that household per capita income falls more than 3 per cent mainly due to the fall in employment levels (SIM1) and not as much (only around 1 per cent) due to the fall in wages (SIM2), a result in turn coming from the wage rigidity captured in the CGE model. Changes in capital income (SIM3) are tiny (as informed from the CGE output). Overall, household per capita income falls 4.4 per cent in the behavioural microsimulations (SIM3), below the 5.4 per cent in the arithmetic ones based on representative household groups (RHG), the difference capturing the different weights

[70] The official moderated poverty line comes from multiplying the extreme poverty line (the price of a Basic Food Basket) by the inverse of the Engel coefficient, which is kept fixed.
[71] Households with one or more individuals not reporting wage covariates were dropped, and frequency weights for the remaining households were proportionately adjusted.

that factor incomes have in household incomes in the CGE model and in the micro database.

The cumulative effects of employment, wages and capital income changes (Simulation 3) consistently lead to increases in every inequality and poverty indicator for every poverty line. The Gini coefficient increases from 48.9 to 49.8. However, with the average income falling from A$ 309.1 to A$ 295.5, the average expected difference between two individuals randomly taken falls around 2 per cent (from A$ 302.3 to A$ 294.3)[72]. The increases in the Gini are due to the loss of jobs and to a lesser extent to the reduction of labour wages. The Entropy Index shows a similar behaviour, but starts at a higher level than the Gini and increases by more than it given that the Entropy Index gives a higher weight to the upper tail of the income distribution, and that the households in the upper tail of the distribution have an income which significantly differs from the rest[73] and do not suffer the significant income fall affecting the rest of the households. Arithmethic microsimulations, unable to capture the effect of the loss of jobs on individual incomes, lose a large part of the action, and lead to conclude that inequality goes down, independently of the inequality indicator used (the Gini falls from 48.9 to 48.7 and the Entropy Index from 63.9 to 63.2). Independent of the microsimulation at stake, the changes in inequality are too small to be visualised in a Lorenz curve (Figure 7-4).

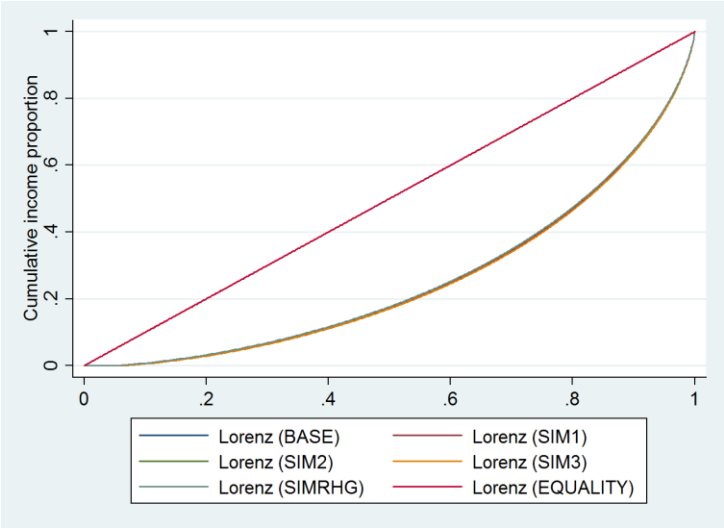
In the behavioural microsimulations, as per capita income falls and inequality increases, the poverty headcounts, the poverty gaps and the poverty severity indices rise for the different poverty lines, reflecting increases in the share of the households below the poverty line, the average difference between the income of the poor households and the poverty line, and income inequality among the poor households. For all these indicators and with all the poverty lines at stake, the increase is mainly due to the employment fall, though there are some slight increases due to the wage fall, and there is no change at all due to the capital income changes.

[72] The expected difference between two individuals randomly chosen is given by twice the Gini coefficient times the average income (Ray, 1998).
[73] Not tabulated.

For the middle and upper percentiles of household per capita income, the employment effect on income proves to be larger than the wage effect, both effects being negative. However, for the first 30 centiles, the wage effect is larger than the employment effect. As clearly shown in Figure 7-5 and Figure 7-9, it is the distribution of lost jobs the one basically shaping the income changes after a threshold given by the 30th centile. Though, as shown in the same figures for those at the bottom of the distribution the wage effect is typically larger than the employment effect, reflecting that jobs lost affect their income less severely than wage falls. The analysis of income changes in terms of percentiles allow to see a higher degree of heterogeneity than the analysis in terms of ventiles.

Capital income changes are insignificant[74], which is hardly surprising given the tiny changes in capital income communicated from the macro model. Finally, Figures 7-7 and 7-11 give a clear indication of the power of behavioural microsimulations to capture the heterogeneity of income changes in different parts of the income distribution due to a macro shock, as opposed to arithmetic microsimulations, which would give us the impression that the shock has a pretty homogenous effect and that its slight heterogeneity leads to a more progressive income distribution.

Figure 7-4 Lorenz curves



[74] This is the reason why in Figures 7-6 and 7-10 only a single line can be seen.

Table 7-5 Per capita income, inequality and poverty by simulation

Indicator	BASE	SIM1	SIM2	SIM3	SIMRHG
Per capita income	309.1	298.6	295.5	295.5	292.4
Inequality					
Entropy Index (α=2)[75]	63.9	66.7	67.8	67.8	63.2
Gini Index	48.9	49.5	49.8	49.8	48.7
Poverty					
Official Extreme Poverty Line					
Head-Count Index (P_0)	11.5	12.8	12.9	12.9	11.8
Poverty Gap Index (P_1)	6.7	7.9	8.0	8.0	6.8
Poverty Severity Index (P_2)	5.4	6.6	6.6	6.6	5.5
Official Moderated Poverty Line					
Head-Count Index (P_0)	31.1	32.9	32.8	32.8	31.9
Poverty Gap Index (P_1)	15.2	16.6	16.7	16.7	15.5
Poverty Severity Index (P_2)	10.4	11.7	11.7	11.7	10.6
US$ 1-a-day Poverty Line					
Head-Count Index (P_0)	7.3	8.6	8.9	8.9	7.7
Poverty Gap Index (P_1)	5.2	6.4	6.5	6.5	5.3
Poverty Severity Index (P_2)	4.6	5.8	5.8	5.8	4.7
US$ 2-a-day Poverty Line					
Head-Count Index (P_0)	14.1	15.6	16.1	16.1	15.1
Poverty Gap Index (P_1)	8.0	9.2	9.5	9.5	8.3
Poverty Severity Index (P_2)	6.1	7.3	7.5	7.5	6.3

7.7 Conclusions

By linking the CGE model to a behavioural microsimulation module in a layered way, the approach takes full account of the observed households' and individuals' heterogeneity and is useful to evaluate the short-run effects of macro policies and shocks on the full income household distribution, capturing the presence of job rationing. Departing from the state-of-the-art work by RBR, I took account of the presence of sample selection bias in a consistent way in the wage equation,

[75] α=2 such that zero income cases can be captured in the index

endogeneised the capital income in the household income model, improved the algorithm used to adjust the individual labour status and wages of the individuals, and extended the set of distributional and poverty indicators and graphs used.

The household income model built here allows for an explicit representation of the actual combination of income sources within sampled households and, weighting appropriately, of the represented population. The link of the CGE model with this micro model allows thus to see how macro phenomena affect individual jobs and income sources, and to look at the relative importance of the different transmission channels by which the CGE model communicates to the microsimulations model.

The conclusion of RBR, by which the selectivity of labour market rationing is the channel through which economy-wide phenomena have the most distributional impact (Bourguignon and Spadaro 2006, p.95), was confirmed here for most of the household groups (ventiles or percentiles). However, for the first groups, it was found that the wage changes affect them more than employment changes. Backing up these points, the relative importance of the employment channel was quantified and shown graphically, filling an existing gap in the literature. As in RBR, it was found that the distributional effects coming from behavioural microsimulations are larger than those found conducting the traditional RHG approach.

The analysis which was conducted (and especially its visual inputs, Figures 7-7 and 7-11, give a clear indication of the power of behavioural microsimulations to capture the heterogeneity of income changes in different parts of the income distribution due to a macro shock, clearly having an advantage for this purpose in comparison to arithmetic microsimulations. Arithmetic microsimulations seem to miss a large part of the action in this case, as they ignore the effect of the employment level fall on the income of the individuals who lose their jobs, a link which proves to be key in the distributional effects of the illustrated macro shock.

The capital outflows were found to lead to a fall in the employment level that, in absolute terms, exceeded 226 thousand jobs. This, in turn, shifted 77 thousand households in the country into poverty, a result robust to different poverty lines used.

Besides, it made the income inequality indicators shift up, generating an increase in the Gini coefficient of almost 1 percentage point.

To a certain extent, this suggests that the capital flows allowed by capital account liberalisation in Argentina had a significant impact on poverty and distribution in the country, and that the large and volatile capital flows hitting the Argentine economy during the nineties led to an increase in the vulnerability of households to poverty, with capital outflows reducing households' income, shifting a number of them below the poverty line and increasing inequality, and capital inflows putting the inverse process in motion.

Figures. Percentage changes in household per capita income and employment by income ventile

Figure 7-5 Income simulations 1 and 2 by ventiles

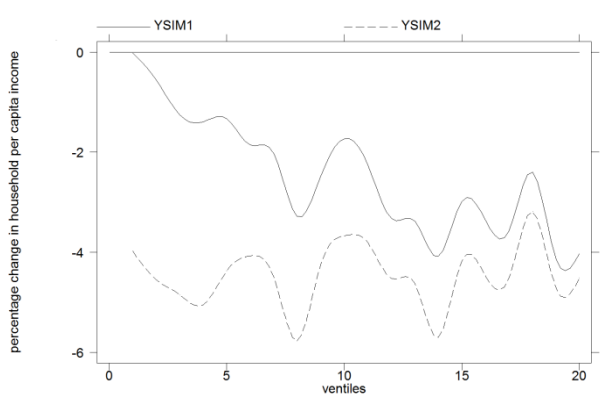


Figure 7-6 Income simulations 2 and 3 by ventiles

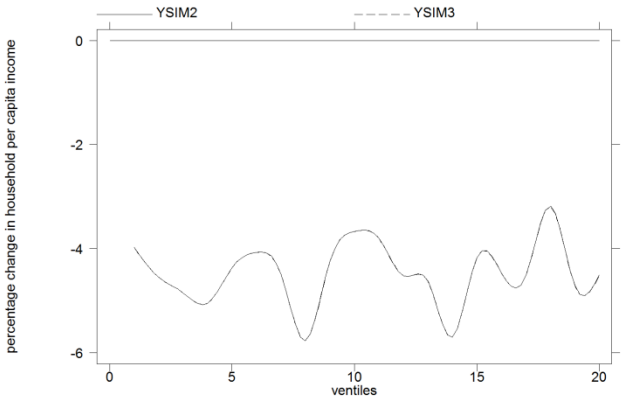


Figure 7-7 Income simulations 3 and RHG by ventiles

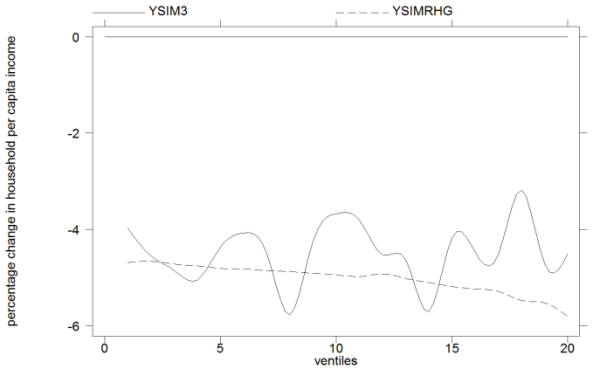
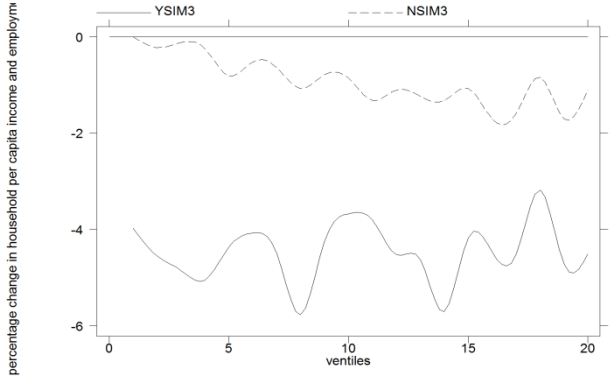


Figure 7-8 Income and employment simulation 3 by ventiles



Figures. Percentage changes in household per capita income and employment by income percentile

Figure 7-9 Income simulations 1 and 2 by percentiles

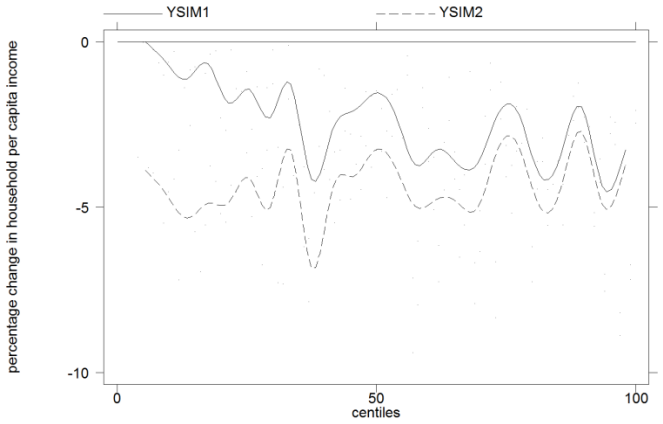


Figure 7-10 Income simulations 2 and 3 by percentiles

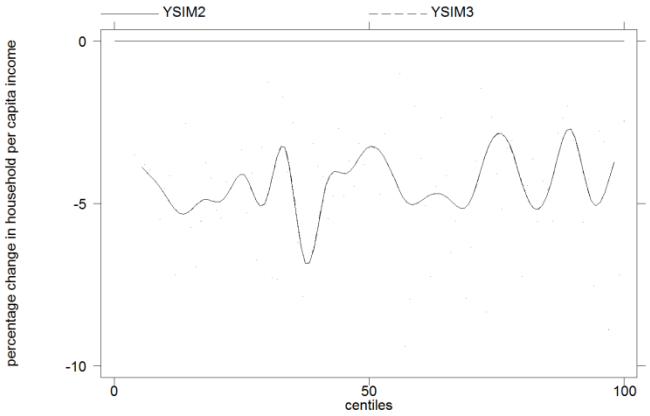


Figure 7-11 Income simulations 3 and RHG by percentiles

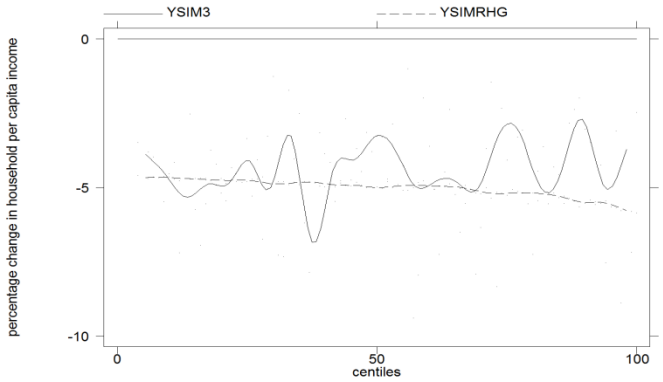
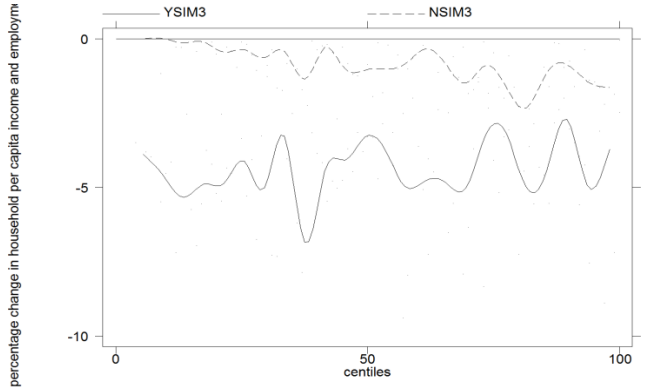


Figure 7-12 Income and employment simulation 3 by percentiles



Conclusions

The conclusions of the dissertations are grouped under the following headings: 1) modelling; 2) the effects of liberalisation on poverty and inequality in Argentina; 3) policy implications, and 4) further research.

C1. On modelling

With a straightforward adaptation of the real-focused IFPRI Standard model, one finds a structural adjustment story where external shocks and policies hit the structure of production of a developing economy and its income distribution. The story is internally consistent and essentially neoclassical, with optimising agents and flexible prices. As has been shown, the effects on income distribution essentially depend on whether the shock mobilises resources to the tradable or the non-tradable sectors, and on the factor-use intensity of these sectors. No significant effects on the activity level of the economy show up.

However, if one is interested in the short-run effects of these shocks on activity levels, then the inclusion of relations that are conventional in macro models and a modification in the production function helps. By allowing the model to capture 1) nominal rigidities embedded in the essence of traditional Keynesian theories of fluctuations according to David Romer (Romer 1996), 2) the relations present in the IS-LM model, 3) the financial assets and liabilities held by the economic actors and 4) working capital as a substitutable factor in the production function, real and financial external shocks lead not only to changes in the composition of aggregate demand, as analysed by Robinson (1991), but significantly affect unemployment and output in a magnitude and through a channel which is not captured by the simple incorporation of rigidities in the real model. Paraphrasing Adam and Bevan (1998), financial inclusion together with complementary devices allow the model to answer relevant questions such as: 1) how do expected defaults on domestic assets affect the economy? and 2) are the short-run effects of different capital flows affecting the economy differently?

The sensitivity analysis of the elasticities of the model versions that capture “money in the production function” suggests that the incorporation of nominal rigidities, while

allowing financial and real shocks to have significant effect on the activity level, come at the cost of reducing the robustness of the model to changes in its elasticity parameters. As acknowledged by Robinson (1991) and Adam and Bevan (1998), this financial inclusion adds richness to the model specification, allows us better to capture the macroeconomic phenomena and policy instruments and, as emphasised by Adam and Bevan (1998), enables us to address additional questions. However, this dissertation illustrates the costs associated with including portfolio considerations in terms of data requirements, and the corresponding tendency of the models to crash.

The use of behavioural microsimulations shows that changes in income distribution within the representative household groups matter, and confirms evidence found by RBR in Indonesia that using the standard approach based on representative household groups leads researchers to ignore significant transmission channels by which macro shocks affect income distribution and poverty, thus missing a large part of the action. Allowing for job rationing in the microsimulation approach enables us to capture the effect of the drop in employment on the income of the individuals who lose their jobs, a link which proved to be key in the distributional effects of the illustrated macro shock.

In determining the unobservables affecting the selection of who is fired (or hired) when labour demand changes occur, an iterative process is needed for them to be consistent with the observed employment status of the individuals. Sample selection bias in the wage equations should be accounted for in order to avoid biasing the parameter estimates of the wage equation. If a logit function is used to explain employment, the two-step Heckman procedure should be adapted for consistency with the logit function. When adjusting the household income model parameters for consistency with the macro variables after a macro shock with a Newtonian algorithm, its steps should shrink when the macro target is close, to make it possible to increase the precision with which the macro target is achieved without sacrificing speed. For the evaluation of poverty and distributional changes, international and national methodologies for setting the poverty line and Lorenz Curves can be usefully applied, together with a graphic consideration of the changes in household per-capita income. Finally, when investigating the importance of different transmission channels in the total effect of macro shocks on income distribution – e.g. employment status changes, wage and price changes, and capital

income changes – it seems useful to separate out these transmission channels, as has been done here.

C2. On the effects of liberalisation in Argentina

The opening of the capital account of the balance of payments allowed Argentina to receive significant capital inflows (in 1991-1994 and 1996-1998). As captured in *Shock 2*, they made it possible to expand the international reserves held by the central bank and monetary aggregates and domestic credit, lowering domestic interest rates and leading through demand and supply channels to an expansion of the activity level. By worsening the international investment position of the country – with expansion of the public and private external debt and foreign holdings of firms – they increased the net investment income paid to non-residents. Capital inflows led to increasing appreciation in the real exchange rate. As documented by Damill et al (2002, p.19), the real exchange rate at the beginning of the Plan appreciated significantly in relation to the previous period, and continued appreciating during the course of the Plan.

In turn, the appreciated exchange rate together with import liberalisation boosted imports (especially those from Mercosur, as the results of *Shock 1* suggest) and hurt tradable activities, as acknowledged by the former Ministry of Finance Dr. Domingo Cavallo (Cavallo and Cottani 1997, p.18), leading to a structural shift in production and factors out of tradable activities, and sustaining a persistent trade imbalance. The increase in the net investment income paid to non-residents combined with a trade imbalance led to recurring current account deficits. As domestic inflation eroded the real wages of skilled and unskilled workers, the income share of capitalist households increased, and income distribution in the country worsened.

With time, the external financial fragility of the economy increased, and the private sector perceived a higher risk of devaluation of the domestic currency and default on domestic debts, to which it responded by increasingly accumulating external assets in its portfolio, as illustrated in Shock 3, avoiding default and devaluation risks at the cost of reducing the international reserves and liquidity of the country, with corresponding contractions in working capital and output supply. With volatile capital inflows and the

private sector allocating an important share of its financial assets abroad, Argentinean firms faced binding financial constrains at the end of the period, as pointed out by Fanelli, Bebczuk et al. (2002), and as reflected in the model.

Overall, during the Currency Board the Argentinean economy witnessed two clear economic cycles. The first involved an expansion in the period 1991-1994 followed by a contraction during 1995. The second involved an expansion during 1996-1998, and a contraction which lasted beyond the collapse of the Currency Board in 2001. In the relative absence of available macroeconomic (fiscal, monetary and exchange rate) instruments to absorb the shocks, volatility was transmitted to the activity and employment levels, as Shocks 2 and 3 illustrate.

These macro effects had a micro counterpart. As the behavioural microsimulations conducted here illustrate, the capital outflows are estimated to have caused more than 75,000 workers to lose their jobs, and more than 30,000 households to fall below the poverty line, a result which is robust to the use of different poverty lines. Together with the increase in capital income that affected the upper part of the income distribution, this caused income inequality indicators to shift upward, though only marginally. This suggests that the capital flows allowed by capital account liberalisation in Argentina led to an increase in the vulnerability of households to poverty, with capital outflows reducing households' income, shifting a number of them below the poverty line and increasing inequality among the poor.

C3. On policy implications

To a certain extent, this analysis of Argentina's experience with its Currency Board can be conceptualised as an illustration of the impossible trinity illuminated by Robert Mundell (1963) concerning 1) perfect capital mobility, 2) fixed exchange rates, and 3) domestic monetary autonomy. During the period 1991-2001, Argentinean authorities adopted capital account convertibility (which significantly increased capital mobility) and a fixed exchange rate regime, losing monetary autonomy and, in turn, significantly reducing their ability to play a counter-cyclical role in the economy. In order to recover this ability, and also to avoid potential long-lasting current account disequilibria with non-residents, the country's authorities need to keep exchange rate and aggregate

demand policies under their control, and reconsider the regulation of international capital flows.

Argentina partly learned this lesson late in 2001. After facing a series of external crises, its authorities decided to derogate the Convertibility Law. They moved into an administered exchange rate regime which has allowed the country to significantly lift its competitiveness. Furthermore, they increased the discretionary use of monetary policy in order to counteract the effect of international capital flows on the activity level, even at the cost of generating inflationary pressures.

However, to increase their margin of manoeuvre regarding exchange rate and monetary policy, the Argentinean authorities should reconsider the regulation of international capital flows. Implementing controls to outflows seem to be extremely problematic, as these controls are easily circumvented and encourage bribery (Edwards 1999). Following John Williamson, Stephany Griffith-Jones and Ricardo Gottschalk (2005), the guiding criteria for regulating inflows are effectiveness (it should have a stabilising effect), cost minimisation (it should not lead to reduce welfare-enhancing financial transactions) and cost of administration (it should not be too costly for either the government or the investors to comply with – or evade – regulations). The Chilean experience with controls on capital inflows during the period 1991-1998, for example, by which an unremunerated reserve requirement (*encaje*) on all loans contracted abroad was imposed, has originated an intense debate on its effectiveness. There is general agreement that it increased the maturity of the inflows received by the country (Williamson, Griffith-Jones, and Gottschalk 2005; Edwards 1999), but the extent to which it made it possible to avoid an overvaluation of its real exchange rate due to capital inflows (Edwards 1999) remains open to debate. In defining the regulation of foreign capital flows, the considerable volume of evidence related to the effectiveness of taxing foreign exchange transactions, i.e. “Tobin” taxes, including studies on the Chilean experience and those surveyed by Neil McCulloch and Grazia Pacillo (2010), should be taken into account.

Finally, regarding fiscal policy, it should be acknowledged that to the extent that trade liberalisation and other real and financial shocks lead the productive structure of the economy to change, the reallocation of workers formerly employed in shrinking sectors

may take time. This is not acknowledged in the short-run model discussed here, which assumes full mobility of workers among segments to avoid unnecessary complications, but in practice (as observed in Argentina) structural changes may generate employment problems and during the transition it may be necessary to implement an extensive unemployment benefit program for which the public sector needs to assure resources in advance.

C4. Further research

For the model to account for the economic cycles generated by external shocks, it should be made dynamic. In doing so, a serious consideration of formation of expectations should be undertaken, exploring potential synergies with Lance Taylor (2004) and New-Keynesian DSGE Models such as Blanchard and Gali (2007), which, by allowing the model to depart from its neoclassical core, could allow for strong external shocks to lead to quantity adjustments without making the model crash.

Another potentially fruitful line of future research, as mentioned in RBR, would be to work on a more satisfactory integration between the macro and micro approaches to distributional issues, considering the extension of the transmission channels that link macro and micro models.

Bibliography

Adam, C. S., and D.L. Bevan. 1998. Costs and Benefits of Incorporating Asset Markets into CGE Models: Evidence and Design Issues. In *Applied Economics Discussion Paper Series*. University of Oxford.

Adelman, I, and S Robinson. 1978. *Income Distribution Policies in Developing Countries*. Stanford, CA: Standford University Press.

Agénor, P.R., R. Fernandes, E. Haddad, and D. van der Mensbrugghe. 2003. Analyzing the Impact of Adjustment Policies on the Poor: An IMMPA Framework for Brazil.

Agénor, P.R., H. Tarp Jensen, M. Verghis, and E. Yeldan. 2005. Disinflation, Fiscal Sustainability, and Labor Market Adjustment in Turkey. In *Adjustment Policies, Poverty and Unemployment: The IMMPA Framework*: Blackwell Publishing (Oxford University Press).

Agenor, P.R., and P.J. Montiel. 2008. Monetary Policy Analysis in a Small Open Credit-Based Economy. *Open Economies Review* 19:33.

Almeida dos Reis, J.G. , and R. Paes de Barros. 1991. Wage inequality and the Distribution of Education: A Study of the Evolution of Regional Differences in Inequality in Metropolitan Brazil. *Journal of Development Economics*:117-143.

Altimir, O, and L Beccaria. 2000. Distribucion del ingreso en la Argentina. In *Desempeno economico en un contexto de reformas*, edited by D. Heymann and B. Kosacoff. Buenos Aires: EUDEBA-ECLAC.

———. 2000. El mercado de trabajo bajo el nuevo regimen economico en Argentina. In *Desempeno economico en un contexto de reformas*, edited by D. Heymann and B. Kosacoff. Buenos Aires: EUDEBA-ECLAC.

Amemiya, T., and K. Shimono. 1989. An application of nested logit models to the labor supply of the elderly. *The Economic Studies Quarterly* 40 (1):14-22.

Barro, R. 2000. Inequality and growth in a panel of countries. *Journal of Economic Growth* 5:5-32.

Behrman, J.R., N Birdsall, and M. Szekely. 2001. Economic Policy and Wage Differentials in Latin America. In *PIER Working Paper*. Philadelphia: Penn Institute for Economic Research.

Behrman, J.R., N. Birdsall, and M. Szekely. 2001. Pobreza, desigualdad y liberalización comercial y financiera en América Latina. In *IADB Working Paper*. Washington: IADB.

Berlinski, J. 1998. *El sistema de incentivos en Argentina (De la liberalización unilateral al Mercosur)*. Buenos Aires: Instituto Torcuato Di Tella - Centro de Investigaciones Económicas.

———. 2004. *Los impactos de la política comercial: Argentina y Brasil (1988-1997)*. Edited by S. XXI. Buenos Aires: United Nation Programme for Development.

Berlinski, J, H Kume, and M (coordinators) Vaillant. 2006. *Hacia una política comercial común del Mercosur*. Edited by S. XXI. Buenos Aires: Red Mercosur.

Bhagwati, J. 2004. *In defense of globalization*. New York: Oxford University Press.

Bhagwati, J. 1973. The theory of immiserizing growth: Further applications. In *International trade and money*, edited by M. B. Connolly and A. K. Swoboda. Toronto: University of Toronto Press.

Birdsall, N. 1999. Globalization and the Developing Countries:The Inequality Risk. Paper read at Making Globalization Work. Remarks at Overseas Development Council Conference, March 18, at Washington, D.C.

Bisang, R., and G. Gomez. 2000. Las inversiones en la industria argentina en la década de los noventa. In *Desempeño económico en un contexto de reformas*, edited by D. Heymann and B. Kosacoff. Buenos Aires: EUDEBA-ECLAC.

Blanchflower, D.G., and A.J. Oswald. 1994. *The Wage Curve*. London: The MIT Press.

Blau, F., and L. Khan. 1996. International Differences in Male Wage Inequality: Institutions versus Market Forces. *Journal of Political Economy* 104 (4):791-837.

Bourguignon, F, B.H. Branson, and J. de Melo. 1992. Adjustment and Income Distribution: A Micro-Macro model for counterfactual analysis. *Journal of Development Economics* 38 (1):17-39.

Bourguignon, F, and L. A. Pereira da Silva. 2003. The Impact of Economic Policies and Income Distribution. Evaluation Techniques and Tools. Place Published: World Bank and Oxford University Press. www.worldbank.org (accessed 8/1/2010).

Bourguignon, F., and F. Ferreira. 2003. Ex Ante Evaluation of Policy Reforms Using Behavioral Models. In *The Impact of Economic Policies on Poverty and Income Distribution*, edited by F. a. L. A. P. d. S. Bourguignon. New York: World Bank and Oxford University Press.

Bourguignon, F., A.S. Robilliard, and S. Robinson. 2004. Representative versus real households in the macroeconomic modelling of inequality. In *Frontiers in Applied General Equilibrium Modelling*, edited by T.J.Kehoe, T.N.Srinivasan and J. Whalley. Cambridge: Cambridge University Press.

Bourguignon, F., and A. Spadaro. 2006. Microsimulation as a tool for evaluating redistribution policies. *Journal of Economic Inequality* 4 (1):77-106.

Brecher, R, and C. Diaz-Alejandro. 1977. Tariffs, Foreign Capital and Immiserizing Growth. *Journal of International Economics* 7:317-322.

Bustelo, P. 2002. Los orígenes de la crisis financiera de Argentina: una comparación con las crisis asiáticas. *Boletín Económico de Información Comercial Española*, January, 7 to 13, 2002, 9-14.

Camdessus, M. 1998. Capital account liberalization and the role of the Fund. , March 9, at Washington DC.

Canavese, A., H. Ahumada, P. Canavese, and F. Gonzalez. 2001. Currency Demand and the Size of the Shadow Economy: Critical Review of an Estimation Method with an Application For Argentina. In *LACEA 2001* Montevideo, Uruguay.

Cavallo, D. F., and J. A. Cottani. 1997. Argentina's convertibility plan and the IMF. *American Economic Review* 87 (2):17-22.

Cockburn, J. 2006. Trade liberalisation and poverty in Nepal: a computable general equilibrium micro simulation analysis. In *Globalization and poverty: channels and policies*, edited by M. Bussolo and J. Round. London: Routledge.

Cogneau, D., and A-S. Robilliard. 2006. Growth, distribution and poverty in Madagascar: learning from a microsimulation model in a general equilibrium framework. In *Microsimulation as a tool for the evaluation of public policies: methods and applications*, edited by A. Spadaro. Bilbao: Fundacion BBVA.

Damill, M, R Frenkel, and R Maurizio. 2002. Argentina: una década de convertibilidad. Un análisis del crecimiento, el empleo y la distribución del ingreso. Place Published: ILO (accessed 21/06/2010).

Davies, J.B. 2009. Combining Microsimulation with CGE and Macro Modelling for Distributional Analysis in Developing and Transition Countries. *International Journal of Microsimulation* 2 (1):49-65.

Dawkins, C., T.N. Srinivasan, and J. Whalley. 2001. Calibration. In *Handbook of Econometrics*, edited by J. J. Heckman and E. Leamer. North-Holland: Elsevier.

De Melo, J, and David Tarr. 1992. *A General Equilibrium Analysis of US Foreign Trade Policy*. Cambridge, Massachusetts and London, England: The MIT Press.

Decaluwe, B., and F. Nsengiyumva. 1994. Policy Impact under Credit Rationing: a Real and Financial CGE of Rwanda. *Journal of African Economies* 3 (2):262-308.

Dervis, K., J. de Melo, and S. Robinson. 1982. *General Equilibrium Models for Development Policy*. New York: Cambridge University Press for the World Bank.

Devaragan, S., J.D. Lewis, and S. Robinson. 1990. Policy Lessons from Trade-Focused, Two-Sector Models. *Journal of Policy Modeling* 12 (4):625-667.

Devarajan, S., J.D. Lewis, and S. Robinson. 1990. Policy Lessons from Trade-Focused, Two-Sector Models. *Journal of Policy Modeling* 12 (4):625-667.

DFID. 2000. Eliminating World Poverty: Making Globalization Work for the Poor. In *White Paper on International Development*. Place Published. www.dfid.gov.uk (accessed 20/06/2010).

Diaz Bonilla, C. 2005. Female participation, workers' sectoral choice, and household poverty: the effects of Argentina's structural reform during the 1990s Johns Hopkins University

Dollar, D, and A Kraay. 1999. Trade, growth and poverty. In *Policy Research Working Paper*. Washington, D.C.: World Bank.

———. 2000. Growth is Good for the Poor. In *World Bank Policy Research Working Paper*. Washington D.C.: World Bank.

———. 2003. Institutions, trade, and growth : revisiting the evidence. In *World Bank Policy Research Working Paper* Washington D.C.: The World Bank.

Easterly, W. 1990. Portfolio Effects in a CGE Model. Devaluation in a Dollarized Economy. In *Socially Relevant Policy Analysis: Structuralist Computable General Equilibrium Models for the Developing World*, edited by L. Taylor. Cambridge MA: MIT Press.

Edwards, S. 1997. Trade Policy, Growth and Income Distribution. *AEA Papers and Proceedings* 87 (2):205-220.

———. 1999. How effective are capital controls? *Journal of Economic Perspectives* 13 (4):65.

Escaith, H., and H. Paunovic. 2004. Reformas estructurales en América Latina y el Caribe en el período 1970:2000: Indices y Notas Metodológicas.

Evans, D. 2005. Inequality and Trade in Latin America. In *Overcoming inequality in Latin America, Issues and Challenges for the twenty-first century*, edited by R. Gottschalk and P. Justino. London: Routledge.

Fanelli, J.M., R.N. Bebczuk, and J.J. Pradelli. 2002. Determinants and Consequences of Financial Constraints Facing Firms in Argentina. In *IADB Working Paper*: Inter American Development Bank.

Fargeix, A., and E Sadoulet. 1994. A financial computable general equilibrium model for the analysis of stabilization programs. In *Applied general equilibrium and economic development: present achievements and future trends*, edited by T. Srinivasan. Michigan: Michigan University Press.

Fields, G.S., and S. Soares. 2004. The Microeconomics of Changing Income Distribution in Malaysia. In *Microeconomics of income distribution dynamics in*

East Asia and Latin America edited by F. Bourguignon, F. Ferreira and N. Lustig. Washington, DC: Inter-American Development Bank.

Fischer, S. 2003. Globalization and Its Challenges. Paper read at One Hundred Fifteenth Annual Meeting of the American Economic Association, at Washington, D.C.

Foster, E.F., and M. Szekely. 2001. Is Economic Growth Good for the Poor? Tracking Low Incomes Using General Means. In *IADB Working Paper 453*. Washington D.C.: IADB.

Frankel, J.A., and D. Romer. 1999. Does Trade Cause Growth? *The American Economic Review* 89 (3):379-400.

Frankel, J.A., and A. Rose. 2002. An estimate of the effect of common currencies on trade and income *Quarterly Journal of Economics* 117 (2):437-466.

Frenkel, R, and M Rapetti. 2006. Monetary and Exchange Regime Policies in Argentina after the Convertibility Regime Collapse. *Nuevos Documentos CEDES* (20).

Friedman, M. 1969. The Optimum Quantity of Money. In *The Optimum Quantity of Money and Other Essays*. Chicago: Aldine Publishing Company.

Ganuza, E., R. Paes de Barros, and R. Vos. 2001. Labour Market Adjustment, Poverty, and Inequality during Liberalisation. In *Economic liberalization, distribution and poverty: Latin America in the 1990s*, edited by L. T. E. Ganuza, R. Barros and R. Vos. Buenos Aires: UNDP.

Goldberg, P.K., and N. Pavcnik. 2007. Distributional Effects of Globalization in Developing Countries. *Journal of Economic Literature* 45 (1):39-82.

Gottschalk, R, and X. Cirera. 2003. Weighting the Potential Costs and Benefits of Capital Account Liberalisation: Institute of Development Studies.

Gray, J.S. 1997. The Fall in Men's Return to Marriage: Declining Productivity Effects or Changing Selection? *The Journal of Human Resources* 32 (3):481-504.

Harris, J., and M. Todaro. 1970. Migration, Unemployment & Development: A Two-Sector Analysis. *American Economic Review* 60 (1):126-142.

Helleiner, G.K. 2001. Markets, Politics and Globalization: Can the Global Economy be Civilized? *Journal of Human Development* 2 (1):27-46.

Iserles, A. 1996. *A First Course in the Numerical Analysis of Differential Equations*. Edited by D. G. Crighton. Cambridge, UK: Cambridge University Press.

Johansen, L. 1960. *A multi-sectoral study of economic growth*. Amsterdam: North-Holland.

Johnson, H.G. 1967. The possibility of income losses from increased efficiency or factor accumulation in the presence of tariffs. *Economic Journal* 77 (305):151-154.

Juhn, C., K. Murphy, and B. Pierce. 1993. Wage Inequality and the Rise in Returns to Skill. *Journal of Political Economy* 101 (3):410-442.

Kapur, B.K. 1976. Alternative Stabilization Policies for Less-Developed Economies. *Journal of Political Economy* 84 (4):777-796.

Korenman, S, and D Neumark. 1991. Does Marriage Really Make Men More Productive? *The Journal of Human Resources* 26 (2):282-307.

Kraay, A. 1998. In Search of the Macroeconomic Effects of Capital Account Liberalization.

Lee, H.Y., L.A.Ricci, and R.Rigobon. 2004. Once again, is openness good for growth? *Journal of Development Economics* 75:451-472.

Levhari, D, and D Patinkin. 1968. The Role of Money in a Simple Growth Model. *American Economic Review* (58):713-53.

Lewis, J.D. 1992. Financial Repression and Liberalization in a General Equilibrium Model with Financial Markets. *Journal of Policy Modeling* 14 (2):135-166.

Lofgren, H, R Lee Harris, and S Robinson. 2002. *A Standard Computable General Equilibrium (CGE) Model in GAMS*: IFPRI.

Londono, J.L. 2002. Capital for Equity in Latin America. In *Forth ABCDE Conference*. Oslo.

Lora, E. 1997. Una Década de Reformas Estructurales en América Latina: Qué ha Sido Reformado y Cómo Medirlo. In *IADB Working Paper*. Washington D.C., United States: Inter American Development Bank, Research Department.

Lundberg, M., and L. Squire. 2003. The simultaneous evolution of growth and inequality. *Economic Journal* 113 (487):326-344.

Mathieson, D.J. 1980. Financial Reform and Stabilization Policy in Developing Economy. *Journal of Development Economics* 7 (3):359-395.

McCulloch, N., and G. Pacillo. 2010. The Tobin Tax - A Review of the Evidence (draft 9 June 2010).

McKinnon, R. 1991. *The Order of Economic Liberalization*. Baltimore and London: The Johns Hopkins University Press.

Milanovic, B. 2002. Can We Discern the Effect of Globalization on Income Distribution? Evidence from Household Budget Surveys. In *World Bank Working Paper*: World Bank.

———. 2003. The Two Faces of Globalization: Against Globalization as We Know It. *World Development* 31 (3):667-683.

Milanovic, B, and L. Squire. 2005. Does tariff liberalization increase wage inequality? Some empirical evidence. In *World Bank Policy Research Working Paper 3571*.

Morley, S.A., R. Machado, and S. Pettinato. 1999. Indexes of Structural Reform in Latin America. In *CEPAL Serie de Reformas Economicas*. Santiago, Chile: Comisión Económica para América Latina y el Caribe.

Mundell, R. 1963. Capital Mobility and Stabilization Policy under Fixed and Flexible Exchange Rates. *Canadian Journal of Economics* (29):475-485.

Naastepad, C.W.M. 2002. Trade-offs in stabilisation: a real-financial CGE analysis with reference to India. *Economic Modelling* 19:221-244.

Orcutt, G. 1957. A new type of socio-economic system. *Review of Economics and Statistics* 39 (2):116-123.

Prasad, E, K. Rogoff, S. Wei, and M. A. Kose. 2003. Effects of Financial Globalization on Developing Countries: Some Empirical Evidence. Place Published: International Monetary Fund.

(accessed 20/10/2010).

Ravallion, M. 2001. Growth, inequality and poverty: Looking beyond averages. *World Development* 29 (11):1803-1815.

Ray, D., ed. 1998. *Development Economics*: Princeton University Press.

Robilliard, A-S, F Bourguignon, and S Robinson. 2008. Crisis and income distribution: a micro-macro model for Indonesia. In *The impact of macroeconomic policies on poverty and income distribution: macro-micro evaluation techniques and tools*, edited by F. Bourguignon, L. da Silva and M. Bussolo. Houndmills, UK: Palgrave-Macmillan Publishers Limited.

Robinson, S. 1989. Multisectoral models. In *Handbook of Development Economics*, edited by H. Chenery and T. N. Srinivasan. Amsterdam: Elsevier Science Publishers.

———. 1991. Macroeconomics, Financial Variables, and Computable General Equilibrium Models. *World Development* 19 (11):1509-1525.

———. 2006. Macro Models and Multipliers: Leontief, Stone, Keynes, and CGE Models. In *Poverty, Inequality and Development: Essays in Honor of Erik Thorbecke*, edited by A. d. Janvry and R. Kanbur. New York: Springer Science.

Robinson, S., A. Cattaneo, and M. El-Said. 2000. GAMS Code for Estimating a Social Accounting Matrix (SAM) using Cross Entropy (CE) Methods. In *IFPRI TMD Discussion Paper N. 58*. Washington: International Food Policy Research Institute.

Rodriguez, F, and D. Rodrik. 2001. Trade policy and economic growth: a skeptic's guide to the cross-national evidence Centre for Economic Policy Research.

Rodrik, D. 1998. Who needs capital account convertibility? (mimeo).

———. 1999. Governing the Global Economy: Does One Arquitectural Style Fit All? .

———. 2000. Comments on "Trade, Growth, and Poverty," by D. Dollar and A. Kraay: Harvard University.

Romer, D. 1996. *Advanced Macroeconomics*. Berkeley, US: Mc Graw Hill.

Rosenzweig, J.A., and L Taylor. 1990. Devaluation, capital flows and crowding out: a CGE model with portfolio choice for Thailand. In *Socially Relevant Policy Analysis: Structuralist Computable General Equilibrium Models for the Developing World*, edited by L. Taylor. Cambridge MA: The MIT Press.

Shoven, J.B., and J. Whalley. 1972. A general equilibrium calculation of the effects of differential taxation of income from capital in the U.S. *Journal of Public Economics* 1:281-323.

Spilimbergo, A., J.L. Londono, and M. Szekely. 1999. Income distribution, factor endowment and trade openness. *Journal of Development Economics* 59:77-101.

Stiglitz, J. 1998. More Instruments and Broader Goals: Moving Toward the Post-Washington Consensus. In *The 1998 WIDER Annual Lecture*. Helsinki.

———. 2002. *Globalization and Its Discontents*. New York: W.W.Norton.

Taylor, L. 1981. IS/LM in the Tropics: Diagrammatics of the New Structuralist Macro Critique. In *Economic Stabilization in Developing Countries*, edited by W. R. Cline and S. Weintraub. Washington D.C.: The Brookings Institution.

———. 1983. Foreign Assets and Balance of payments. In *Structuralist Macroeconomics. Applicable Models for the Third World*
New York: Inc. Publishers.

———. 2004. External Liberalization, Economic Performance, and Distribution in Latin America and Elsewhere. In *Inequality, Growth and Poverty in an era of liberalization and globalization*, edited by G. A. Cornia. Oxford.

Taylor, L., and F.J. Lysy. 1979. Vanishing Income Redistributions: Keynesian Clues About Model Surprises in the Short Run. *Journal of Development Economics* 6 (1):11-30.

Thissen, M. 2000. *Building Financial CGE Models: Data, Parameters, and the Role of Expectations, Theses on Systems, Organization and Management.* Rijkuniversiteit Groningen: Graduate School / Research Institute Systems, Organization and Management.

Tobin, J. 1969. A General Equilibrium Approach To Monetary Theory. *Journal of Money, Credit and Banking* 1 (1):15-29.

Tobin, J. 1981. Money and Finance in the Macro-Economic Process. In *Nobel Memorial Lecture, 8 December, 1981*.

UNCTAD, ed. 2002. *The Least Developed Countries Report*. Geneve: UNCTAD.

Vos, R. 1997. External Finance and Adjustment Policies: A Comparative General Equilibrium Analysis. In *External Finance and Adjustment: Failure and*

Successes in the Developing World, edited by K. Jansen and R. Vos. London: MacMillan.
Wade, R.H. 2001. Is Globalization making world income distribution more equal? . London: LSE Development Studies Institute.
White, H. 2001. National and International Redistribution as tools for poverty reduction Institute of Development Studies.
Williamson, J., S. Griffith-Jones, and R. Gottschalk. 2005. Should Capital Controls Have a Place in the Future International Monetary System? . In *The Future ofthe International Monetary System*, edited by M. Uzan. London: Edward Elgar.
Winters, A, N. McCulloch, and A.McKay. 2004. Trade Liberalization and Poverty: The Evidence So Far. *Journal of Economic Literature* XLII:72–115.
Wood, A., and C. Ridao-Cano. 1996. Skill, Trade and International Inequality: Institute of Development Studies.
Wooldridge, J. 2003. *Introductory Econometrics, A Modern Approach*. 2 ed. London: South-Western.
WorldBank. 2002. *Globalization, Growth and Poverty: Building an inclusive world economy*. New York: Oxford University Press.
Yeldan, E. 1997. Financial Liberalization and Fiscal Repression in Turkey: Policy Analysis in a CGE Model With Financial Markets. *Journal of Policy Modeling* 19 (1):79-117.

Appendix

I. Matrix on the evolution of economic policies in Argentina

	Capital Account Policy	Others Monetary and Financial Policies	Trade Policy	Fiscal Policy	Privatizations (default) / Deregulations
1989	Elimination of restrictions on trading foreign currencies, completely abolishing exchange controls	Rescheduling of public bonds	Increase in taxes on exports	Suspension of subsidies for industrial promotion	
	Financial institutions are obliged to make repayments of deposits in the original currency		Suspension of refunds on exports	Increase in prices of public services (e.g. telephone)	
			Decrease in import tariffs (maximum tariff 30%)	State intervention in public companies and development of mechanisms for their privatisation	
			Abolition of import permission requirement	Generalisation of VAT (the largest source of fiscal income), and reduction of VAT rate from 15% to 13.5%. Decrease in rate of Profits Tax	
1990		"Bonex Plan": compulsory conversion of fixed term deposits in banks to public bonds of long maturity denominated in dollars	Rise in taxes on exports	"Unique Cash (Register)" for public companies	Telephones
			Reintroduction of refunds on exports	Reduction of number of areas of Central Administration	Airlines
			Decrease in import tariffs (maximum tariff 24%). Elimination of payments in excess of declared rates ("sobretasas").	Rise in tax on company assets and in tax rate of VAT (to 15.6%). Enlargement of VAT base. Derogation of taxes on capital, on net wealth and other minor taxes.	Petrochemicals
			Negotiation for Mercosur Area, and Treaty of Integration, Cooperation and Development between Argentina and Brazil, defining the consolidation of a common market over five years		Concession on petroleum and highways

	Capital Account Policy	Others Monetary and Financial Policies	Trade Policy	Fiscal Policy	Privatizations (default) / Deregulations
1991	April 1: Convertibility Law installs currency board regime, rigidly linking national currency ("peso") to dollar, completely liberalising the exchange market, allowing foreign-currency-denominated contracts and strongly restricting capacity to manoeuvre in monetary policy.	April 1: Use of adjustment by price index in contracts is explicitly prohibited by Convertibility Law	Elimination of most taxes on exports	Law related to the cancellation of public debts	Initial Public Offering of telephone shares
	Taxes on stock market operations are eliminated		Decrease in import tariffs and introduction of 4 rates (0% raw inputs and machinery, 11% intermediate goods, 22% most consumer goods and 35% electronic goods. These rates later become respectively 5%, 13%, 22%, 35%), all plus "statistical" rate of 3pp	VAT increases to 16%; then to 18%. Tax on Personal Goods introduced.	Concession on extractable fuels
	Banks and companies authorised to issue negotiable bonds in foreign currency and commercial papers		A temporary import regime is implemented	Nation-Provinces Agreement: transfer of some services (education, health, some social programmes) to provinces, with a financial compensation in return.	Concession on trains
			All import quotas are removed, except for automobiles, which have a special regime	From this year, low fiscal deficits are the rule (1pp of GDP vs. 4pp in the 80s)	Dissolution of public companies
			March: Treaty of Constitution of Mercosur, formalising the intention by Argentina, Brazil, Uruguay and Paraguay of forming a common market by the end of 1994, with free circulation of goods, services and production factors, setting a Common External Tariff and a common commercial policy, plus the coordination of macroeconomic policies and the harmonisation of legislation in relevant areas		Deregulation of freight transport

	Capital Account Policy	Others Monetary and Financial Policies	Trade Policy	Fiscal Policy	Privatizations (default) / Deregulations
1992		September: Central Bank assumes the obligation to keep reserves of at least 80% (or 70% in exceptional circumstances) of the monetary base, allowing in the remaining holdings of public bonds; imposes limits both on government's access to credit and Central Bank re-discounts; independence of Central Bank. Limited system of deposit guarantees. Rules on payment default, risk diversification, capital requirements and reserve rate requirement for immediate availablility of deposits become more strict, exceeding international standards.	Refunds on exports increase	Agreement on Amplified Facilities with IMF	Gas (transport and distribution)
		Law of Financial Entities reformed.	"Statistical" rate for imports increase from 3% to 10%	Amplification of VAT coverage. Increase in tax rate of Profits (from 20% to 30%)	Water
		Bank legal reserves ("encajes") in dollars authorised	Tariffs are scaled in 9 rates, from 0% (for capital goods not produced in Argentina, medical products and fuels) to 20% (for consumer goods)	Nation-Provinces Agreement: a minimum transfer from Nation to Provinces is guaranteed.	Electricity
		By Fiscal Administration Law, repatriation of argentineans resources abroad tax exempted is accepted	Tariffs reduced (maximum tariff becomes 22%)	Regularisation of debts to pensioners, giving them public bonds	Iron and steel industries
			Progress in Mercosur's system of preferences		Deregulation of mining, pharmaceutical products, automobile transport and ports law
1993	Law of Investment Funds	Brady Plan: agreement by which public debt to banks is changed to long term bonds (up to 30 years) with a nominal value of just over 25 billion dollars, with reductions of capital and interest.	Common External Tariff Agreement in Mercosur	The pension regime is reformed: workers can now choose between staying in public distribution regime or channelling personal payments to individual savings accounts managed by private Pensions Manager, which becomes a source of credit for public sector. Measures taken to reduce expenditures (to compensate for reduced incomes)	YPF (Fiscal Oilfields)
		Deposits of less than 30 days are prohibited	Regime of free tax zones ("francas")	Nation-Provinces Agreement: tax structures are coordinated	Hydroelectric and thermal energy central statios
			Application of anti-dumping precautions with quantitative restrictions and increases in tariffs	Modification of tax on profits	Electricity transmission
			Regime of "specialisation and restructuring", giving benefits of lower tariffs against exports		Concession on trains and subways

	Capital Account Policy	Others Monetary and Financial Policies	Trade Policy	Fiscal Policy	Privatizations (default) / Deregulations
1994	Law of financial entities is modified so that foreign capital enterprises are treated equally to national ones.		Definition of Common External Tariffs	Employer taxes are reduced (see Labour Market)	Electric central stations
				New pensions regime comes into effect	Electricity distribution
					Initial Public Offering on national gas company (transport and distribution)
1995		Modification of Organic Letter of Central Bank: capital requirements increase; banking reserves are converted into dollars; Central Bank is authorized to restructure the banks in problems; deposit guarantees are augmented; funds ("fiduciarios") are created for dealing with liquidity problems. In general terms, prudential regulation increases.	Export refunds are reduced: extra-Mercosur get in the 2%-20% range: intra-Mercosur agreement on progressive reduction	VAT increase to a rate of 21%; the taxable base of Profits and Personal Goods is enlarged	Electricity centrals
			Common External Tariffs come into effect, with a few products exempted until 2001 (394 in Argentina, 324 in Brazil, 439 in Paraguay, 960 in Uruguay from around 10,000 CIIU items). Capital goods may have different tariffs, but must converge to common ones.		Bahia Blanca Petrochemicals
			Increase in tariffs to imports		
1996		Modification to Law of Financial Entities: legal framework applicable to the assets and liabilities of financial entities which are liquidated.	Maximum refunds, extra-zone and intra-zone, are modified	Fuel tax increases. Taxable base of profits raised	Provincial Banks
			Refunds on the production of capital goods are suspended	The regime of family benefits is modified	

	Capital Account Policy	Others Monetary and Financial Policies	Trade Policy	Fiscal Policy	Privatizations (default) / Deregulations
1997/ 1998	Mercosur: rules of operation for banks' dealings between member countries created	Liquidity requirements increase	Common External Tariffs are increased, "statistical" rate is derogated	Increase in tax rate on profits to 35%	Postal service
				Tributary reform: VAT rate is reduced (from 21% to 10.5%) in the case of basic food; the VAT base starts to include new services: cable TV (tax rate 10.5%), pre-paid medical services and graphic advertising (21%). Internal taxes increase.	Airports
				Interest on company debt taxed	Mechanisms for transferring nuclear central stations are developed
					Congress approves selling of National Mortgage Bank
1999/ 2000				Fiscal contraction at national and provincial level as an attempt to reduce the country risk	
2001	December: end of Convertiblity Plan	Financial transactions (debits and credits in current accounts) become taxed (Decreto 380/2001)	Exports refunds are increased, as a function of a so-called "convergence factor", which captures the difference of value between the dollar and a basket which is composed of half a dollar and half a euro. It is proposed to shift to an "extended convertibility" to a basket of dollar and euro (50% & 50%) when their values converge	Fiscal contraction continues, eliminating exemptions to tax to profits and extending the VAT base	
			VAT reimbursement to exporters facilitated (Law 25.406)		

Sources: Heymann, D (2000) "Politicas de reforma y comportamiento macroeconomico" United Nations - EUDEBA, Buenos Aires; Altimir, O y L. Beccaria (2000) "El mercado de trabajo bajo el nuevo regimen economico en Argentina" United Nations - EUDEBA, Buenos Aires; Penido de Freitas, M.C, and D.Magalhaes Prates (2000), "La experiencia de apertura financiera en Argentina, Brasil y Mexico", Revista de la Cepal 70, downloadable from http://www.eclac.cl/publicaciones/; www.infoleg.gov.ar on text of Laws and Decrees and Connell, A. (2001) "Los desafios del Mercosur ante la devaluacion de la economia brasilena", downloadable from http://www.eclac.cl/publicaciones/Estadisticas/8/LCL1498P/lcl1498e.pdf, http://www.mecon.gov.ar/informe/informe37/perspectiva.pdf
Note: from 1977 the financial system is partially liberalized by elimination in this year of restrictions to entry of new institutions and expansion of bank nets by national or external institutions, with principle of national treatment to foreign banks (rules applicable to external institutions not less favorable than those applicable to national ones).

II. Mathematical Statement of the Set of Nested Models

1 Real Model

1.1 Price formation

1.1.1 Domestic goods, imports and exports

$$QQ_c = \sum_a QINT_{c,a} + \sum_h QH_{c,h} + QI_c + \overline{QGC_c} \tag{1}$$

$$PMR_{c,r} = pwmr_{c,r} \cdot (1 + tmr_{c,r}) \cdot exr \qquad c \in CM \tag{2}$$

$$PER_{c,r} = pwer_{c,r} \cdot (1 - ter_{c,r}) \cdot exr \qquad c \in CE \tag{3}$$

$$PM_c \cdot QM_c = \sum_r PMR_{c,r} \cdot QMR_{c,r} \qquad c \in CM \tag{4}$$

$$PE_c \cdot QE_c = \sum_r PER_{c,r} \cdot QER_{c,r} \qquad c \in CE \tag{5}$$

1.1.2 Other prices

$$PQ_c \cdot QQ_c = PD_c \cdot QD_c + PM_c \cdot QM_c \tag{6}$$

$$PX_c \cdot QX_c = PD_c \cdot QD_c + PE_c \cdot QE_c \tag{7}$$

$$PA_a = \sum_c \theta_{a,c} \cdot PXAC_{a,c} \tag{8}$$

$$PA_a \cdot QA_a = PVA_a \cdot QVA_a + PINTA_a \cdot QINTA_a \tag{9}$$

$$CPI = \sum_c wcpi_c \cdot PQ_c \tag{10}$$

$$PK = \sum_c capcomp_c \cdot PQ_c \tag{11}$$

$$PINTA_a = \sum_c ica_{c,a} \cdot PQ_c \tag{12}$$

$$GDPDEFL = \frac{\sum_a PVA_a \cdot QVA_a}{\sum_a PVA0_a \cdot QVA_a} \tag{13}$$

1.2 Production and trade

$$RGDP = \sum_a PVA0_a \cdot QVA_a \tag{14}$$

1.2.1 The production function

$$QXAC_{a,c} = \theta_{ac} \cdot QA_a \tag{15}$$

$$QX_c = \alpha_c^{ac} \cdot \sum_a (\delta_{a,c}^{ac} \cdot QXAC_{a,c}^{-\rho_c^{ac}})^{\frac{-1}{\rho_c^{ac}}} \tag{16}$$

$$PXAC_{a,c} = PX_c \cdot QX_c \cdot \sum_{a'} (\delta_{a',c}^{ac} \cdot QXAC_{a',c}^{-\rho_c^{ac}})^{-1} \cdot \delta_{a,c}^{ac} \cdot QXAC_{a,c}^{-\rho_c^{ac}-1} \tag{17}$$

$$QVA_a = iva_a \cdot QA_a \tag{18}$$

$$QINTA_a = inta_a \cdot QA_a \tag{19}$$

$$QINT_{c,a} = ica_{c,a} \cdot QINTA_a \tag{20}$$

$$QVA_a = \alpha_a^{va} \cdot (\sum_{fa} \delta_{fa,a}^{va} \cdot QF_{fa,a}^{-\rho_a^{va}})^{-\frac{1}{\rho_a^{va}}} \quad fa = \{FA_1, IU, FU\} \tag{21}$$

$$QF_{FA_1,a} = \alpha_{FA_1,a}^{g} \cdot \sum_f (\delta_{f,FA_1,a}^{g} \cdot QF_{f,a}^{-\rho_{FA,a}^{g}})^{-\frac{1}{\rho_{FA_1,a}^{g}}} \quad f = FS, K \tag{22}$$

1.2.2 Trade

$$QQ_c = QX_c = QD_c \qquad c \in (CMN \cap CEN) \tag{23}$$

$$QQ_c = \alpha_c^q \cdot \left(\delta_c^q \cdot QM_c^{-\rho_c^q} + (1-\delta_c^q) \cdot QD_c^{-\rho_c^q}\right)^{-\frac{1}{\rho_c^q}} \qquad c \in (CM \cap CD) \tag{24}$$

$$\frac{QM_c}{QD_c} = \left(\frac{PD_c}{PM_c} \cdot \frac{\delta_c^q}{1-\delta_c^q}\right)^{\frac{1}{1+\rho_c^q}} \qquad c \in (CM \cap CD) \tag{25}$$

$$QX_c = \alpha_c^t \cdot \left(\delta_c^t \cdot QE_c^{\rho_c^t} + (1-\delta_c^t) \cdot QD_c^{\rho_c^t}\right)^{\frac{1}{\rho_c^t}} c \in (CE \cap CD) \tag{26}$$

$$\frac{QE_c}{QD_c} = \left(\frac{PE_c}{PD_c} \cdot \frac{1-\delta_c^t}{\delta_c^t}\right)^{\frac{1}{\rho_c^t-1}} \qquad c \in (CE \cap CD) \tag{27}$$

$$QMR_{c,r} = QM_c \cdot [\frac{PMR_{c,r} \cdot (\alpha_c^m)^{\rho_c^m}}{PM_c \cdot \delta_{c,r}^m}]^{-\frac{1}{\rho_c^m+1}} \qquad c \in CM \tag{28}$$

$$QER_{c,r} = QE_c \cdot [\frac{PER_{c,r}}{PE_c \cdot \delta_{c,r}^e \cdot (\alpha_c^e)^{\rho_c^e}}]^{\frac{1}{\rho_c^e-1}} \qquad c \in CE \tag{29}$$

1.3 Factor markets

$$\begin{aligned} W_{fa} \cdot WDIST_{fa,a} =& PVA_a \cdot (1-tva_a) \cdot QVA_a \cdot \sum_{fa'} (\delta_{fa',a}^{va} \cdot QF_{fa',a}^{-\rho_a^{va}})^{-1} \\ & \cdot \delta_{fa,a}^{va} \cdot QF_{fa,a}^{-\rho_a^{va}-1} \qquad fa = \{FA_1, IU, FU\} \end{aligned} \tag{30}$$

$$\begin{aligned} W_f \cdot WDIST_{f,a} =& \sum_{FA_1} (W_{FA_1} \cdot WDIST_{FA_1,a} \cdot QF_{FA_1,a}) \cdot \sum_{f'} (\delta_{f',FA_1,a}^{g} \cdot QF_{f',a}^{-\rho_{FA_1,a}^{g}})^{-1} \\ & \cdot \delta_{f,FA_1,a}^{g} \cdot QF_{f,a}^{-\rho_{FA_1,a}^{g}-1} \qquad f = FS, K \end{aligned} \tag{31}$$

$$QK_{a,t} = (1-\delta^k) \cdot QK_{a,t-1} + \Delta QK_{a,t-1} \tag{32}$$

$$QF_{FK,a} = \overline{CAPUT}_a \cdot QK_a \tag{33}$$

$$\overline{QFS}_{FLUN} = QFS_{FLFU} + QFS_{FLIU} \tag{34}$$

$$\frac{QFS_{FLFU,t} - QFS_{FLFU,t-1}}{QFS_{FLIU,t}} = \varepsilon_w^{mig} \cdot \log \frac{(1-UR_{FLFU,t}) \cdot W_{FLFU,t}}{W_{FLIU,t}} + \gamma_w^{mig} \tag{35}$$

$$(1-UR_f) \cdot QFS_f = \sum_a QF_{f,a} \qquad f \in FLF \tag{36}$$

$$\frac{W_f}{CPI} = \gamma_f^w \cdot (UR_f - nur)^{\varepsilon_f^w} \qquad f \in FLF \tag{37}$$

$$QFS_{FLIU} = \sum_a QF_{FLIU,a} \tag{38}$$

$$YF_f = \sum_a W_f \cdot WDIST_{f,a} \cdot QF_{f,a} \tag{39}$$

$$WAV_f = \frac{YF_f}{\sum_a QF(f,a)} \tag{40}$$

1.4 Institutions: income, expenditure, and savings

1.4.1 Households

$$YH_S = \sum_{fl}(shhf_{S,fl} \cdot (1 - tf_{fl}) \cdot YF_{fl}) + \overline{FINT}_{S,B} - \overline{FINT}_{B,S} \tag{41}$$

$$YH_U = \sum_{fl}(shhf_{U,fl} \cdot (1 - tf_{fl}) \cdot YF_{fl}) + \overline{FINT}_{U,B} - \overline{FINT}_{B,U} + \overline{TRNSFR}_{U,G} \tag{42}$$

$$YH_C = \sum_e DIVD_e + \sum_{n=B,G,R} \overline{FINT}_{C,n} - \overline{FINT}_{B,C} \tag{43}$$

$$SAV_h = mps_h \cdot MPSADJ \cdot YH_h \tag{44}$$

$$EH_h = YH_h - SAV_h \tag{45}$$

$$PQ_c \cdot QH_{c,h} = PQ_c \cdot \gamma^m_{c,h} + \beta^m_{c,h} \cdot (EH_h - \sum_{c'}(PQ_{c'} \cdot \gamma^m_{c',h})) \tag{46}$$

1.4.2 Enterprises

$$PROFBT_e = \sum_a W_{FK} \cdot WDIST_{FK,a} \cdot QF_{FK,a} + \overline{FINT}_{e,B} - \overline{FINT}_{B,e} + TRNSFR_{e,B} \tag{47}$$

$$TRNSFR_{ES,B} = PROFBT_B \tag{48}$$

$$PROFBT_B = \sum_n (\overline{FINT}_{B,n} - \overline{FINT}_{n,B}) \tag{49}$$

$$PROFAT_e = min((1 - tpr_e) \cdot PROFBT_e, PROFBT_e) + \overline{TRNSFR}_{e,G} \tag{50}$$

$$DIVT_e = max(0, shrp_e \cdot PROFAT_e) \tag{51}$$

$$SAV_e = PROFAT_e - DIVT_e \tag{52}$$

$$DIVD_e = \overline{SHEQD}_e \cdot DIVT_e \tag{53}$$

$$DIVE_e = (1 - \overline{SHEQD}_e) \cdot DIVT_e \tag{54}$$

1.4.3 Government

$$\begin{aligned} YG = &\sum_a tva_a \cdot PVA_a \cdot QVA_a + \sum_{f \in flf} tf_f \cdot YF_f \\ &+ \sum_{c,r} tmr_{c,r} \cdot pwmr_{c,r} \cdot exr \cdot QMR_{c,r} + \sum_{c,r} ter_{c,r} \cdot pwer_{c,r} \cdot exr \cdot QER_{c,r} \\ &+ \sum_e max(0, tpr_e \cdot PROFBT_e) + TRNSFR_{G,CB} \end{aligned} \tag{55}$$

$$TRNSFR_{G,CB} = PROFBT_{CB} \tag{56}$$

$$PROFBT_{CB} = \overline{FINT}_{CB,B} + \overline{FINT}_{CB,R} \tag{57}$$

$$EG = \sum_c PQ_c \cdot \overline{QGC_c} + \sum_n \overline{TRNSFR}_{n,G} + \sum_n \overline{FINT}_{b,G} \quad b = \{C,R,B,CB\} \tag{58}$$

$$SAV_G = YG - EG \tag{59}$$

1.4.4 Non-residents

$$\begin{aligned} SAV_R = &exr \cdot \sum_{c,r} (pwmr_{c,r} \cdot QMR_{c,r} - pwer_{c,r} \cdot QER_{c,r}) \\ &+ \sum_e DIVE_e + \sum_n \overline{FINT}_{R,n} - \sum_n \overline{FINT}_{n,R} \\ &+ \sum_n (\overline{TRNSFR}_{R,n} - \overline{TRNSFR}_{n,R}) \end{aligned} \tag{60}$$

1.5 Savings and investments

$$SAVTOT = \sum_h SAV_h + \sum_e SAV_e + SAV_G + SAV_R \tag{61}$$

$$\Delta QK_a = dqkn_a \cdot [\frac{W_{FK} \cdot WDIST_{FK,a}}{RL \cdot PK}]^{\varepsilon_q^I} \qquad a \in APRI \tag{62}$$

$$QI_c = capcomp_c \cdot \sum_a \Delta QK_a + qgi_c \tag{63}$$

$$VI_a = PK \cdot \Delta QK_a \qquad a \in apri \tag{64}$$

$$VI_{AG} = \sum_c PQ_c \cdot qgi_c \tag{65}$$

$$VIT = \sum_a VI_a \tag{66}$$

$$VIT = SAVTOT + WALRAS \tag{67}$$

2 Financial extension (Real Financial Model)

$$\overline{CURR}_h + DEP_h = LOAN_h + NFW_h \qquad h = S,U \tag{68}$$

$$\overline{CURR}_C + DEP_C + exr \cdot DEPD_C + AH_C = LOAN_C + NFW_C \tag{69}$$

$$DEP_e = LOAN_e + EQT_e + NFW_e \tag{70}$$

$$AB + REQRES = \sum_{dd} DEP_{dd} + exr \cdot DEPD_C + \overline{RED} + \overline{NFW}_B \quad dd = h \cup e \cup \{R\} \tag{71}$$

$$exr \cdot INTRES + PBOND \cdot \overline{BOND}_{CB} + \overline{RED} = MB + \overline{NFW}_{CB} \tag{72}$$

$$\sum_h \overline{CURR}_h + REQRES = MB \tag{73}$$

2.1 Asset demand

$$exr \cdot DEPD_C = k \cdot DEP_C \tag{74}$$

$$PBOND \cdot BOND_C = \Theta_G^C \cdot AH_C \tag{75}$$

$$EQD_e = \Theta_e^C \cdot AH_C \tag{76}$$

$$DEPA_C = \Theta_R^C \cdot AH_C \tag{77}$$

$$\Theta_G^C = \frac{(\delta_G^C)^{\varepsilon_C} \cdot [RB \cdot (1 - pdef_{C,G})]^{\varepsilon_C - 1}}{Q^C} \tag{78}$$

$$\Theta_e^C = \frac{(\delta_e^C)^{\varepsilon_C} \cdot (RE_e)^{\varepsilon_C - 1}}{Q^C} \tag{79}$$

$$\Theta_R^C = \frac{(\delta_R^C)^{\varepsilon_C} \cdot [\overline{RW} \cdot (1 - pdef_{C,R})]^{\varepsilon_C - 1}}{Q^C} \tag{80}$$

$$\begin{aligned} Q^C = &(\delta_G^C)^{\varepsilon_C} \cdot [RB \cdot (1 - pdef_{C,G})]^{\varepsilon_C - 1} + \sum_e (\delta_e^C)^{\varepsilon_C} \cdot (RE_e)^{\varepsilon_C - 1} \\ &+ (\delta_R^C)^{\varepsilon_C} \cdot [\overline{RW} \cdot (1 - pdef_{C,R})]^{\varepsilon_C - 1} \end{aligned} \tag{81}$$

$$EQT_e = EQD_e + EQE_e \tag{82}$$

$$SHEQD_e = \frac{EQD_e}{EQT_e} \tag{83}$$

$$REQRES = rr \cdot (\sum_{dd} DEP_{dd} + exr \cdot DEPD_C) \qquad dd = h \cup e \cup \{R\} \tag{84}$$

$$LOAN_l = \Theta_l^B \cdot AB \quad l = h \cup e \tag{85}$$

$$PBOND \cdot BOND_B = \Theta_G^B \cdot AB \tag{86}$$

$$exr \cdot DEPA_B = \Theta_R^B \cdot AB \tag{87}$$

$$\Theta_l^B = \frac{(\delta_l^B)^{\varepsilon_B} \cdot RL^{\varepsilon_B - 1}}{Q^B} \tag{88}$$

$$\Theta_G^B = \frac{(\delta_G^B)^{\varepsilon_B} \cdot [RB \cdot (1 - pdef_{B,G})]^{\varepsilon_B - 1}}{Q^B} \tag{89}$$

$$\Theta_R^B = \frac{(\delta_R^B)^{\varepsilon_B} \cdot [\overline{RW} \cdot (1 - pdef_{B,R})]^{\varepsilon_B - 1}}{Q^B} \tag{90}$$

$$\begin{aligned} Q^B = &\sum_l (\delta_l^B)^{\varepsilon_B} \cdot (RL)^{\varepsilon_B - 1} + (\delta_G^B)^{\varepsilon_B} \cdot [RB \cdot (1 - pdef_{B,G})]^{\varepsilon_B - 1} \\ &+ (\delta_R^B)^{\varepsilon_B} \cdot [\overline{RW} \cdot (1 - pdef_{B,R})]^{\varepsilon_B - 1} \end{aligned} \tag{91}$$

2.2 Rates of return

$$log \frac{MB}{GDPDEFL} = \varepsilon_y^m \cdot log(RGDP) - \varepsilon_r^m \cdot log(RD) + \gamma^{LM} \tag{92}$$

$$RL = \frac{RD}{1 - rr} \cdot (1 + \mu) \tag{93}$$

$$BONDS = \sum_b (BOND_b) \qquad b = \{C, R, B, CB\} \tag{94}$$

$$RB = \frac{1}{PBOND} \cdot RB0 \tag{95}$$

$$RE_e = \frac{PROFAT_e}{EQT_e} \tag{96}$$

2.3 Interest flows

$$FINT_{dd,B} = RD \cdot DEP_{dd} \quad dd = \{S, U\} \cup e \cup \{R\} \tag{97}$$

$$FINT_{C,B} = RD \cdot (DEP_C + exr \cdot DEPD_C) \tag{98}$$

$$FINT_{B,l} = RL \cdot LOAN_l \qquad l = h \cup e \tag{99}$$

$$FINT_{b,G} = RB \cdot PBOND \cdot BOND_b \qquad b = \{C, R, B, CB\} \tag{100}$$

$$FINT_{da,R} = \overline{RW} \cdot exr \cdot DEPA_{da} \quad da = \{C, B\} \tag{101}$$

$$FINT_{CB,R} = \overline{RW} \cdot exr \cdot INTRES \tag{102}$$

$$FINT_{CB,B} = \overline{RRED} \cdot \overline{RED} \tag{103}$$

2.4 Balance of payments

$$exr \cdot CAB = -SAV_R \tag{104}$$

$$exr \cdot KAB = \sum_e (\overline{\Delta EQE_e}) + \overline{\Delta DEP_R} + \overline{\Delta VBOND_R} - exr \sum_{da} \Delta DEPA_{da} \tag{105}$$

$$\Delta INTRES = CAB + KAB \tag{106}$$

$$CAB = -k_I \cdot KAB \tag{107}$$

2.5 Updates for financial stocks

$$\Delta NFW_{h,t} = SAV_{h,t} \tag{108}$$

$$\Delta NFW_{e,t} = SAV_{e,t} - VI_{a,t} \tag{109}$$

$$PBOND \cdot \Delta BONDS = \sum_c PQ_c \cdot qgi_c - SAV_G \tag{110}$$

$$BONDS_t = BONDS_{t-1} + \Delta BONDS_t \tag{111}$$

$$BOND_{b,t} = BOND_{b,t-1} + \Delta BOND_{b,t} \quad b = \{C,R,B,CB\} \tag{112}$$

$$\Delta VBOND_{b,t} = PBOND_t \cdot BOND_{b,t} - PBOND_{t-1} \cdot BOND_{b,t-1} \quad b = \{C,R,B,CB\} \tag{113}$$

$$DEP_{R,t} = DEP_{R,t-1} + \overline{\Delta DEP}_{R,t} \tag{114}$$

$$EQE_{e,t} = EQE_{e,t-1} + \overline{\Delta EQE}_{e,t} \tag{115}$$

$$DEPA_{da,t} = DEPA_{da,t-1} + \Delta DEPA_{da,t} \quad da = \{C,B\} \tag{116}$$

$$INTRES_t = INTRES_{t-1} + \Delta INTRES_t \tag{117}$$

3 Augment (Real Financial Augmented Model)

$$QVA_a = \alpha_a^{va} \cdot (\sum_{fa} \delta_{fa,a}^{va} \cdot QF_{fa,a}^{-\rho_a^{va}})^{-\frac{1}{\rho_a^{va}}} \quad fa = \{FA_1, IU, FA_2\} \tag{118}$$

$$QF_{FA_1,a} = \alpha_{FA_1,a}^{g} \cdot \sum_{f} (\delta_{f,FA_1,a}^{g} \cdot QF_{f,a}^{-\rho_{FA_1,a}^{g}})^{-\frac{1}{\rho_{FA_1,a}^{g}}} \quad f = FS, K, WK_1 \tag{119}$$

$$QF_{FA_2,a} = \alpha_{FA_2,a}^{g} \cdot \sum_{f} (\delta_{f,FA_2,a}^{g} \cdot QF_{f,a}^{-\rho_{FA_2,a}^{g}})^{-\frac{1}{\rho_{FA_2,a}^{g}}} \quad f = FU, WK_2 \tag{120}$$

$$\begin{aligned} W_{fa} \cdot WDIST_{fa,a} =& PVA_a \cdot (1 - tva_a) \cdot QVA_a \cdot \\ & \sum_{fa'} (\delta_{fa',a}^{va} \cdot QF_{fa',a}^{-\rho_a^{va}})^{-1} \cdot \delta_{fa,a}^{va} \cdot QF_{fa,a}^{-\rho_a^{va}-1} \quad fa = \{FA_1, IU, FA_2\} \end{aligned} \tag{121}$$

$$\begin{aligned} W_f \cdot WDIST_{f,a} =& \sum_{fa} (W_{FA_1} \cdot WDIST_{FA_1,a} \cdot QF_{FA_1,a}) \cdot \sum_{f',FA_1} (\delta_{f',FA_1,a}^{g} \cdot QF_{f',a}^{-\rho_{FA_1,a}^{g}})^{-1} \\ & \cdot \sum_{FA_1} (\delta_{f,FA_1,a}^{g} \cdot QF_{f,a}^{-\rho_{FA_1,a}^{g}-1}) \qquad f = FS, K, WK_1 \end{aligned} \tag{122}$$

$$\begin{aligned} W_f \cdot WDIST_{f,a} =& \sum_{fa} (W_{FA_2} \cdot WDIST_{FA_2,a} \cdot QF_{FA_2,a}) \cdot \sum_{f',FA_2} (\delta_{f',FA_2,a}^{g} \cdot QF_{f',a}^{-\rho_{FA_2,a}^{g}})^{-1} \\ & \cdot \sum_{FA_2} (\delta_{f,FA_2,a}^{g} \cdot QF_{f,a}^{-\rho_{FA_2,a}^{g}-1}) \qquad f = FU, WK_2 \end{aligned} \tag{123}$$

$$LOAN_E = \sum_{e} \Theta_e^B \cdot AB \tag{124}$$

$$QFS_{FW} = \frac{LOAN_E}{GDPDEFL} \tag{125}$$

$$(1 - UR_W) \cdot QFS_{FW} = \sum_{fw,a} QF_{fw,a} \quad fw = \{WK_1, WK_2\} \tag{126}$$

$$WAV_{FW} = \frac{YF_{FW}}{\sum_{fw,a} QF_{fw,a}} \quad fw = \{WK_1, WK_2\} \tag{127}$$

$$WAV_{FW} \geq minwwk \tag{128}$$

$$RL = WAV_{FW} \cdot GDPDEFL \tag{129}$$

$$LOAN_e = \frac{\sum_{fw} QF_{fw,a}}{QFS_{FW}} \cdot LOAN_E \qquad e = a \in apri \tag{130}$$

3.1 Short-run version

$$WKR_a \cdot GDPDEFL = WDIST_{FK,a} \cdot W_{FK} \qquad a \in apri \tag{131}$$

$$WKR_a \geq minwpk \qquad a \in apri \tag{132}$$

$$CAPUT_a \leq 1 \qquad a \in apri \tag{133}$$

$$W_f = \gamma_f^w \cdot (UR_f - nur)^{\varepsilon_f^w} \qquad f \in FLF \tag{134}$$

Sets

Name	Definition
a	Activities
apri	Private activities
b	Bond holders
c	Commodities
cd_c	Commodities demanded domestically
ce_c	Commodities dxported
cm_c	Commodities imported
cx_c	Commodities produced domestically
da	Deposits abroad holders
dd	Domestic deposits holders
e	Enterprises
f	Factors
fa_f	Factor aggregates
fb_f	Factors at Bottom of production function
flf_f	Formal labor factor
flu_f	Unskilled labor factor
fw_f	Uses of working capital in the production function
h	Households
hsu	Skilled and unskilled households
l	Loan holders with firms disaggregated
lb	Loan holders with firms aggregated
n	Institutions
r	Regions
t	Time set

Elements of sets referred in model equations

Name	Definition
AG	Public activity
B	Commercial banks
CB	Central bank
E	Enterprise (supra-sector)
ES	Private services enterprises
FK	Physical capital factor
FLFU	Formal unskilled labor
FLIU	Informal unskilled labor
FLUN	Unskilled labor
FW	Working capital factor
G	Government
C	Capitalist household
R	Rest-of-world

Parameters

Name	Definition
α_c^{ac}	Scale parameter for activities producing commodity c
α_c^{e}	Scale parameter for export destination CET function
$\alpha_{fagg,a}^{g}$	Scale parameter for factor aggregate function
α_c^{m}	Scale parameter for import origin Armington function
α_c^{q}	Scale parameter for import-domestic Armington function
α_c^{t}	Scale parameter for export-domestic CET function
α_a^{va}	Scale parameter for CES value added production function
$\beta_{c,h}^{m}$	Marginal share of consumption spending on commodity c by household h
γ^{LM}	Parameter in LM equation
$\gamma_{c,h}^{m}$	Subsistence consumption of commodity c by household h
γ_w^{mig}	Parameter for unskilled migration function to formal segment
γ_f^{w}	Parameter for wage curve equation
$\delta_{a,c}^{ac}$	Share parameter for activities producing commodity c
$\delta_{n,np}^{B}$	Share parameter for bank's CES utility functions on asset earnings
$\delta_{c,r}^{e}$	Share parameter for export destination CET function
$\delta_{n,np}^{C}$	Share parameter for capitalist household's CES utility functions on asset earnings
$\delta_{f,fagg,a}^{g}$	Share parameter for factor aggregate function
δ^{k}	Depreciation rate of physical capital
$\delta_{c,r}^{m}$	Share parameter for import origin Armington function
δ_c^{q}	Share parameter for import-domestic Armington function
δ_c^{t}	Share parameter for export-domestic CET function
$\delta_{f,a}^{va}$	Share parameter for CES value added production function
ε_B	Elasticity for bank's CES utility functions on asset earnings
ε_C	Elasticity for capitalist household's CES utility functions on asset earnings
ε_q^{I}	Semi-elasticity of investment with respect to real remun - real cost ratio
ε_r^{m}	Elasticity of money demand with respect to interest rate on deposits
ε_y^{m}	Elasticity of money demand with respect to real GDP
ε_w^{mig}	Elasticity for unskilled migration function to formal segment
ε_f^{w}	Elasticity of real wage with respect to changes in the unemployment rate
$\theta_{a,c}$	Yield of commodity c per unit of activity a
μ	Mark-up rate of banks to determine interest rate on loans
ρ_c^{ac}	Exponent for activities producing commodity c

Parameters (cont)

Name	Definition
ρ_c^e	Exponent for export destination CET function
$\rho_{fagg,a}^g$	Exponent for factor aggregate function
ρ_c^m	Exponent for import origin Armington function
ρ_c^q	Exponent for import-domestic Armington function
ρ_c^t	Exponent for export-domestic CET function
ρ_a^{va}	Exponent for CES value added production function
capcomp_c	Share of good c in composition of capital good
dqkn_a	Parameter for investment function
exr	Nominal exchange rate - local currency units per USD -
$\text{ica}_{c,a}$	Intermediate input c per unit of aggregate intermediate of act. a
inta_a	Aggregate intermediate input coefficient
iva_a	Aggregate value added coefficient
k	Ratio between deposits in dollars and in local currency of capitalist household
k_I	Sensibility of the current account deficit (superavit) to the capital account superavit (deficit)
minwwk	Minimum average wage of working capital
mps_h	Initial marginal propensity to save for households
nur	Natural unemployment rate
$\text{pdef}_{n,n'}$	Probability of default perceived by inst n about inst n' payments
ped_h	Capitalist households dummy (1 for capitalist, 0 otherwise)
$\text{pwer}_{c,r}$	World price of export by commodity and region - in dollars
$\text{pwmr}_{c,r}$	World price of imports by region - in dollars
rr	Cash reserve ratio on bank deposits
$\text{shhf}_{h,f}$	Share of household h in factor f income
shrp_n	Share of profits retained by enterprise n
$\text{ter}_{c,r}$	Rate of tax on exports by region and sector
tf_f	Rate of direct tax on factors (social security tax)
$\text{tmr}_{c,r}$	Rate of tax on imports by region and sector
tpr_n	Rate of tax to profits
tva_a	Rate of VAT
wcpi_c	CPI weights

Variables

Name	Definition
AB	Banks return-responsive portfolio value (billions of LCU)
AH	Households return-responsive portfolio value (billions of LCU)
$BOND_n$	Stock of public bonds by holder (billions of units)
BONDS	Total stock of public bonds (billions of units)
CAB	Current Account Balance (billions of dollars)
$CAPUT_a$	Capacity utilization in activity a (1.00 = 100%)
CPI	Consumer Price Index (1.00 in benchmark)
$CURR_n$	Currency held by holder (billions of LCU)
CURRS	Currency supply (billions of LCU)
$VBOND_n$	Value of public bonds by holder (billions of LCU)
DEP_n	Deposits in local currency at domestic banks by holder (billions of LCU)
$DEPA_n$	Deposits abroad by holder (billions of dollars)
$DEPD_n$	Deposits in dollars at domestic banks by holder (billions of dollars)
$DIVD_n$	Dividends paid to residents by enterprise (billions of LCU)
$DIVE_n$	Dividends paid to non-residents by enterprise (billions of LCU)
$DIVT_n$	Dividends paid by enterprise (total) (billions of LCU)
EG	Government current expenditure (billions of LCU)
EH_h	Households consumption expenditure (billions of LCU)
EQD_n	Equity held by residents disaggregated by sector (billions of LCU)
EQE_n	Equity held by non-residents disaggregated by sector (billions of LCU)
EQT_n	Equity disaggregated by sector (billions of LCU)
$FINT_{n,n'}$	Interest flow paid to inst. n by inst. n' (billions of LCU)
GDPDEFL	GDP Deflator (1.00 in benchmark)
INTRES	International reserves held by central bank (billions of dollars)
KAB	Capital Account Balance (billions of dollars)
$LOAN_n$	Bank loans by domestic recipient institution (billions of LCU)
MB	Monetary base (billions of LCU)
MPSADJ	Marginal propensity to save endogenous adjustment factor (scalar)
NFW_n	Financial wealth by institution (billions of LCU)
PA_a	Price of activity (1.00 in benchmark)
PBOND	Price of bonds (1.00 in benchmark)
PD_c	Price of comm produced and sold domestically (1.00 in benchmark)
PE_c	Price of export (1.00 in benchmark)

Variables (cont.)

Name	Definition
$PER_{c,r}$	Price of export by region of destination (1.00 in benchmark)
$PINTA_a$	Price of intermediate aggregate (1.00 in benchmark)
PK	Price of capital (1.00 in benchmark)
PM_c	Price of import (1.00 in benchmark)
$PMR_{c,r}$	Price of import by region of origin (1.00 in benchmark)
PQ_c	Price of composite good (1.00 in benchmark)
$PROFAT_n$	After-tax profits (billions of LCU)
$PROFBT_n$	Before-tax profits (billions of LCU)
PVA_a	Price of value added (1.00 in benchmark)
PX_c	Average output price (1.00 in benchmark)
$PXAC_{a,c}$	Price of commodity c generated by activity a (1.00 in benchmark)
QA_a	Domestic output by activity (billions of units)
Q^B	Harmonic mean in financial CES utility function of banks
QD_c	Quantity of domestic sales (billions of units)
QE_c	Quantity of exports (billions of units)
$QER_{c,r}$	Quantity of exports to region r (billions of units)
$QF_{f,a}$	Quantity of factor f employed in act a (billions of units)
QFS_f	Quantity of factor f supply (billions of units)
QGC_c	Quantity of public consumption of comm c (billions of units)
$QH_{c,h}$	Quantity of comm c consumed by household h (billions of units)
Q^C	Harmonic mean in financial CES utility function of capitalist households
QI_c	Quantity of private investment by sector of origin (billions of units)
$QINT_{c,a}$	Quantity of intermediate input c used by activity a (billions of units)
$QINTA_a$	Quantity of intermediate inputs used by activity a (billions of units)
QK_a	Physical capital stock in activity a (billions of units)
QM_c	Quantity of imports (billions of units)
$QMR_{c,r}$	Quantity of imports from region r (billions of units)
QHP	Harmonic mean in financial CES utility function of capitalist household (billions of units)
QQ_c	Quantity of composite good c (billions of units)
QVA_a	Quantity of value added demanded by act a -gross of VAT and factor taxes (billions of units)
QX_c	Quantity of commodity output (billions of units)

Variables (cont.)

Name	Definition
$QXAC_{a,c}$	Quantity of commodity output by activity (billions of units)
RB	Rate of interest on public bonds (1.00 = 100%)
RD	Rate of interest on deposits at domestic banks (1.00 = 100%)
RE_e	Rate of return on enterprise equity, by enterprise (1.00 = 100%)
RED	Central Bank rediscount level (billions of LCU)
REQRES	Required bank reserves (billions of LCU)
RGDP	Real GDP (billions of units)
RL	Rate of interest on domestic banks loans (1.00 = 100%)
RRED	Rate of interest on Central Bank rediscounts (1.00 = 100%)
RW	Risk-free world interest rate (1.00 = 100%)
SAV_n	Savings by institution (billions of LCU)
SAVTOT	Total savings (billions of LCU)
$SHEQD_n$	Share of residents in equity (1.00 = 100%)
Θ_n^B	Shares of financial assets in banks portfolio (1.00 = 100%)
Θ_n^{HP}	Shares of financial assets in capitalist household portfolio (1.00 = 100%)
$TRNSFR_{n,n'}$	Transfer to institution n by institution n' (billions of LCU)
UR_f	Unemployment rate of factor f (1.00 = 100%)
URW	Unemployment rate of working capital (1.00 = 100%)
VI_a	Value of investment by sector of destination (billions of LCU)
VIT	Value of total investment (billions of LCU)
W_f	Nominal wage for factor f before factor tax payment and distorsions (thousands of LCU)
WALRAS	Walras variable -0 if agg savings = agg investment-
WAV_f	Average nominal wage for factor f before factor tax payment accounting for distorsions (thousands of LCU)
$WDIST_{f,a}$	Factor wage distorsion for factor f in activity a (scalar)
YF_f	Total factor income before taxes to factors by factor (billions of LCU)
YG	Total government income (billions of LCU)
YH_h	Total household income after interest flow by household (billions of LCU)

III. Financial assets and liabilities by institution

Households

Assets	Liabilities
Domestic equity	Domestic borrowing
Public bonds	Financial wealth
Deposits at domestic banks	
Deposits abroad	
Cash holdings	

Firms

Assets	Liabilities
Deposits at domestic banks	Domestic equity
	Foreign equity
	Domestic borrowing
	Financial wealth

Government

Assets	Liabilities
----	Public bonds
	Financial wealth

Commercial banks

Assets	Liabilities
Loans to households	Deposits at domestic banks
Loans to domestic firms	Rediscounts
Public bonds	Financial wealth
Reserve requirements	
Deposits abroad	

Central bank

Assets	Liabilities
Public bonds	Cash in circulation
International reserves	Reserve requirements
Rediscounts	Central bank’s debt with non-residents
	Financial wealth

IV. Derivation of demanded asset shares

The problem of choosing asset shares to maximize a CES utility function on asset earnings can be stated as:

Max_{θ_i} U $= [\sum_i \delta_i(\overline{R}_i\theta_i\overline{A})^{-\rho}]^{-\frac{1}{\rho}}$ s.t. $\sum_i \theta_i = 1$

where U=utility level, θ_i=share of asset i in asset portfolio, $\overline{R}_i$=rate of return on asset i, $\overline{A}$=total portfolio value, and δ_i and ρ_i are the share and exponent parameters of the CES function

Operating algebraically, the problem can be restated as:

Max_{θ_i} U $= \overline{A}[\sum_i \delta_i(\overline{R}_i\theta_i)^{-\rho}]^{-\frac{1}{\rho}}$ s.t. $\sum_i \theta_i = 1$

which can be solved by maximising the following Lagrangian function:

$$L = \overline{A}[\sum_i \delta_i(\overline{R}_i\theta_i)^{-\rho}]^{-\frac{1}{\rho}} + \lambda(1 - \sum_i \theta_i)$$

such that, focusing on two generic assets, i and j:

$$L_{\theta_i} = -\overline{A}\frac{1}{\rho}[\sum_i \delta_i(\overline{R}_i\theta_i)^{-\rho}]^{-\frac{1}{\rho}-1}\delta_i\overline{R}_i^{-\rho}(-\rho)\theta_i^{-\rho-1} - \lambda = 0$$

$$L_{\theta_j} = -\overline{A}\frac{1}{\rho}[\sum_j \delta_j(\overline{R}_j\theta_j)^{-\rho}]^{-\frac{1}{\rho}-1}\delta_j\overline{R}_j^{-\rho}(-\rho)\theta_j^{-\rho-1} - \lambda = 0$$

and

$$L_\lambda = 1 - \sum_i \theta_i = 0$$

From the $L_{\theta_i} = 0$ and $L_{\theta_j} = 0$ conditions,

$$\delta_i \overline{R}_i^{-\rho} \theta_i^{-\rho-1} = \delta_j \overline{R}_j^{-\rho} \theta_j^{-\rho-1}$$

Isolating θ_j,

$$\theta_j = \theta_i \delta_i^{-\frac{1}{\rho+1}} \overline{R}_i^{\frac{\rho}{\rho+1}} \delta_j^{\frac{1}{\rho+1}} \overline{R}_j^{-\frac{\rho}{\rho+1}}$$

Given that in a CES function the elasticity $\epsilon = \frac{1}{\rho+1}$,

$$\theta_j = \theta_i \delta_i^{-\epsilon} \overline{R}_i^{1-\epsilon} \delta_j^{\epsilon} \overline{R}_j^{\epsilon-1}$$

And, given that the sum of the asset shares equals one, i.e. $\sum_j \theta_j = 1$:

$$\sum_j \theta_j = \sum_j (\theta_i \delta_i^{-\epsilon} \overline{R}_i^{1-\epsilon} \delta_j^{\epsilon} \overline{R}_j^{\epsilon-1}) = 1$$

Taking common factor $\theta_i \delta_i^{-\epsilon} \overline{R}_i^{1-\epsilon}$,

$$\theta_i \delta_i^{-\epsilon} \overline{R}_i^{1-\epsilon} \sum_j \delta_j^{\epsilon} \overline{R}_j^{\epsilon-1} = 1$$

And, isolating θ_i, we get to the final formula which determines the asset shares given the CES function parameters and the assets returns, where ϵ should exceed 1:

$$\theta_i = \frac{\delta_i^{\epsilon} \overline{R}_i^{\epsilon-1}}{\sum_j \delta_j^{\epsilon} \overline{R}_j^{\epsilon-1}}$$

V. Construction of a proto-SAM for Argentina

The SAM cells were calculated in three main steps[76]. First I prepared an aggregated proto-SAM, a table where I aggregated activities, commodities, factors, households and enterprises into a single activity, a single commodity, etc, and where consistency is not assured: agents' sources of income do not necessarily match their uses. Second, I disaggregated the accounts in the proto-SAM, still without assuring consistency. Finally, I eliminated inconsistencies using Cross Entropy, as explained in Chapter II-4. Below, I explain the first two steps in detail.

[76] While in theory any anomalies in the economy for the benchmark year might be transmitted to the model results, tainting the conclusions, Roberts (1994) examines the significance of this in a model of Poland by calibrating to five different benchmark years, and concludes that model results are robust to the choice of benchmark year.

Step 1. Construction of the aggregated proto-SAM:

The construction is explained cell by cell, following the order in which the cells are calculated. The SAM is at 1993 prices, following National Direction of National Accounts (NDNA) data. When values are not originally in 1993 prices, they are converted using the GDP deflator as informed by NDNA.

Cell	Estimation
Taxes on value added	Data provided under special request by the National Direction of Fiscal Research and Analysis (NDFRA, Chart Recaudación Nominal 1980-2006')[77].
Taxes on imports	
Taxes on exports	
Taxes on labour	
Taxes on profits	
Public consumption	As informed in Table of Public Expenditure 1991-2001 (TPE), p. 25 in System of National Accounts (SNA).
Public Investment	Sum of 'Capital Goods' and 'Construction' items in TPE.

[77] For tax to profits, data is not available for 1991 so 1992 data is used instead.

Cell	Estimation
Public transfers to households	Total public transfers to private sector times share of household sector in the transfers. Total transfers from 'Transfers' item in TPE. Households' share estimated from data provided on request by NDNA for closest year with available data (1993). Specifically, calculated as the share in total public transfers of pensions, scholarships, transfers to cooperatives and to other cultural and social institutions.
Public transfers to enterprises	Total public transfers (informed in TPE) minus transfers to households.
Value added at factor cost	GDP at basic prices as informed by SNA (Table Total Supply – Total Demand 1980-2005).
Private consumption	Calculated as GDP at market prices, times the domestic consumption share, minus the value of public consumption. GDP at market prices estimated as value added at factor cost plus indirect taxes (taxes on value added, imports and exports). Domestic consumption share taken from Chart I.1. Global Supply and Demand (GS&D) in SNA
Private Investment	GDP at market prices times investment share minus value of public investment. Investment share from GS&D.

Cell	Estimation
Exports	GDP at market prices times export share. Export share from GS&D.
Imports	GDP at market prices times import share. Import share from GS&D.
Gross production value	Value added at factor cost, times the relation between gross production and value added at factor cost for the year closest to 1991, informed by NDNA (1993).
Intermediate consumption	Gross production value, minus value added at factor cost, minus taxes to value added.
Households factor income	Share of labour in value added (included tax to labour) times value added at factor cost minus tax to labour, with mentioned share coming from NDNA data on income generation.[78]
Enterprises factor income	Value added at factor cost, minus households factor income, minus tax on labour.

[78] 1993 proxy as closest year with available data for year of the SAM (1991).

Cell	Estimation
Interest paid by households to banks	Like other interest payments, these are calculated as a relevant interest rate times a relevant stock (at the closest available point to the middle of the year). Interest rate: rate on loans as in BCRA data: Document C7.2 'Tasas de interés bancarias' 'Tasas activas'. Stock: loans to households as in Financial Entities Balance – Mortgage and Personal Loans.
Interest paid by enterprises to banks	Interest rate: rate on loans Stock: excess of total bank loans to private sector over loans to households. Total bank loans as in Financial Entities Balance – Total Loans to Private Sector.
Interest paid by government to foreign sector	Interest rate: rate on bonds, coming from series on returns of Argentinean public bonds elaborated and provided upon special request by R. Schefer from CEMA. Stock: 'External Position of Non-Financial Public Sector' in International Investment Position by Sector and Concept (IIP) elaborated by National Direction of International Accounts (NDIA).
Interest paid by government to banks	Interest rate: rate on bonds Stock: bonds held by commercial banks as in Financial Entities Balance – Credit to the Public Sector.

Cell	Estimation
Interest paid by government to central bank	Interest rate: rate on bonds Stock: central bank holdings of public bonds as in central bank balance – Sources of creation of the monetary base, Public Sector.
Interest paid by government to households	Interest rate: rate on bonds Stock: total public debt informed by NSNA, minus value of bond stocks held by other agents.
Interest paid by foreign sector to domestic households	Interest rate: risk-free world interest rate, as informed by US Federal Reserve for US government securities - Treasury bills (secondary market)", 6-month maturity, annualised.[79] http://www.federalreserve.gov/releases/h15/data.htm Stock: 'External Assets of Non-Financial Private Sector' in IIP.
Interest paid by foreign sector to banks	Interest rate: risk-free world interest rate Stock: 'External Assets of (non-central bank) Financial Sector' in IIP.
Interest paid by foreign sector to central bank	Interest rate: risk-free world interest rate Stock: 'central bank foreign assets' as informed in IIP.

[79] The one-year maturity bond was not used because it was discontinued during the analyzed period.

Cell	Estimation
Interest paid by banks to households	Interest rate: on deposits, taken from BCRA data: Chart IX. Annual interest rate on deposits for 60 or more days, monthly data, arithmetic average. Stock: Financial Entities Balance – Deposits of the Private Sector – 'Cajas de Ahorro'.
Interest paid by banks to enterprises	Interest rate: rate on deposits Stock: Financial Entities Balance – Total Deposits of the Private Sector minus households deposits.
Interest paid by banks to foreign sector	Interest rate: on deposits Stock: of 'External Liabilities of Financial Sector (excluding central bank)' in IIP.
Interest paid by banks to central bank	Interest rate: on rediscounts, as informed by central bank Stock: central bank Balance – 'Credit granted by the central bank to financial institutions'.
Transfer of profits from domestic banks to enterprises	Residual from bank's current sources and uses of funds.
Transfer of profits from central bank to government	Residual from central bank's current sources and uses of funds.

Cell	Estimation
Dividends paid to non-residents	‘Net utilities and dividends’ account in the Balance of payments.
Dividends paid to domestic households	Payout times excess of enterprise incomes, over expenditures, minus dividends paid to non-residents. Payout rate informed by exchange market commission bulletin for 1991.
Household savings	Residual from household current sources and uses of funds.
Enterprise savings	Residual from enterprise current sources and uses of funds.
Public savings	Residual from government current sources and uses of funds.
Foreign savings	Residual from non-residents’ current sources and uses of funds.
Variation in central bank’s foreign reserves	Subtracting January 1991 from January 1992 stock value of ‘External Assets of central bank’ as informed in IIP.
Variation in domestic banks’ deposits abroad	Subtracting Jan. 1991 from Jan. 1992 stock value of ‘External Assets of (non-central bank) Financial Sector’ in IIP.

Cell	Estimation
Variation in non-residents' deposits at domestic banks	Subtracting Jan. 1991 from Jan. 1992 stock value of 'External Liabilities of Financial Sector (excluding central bank)' in IIP.
Variation in non-residents' holdings of public bonds	Subtracting Jan. 1991 from Jan. 1992 stock value of 'External Position of Non-Financial Public Sector' in IIP.
Variation in household's deposits abroad	Subtracting Jan. 1991 from Jan. 1992 stock value of 'External Assets of Non-Financial Private Sector' in IIP.
Variation in property of enterprises by non-residents	Subtracting Jan.1991 from Jan.1992 stock value of 'External Liabilities of Non-Financial Private Sector' in IIP.
Variation in households' cash holdings	Subtracting Dec.1990 from Dec.1991 stock value of central bank Balance – Monetary circulation out of the financial system.
Variation in banks' reserve requirements	Subtracting Dec.1990 from Dec.1991 stock value of 'Monetary base held into the financial system' – Central bank Balance.
Variation in Central bank's holdings of public bonds	Subtracting Dec 1990 from Dec 1991 stock value of Central bank Balance – Sources of creation of the monetary base, Public sector.

Cell	Estimation
Variation in households' deposits at domestic banks	Subtracting Dec 1990 from Dec 1991 stock value in Financial Entities Balance – Deposits of the Private Sector – Saving Accounts.
Variation in loans by domestic banks to households	Subtracting Dec 1990 from Dec 1991 stock value in Financial Entities Balance – Credit to the Private Sector –Personal Loans and Mortgages.
Variation in loans by domestic banks to firms	Subtracting Dec 1990 from Dec 1991 stock value in Financial Entitites Balance - Total bank credit to private sector minus credit to households.
Variation in firms' deposits at domestic banks	Subtracting Dec 1990 from Dec 1991 stock value in Financial Entitites Balance – 'Total deposits' and then subtracting 'Variation in households' deposits at domestic banks'.
Variation in domestic banks' holdings of public bonds	Subtracting Dec 1990 from Dec 1991 stock value in Financial Entities Balance – Credit to the Public Sector.
Variation in household's holdings of public bonds	Calculated as residual to equilibrate incomes and expenditures of capital account government in the SAM.

Cell	Estimation
Variation in property of enterprises by households	Calculated as residual to equilibrate incomes and expenditures of capital account households in the SAM.
Variation in rediscounts	Calculated as residual to equilibrate incomes and expenditures of capital account Central bank in the SAM.

Step 2. Disaggregation of the PROTO-SAM:

Departing from the aggregated PROTO-SAM, accounts are disaggregated in the following cells as explained in the right-hand columns:

Cell	Disaggregated account/s	Method of disaggregation
Value added at factor cost	Activities and Factors	1) Split across activities, using NSNA data on value added by sector of activity for closest year to 1991 (1993); 2) For each activity, following NDNA Data Chart Accounts of Income Generation for close available year (1993), split factor income into i) formal labour, ii) informal labour and iii) capital – physical and working, as in NSNA data; 3) Attribute i) and ii) by skill following income shares in Permanent Household Survey.

Cell	Disaggregated account/s	Method of disaggregation
Gross Production Value: Supply matrix	Activities and Commodities	Split among activities following the proportion of activity-specific payments (for value added, intermediates and tax to value added) in total activity payments. Imputed to commodity by excluding secondary production from each activity (negligible given the low disaggregation level).
Intermediate consumption	Activities and Commodities	Split into a two-step process. In Step 1 intermediate consumption is split across activities, following shares of activities in intermediate consumption as informed by NDNA (1993). In Step 2 activity-specific values are distributed across commodities following shares of intermediate inputs by activities in MIPAr97 Use Table at basic prices (Chart 3) [80].
Private consumption	Commodities and Households	Split across commodities following commodity shares in column 'Final Consumption' of Input-Output, and then across households following shares of (interest-adjusted) incomes.
Private investment	Enterprises & Commodities	Split first across enterprises – following value-added shares - and then across commodities - following shares in 'Gross Fixed Capital Formation' column of Input-Output Table (Chart 12 MIPAr97).

[80] Activities: of the 124 existent ones, primary is 1 to 14; industry is 15 to 92; construction is 96; public services are 113,114 and 116, private services are the remaining ones. Commodities: of the 195 existent ones, primary is 1 to 38; industry is 39 to 147; construction is 148; public services is 180 to 183, rest are private services.

Cell	Disaggregated account/s	Method of disaggregation
Public consumption	Commodities	Split following shares in 'Public consumption' column of Input-Output Table (Chart 12 MIPAr97).
Public investment	Commodities	Split following shares in 'Gross Fixed Capital Formation' column of Input-Output Table (Chart 12 MIPAr97).
Exports	Commodities and Regions	Split using export value data by sector (classified by CIIU revision 2 at 3 digits) and partner generated by Banco de Datos Estadisticos de Comercio Exterior[81].
Imports	Commodities and Regions	Split using export value data by sector (classified by CIIU revision 2 at 3 digits) and partner generated by Banco de Datos Estadisticos de Comercio Exterior[82].
Taxes on value added	Activities	Split across activities following value-added shares.
Taxes on labour	Factors	Split among formal (skilled and unskilled) workers according to their shares in income of formal labour.

[81] Facilitated by Gonzalo Varela, University of Sussex.
[82] Facilitated by Gonzalo Varela, University of Sussex.

Cell	Disaggregated account/s	Method of disaggregation
Taxes on imports	Commodities and Regions	Split accounting for region- and sector-specific data on tariff rates and import values. See section on time-specific data for details on tariff rates.
Taxes on exports	Commodities and Regions	Split accounting for region- and sector-specific data on export tax rates and export values. See section on time-specific data for details on export tax rates.
Taxes on profits	Enterprises	Following the value-added shares.
Public transfers to households	Households	Attributed to the unskilled, who typically account for the bulk of these transfers.
Public transfers to enterprises	Enterprises	Split following enterprises' value-added shares.
Households factor income	Households	The after-tax income of the skilled is allocated to skilled households and the after-tax income of formal and informal unskilled (the second being untaxed) allocated to unskilled households.

Cell	Disaggregated account/s	Method of disaggregation
Enterprises factor income	Enterprises and Factors	Split following values of capital income by sector as informed in 'Income Generation' Chart (NDNA). Enterprises receive the income of (physical and working) capital associated to the specific activity where they operate.
Dividends paid to households	Enterprises and Households	Split according to value-added sector shares and attributed entirely to capitalist household.
Dividends paid to non-residents	Enterprises	Split according to value-added sector shares.
Household savings	Households	Split in proportion to (interest-adjusted) incomes.
Enterprise savings	Enterprises	Split according to value-added sector shares.
Interest paid by government to households	Households	Attributed to capitalist households.
Interest paid by non-residents to households	Households	Attributed to capitalist households.

Cell	Disaggregated account/s	Method of disaggregation
Interest paid by households to bank	Households	Split across households in proportion to households' factor incomes, including labour payments and dividends.
Interest paid by banks to households	Households	Split across households in proportion to households' factor incomes, including labour payments and dividends
Interest paid by enterprises to bank	Enterprises	Split following activity-specific borrowed loans during the year as informed by the central bank Department of Monetary and Financial Statistics
Interest paid by banks to enterprises	Enterprises	Split according to value added sector shares
Variation in loans by domestic banks to firms	Enterprises	Split according to shares of 'Loans by activities', information provided by the central bank Department of Monetary and Financial Statistics
Variation in property of enterprises by households	Enterprises and Households	Split according to the shares of variation in loans by domestic banks to firms, assuming for simplification that the provision of financial capital by banks and households follow the same activity-level pattern. Attributed to capitalist households.

Cell	Disaggregated account/s	Method of disaggregation
Variation in property of enterprises by non-residents	Enterprises	Split according to the shares in Variation in loans by domestic banks to firms, assuming for simplification that the provision of financial capital by banks and non-residents follow the same activity-level pattern.
Variation in firms' deposits	Enterprises	Split according to value added sector shares.
Variation in household's deposits abroad	Households	Attributed to capitalist households.
Variation in households' holdings of public bonds	Households	Attributed to capitalist households.
Variation in households' cash	Households	Split in proportion to households' consumption levels.
Variation in households' deposits at domestic banks	Households	Split in proportion to households' saving levels.
Variation in loans by domestic banks to households	Households	Split in proportion to (interest-adjusted) incomes.

VI. Additional shocks

Having described the results of simulating an increase in the perceived probability of default on domestic assets (T1) and a fall in the rate of tax on imports (K1) in Chapter 6, in this Appendix I report the results of the remaining simulations – which are shown in Table VI-1 below - highlighting the workings of the transmission channels present in the models and referring to the explanations given there, as needed.

VI. 1 10 p.p. increase in risk-free world interest rate (RW)

Real Model

- This shock generates an interest inflow to the domestic economy paid to holders of deposits abroad - capitalist households and banks - that increases capitalist RHG incomes directly and indirectly as the banks' profits are subsequently paid to them in the form of dividends. The increase in household income leads household consumption demand to increase, driving domestic prices up so that: 1) the real exchange rate appreciates, making net exports fall; 2) factor demands at given nominal wages increase, driving formal employment levels and all nominal wages up. The increase in employment, in turn, allows the level of economic activity to expand.
- Increases in prices, wages, employment levels and activity levels widen the tax base and lead to a reduction in the public deficit.
- The balance of payment with non-residents is unaltered overall. The additional inflow of interest received by the country is spent on payment for additional net imports and higher dividends to non-residents, the latter out of the increase in the nominal wage of physical capital.

Table VI-1 Results of Additional External Shocks

	Base		Perceived prob. of default on domestic assets ?10 p.p.			Risk-free world interest rate ?10 p.p.			Deposits held by non-residents ?10%			Equity held by non-residents ?10%			Bonds held by non-residents ?10%		
	Amount	Unit	R	RF	RFA	R	RF	RFA	R	RF	RFA	R	RF	RFA	R	RF	RFA
Balance of Payments[?]																	
Current Account	-8.46	B$	..	3.564	3.60	..	23.42	21.49	9.37	8.04	8.10	13.03	13.77	13.92	-32.20	-34.16	-34.47
Trade Balance	3.44	B$	..	9.581	9.67	-221.07	-191.86	-184.41	22.90	17.28	17.51	31.82	35.28	35.55	-78.64	-83.64	-84.23
Exports of Goods and NFS	21.51	B$	..	0.753	0.75	-15.72	-13.75	-13.53	1.81	1.36	1.36	2.52	2.80	2.78	-5.96	-6.34	-6.29
Imports of Goods and NFS	18.07	B$	..	-0.928	-0.95	23.38	20.17	19.01	-2.21	-1.66	-1.72	-3.06	-3.38	-3.46	7.88	8.37	8.55
Investment Income	-11.90	B$	..	-0.237	-0.24	63.93	72.14	68.61	0.04	0.72	0.70	0.06	-0.42	-0.39	-0.14	-0.09	-0.14
Interests	-10.91	B$	..	-0.280	-0.28	70.24	79.19	75.28	..	0.75	0.72	..	-1.43	-1.40	..	0.11	0.07
Profits and Dividends	-0.99	B$	..	0.227	0.24	-5.39	-5.33	-4.77	0.49	0.40	0.42	0.68	10.71	10.74	-1.70	-2.35	-2.44
Capital Account	10.62	B$	..	-3.564	-3.60	..	-23.42	-21.49	-7.47	-8.04	-8.10	-10.38	-13.77	-13.92	25.65	34.16	34.47
Non-inancial Private Sector	7.50	B$	..	-5.063	-5.11	..	-32.50	-29.85	..	-1.38	-1.47	-14.69	-20.45	-20.67	..	14.51	14.95
Public Sector	1.99	B$	FIXED	FIXED	FIXED	FIXED	FIXED	FIXED	FIXED	FIXED	FIXED	FIXED	FIXED	FIXED	137.05	137.05	137.05
Commercial Banks	1.13	B$	..	0.129	0.14	..	-4.32	-3.71	-70.39	-66.62	-66.59	..	6.45	6.48	..	-16.40	-16.47
Public Deficit	11.99	B$	..	0.333	0.36	-8.20	-15.47	-14.62	0.24	0.64	0.70	0.33	1.19	1.29	-0.87	-4.54	-4.74
Price of domestic goods	1.00	$	..	-0.232	-0.23	5.31	4.56	4.24	-0.55	-0.42	-0.42	-0.77	-0.85	-0.84	1.90	2.04	2.00
Real GDP	189.86	B$	..	-0.003	-0.02	0.06	0.05	-0.30	-0.01	0.00	-0.04	-0.01	-0.01	-0.07	0.02	0.02	0.16
Factor use																	
Formal Skilled	1.43	mill. Indi	..	-0.002	-0.01	0.05	0.04	-0.07	0.00	0.00	-0.02	-0.01	-0.01	-0.03	0.02	0.02	0.07
Formal Unskilled	7.39	mill. indi	..	-0.006	-0.02	0.18	0.15	-0.10	-0.01	-0.01	-0.04	-0.02	-0.02	-0.06	0.05	0.06	0.16
Physical Capital	288.65	B$	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Working Capital	17.15	B$	..	..	-0.34	..	..	-6.74	..	..	-0.74	..	..	-1.17	..	..	2.99
Tradables Value-Added Shares																	
Primary	10.9	%	..	0.020	0.02	-0.43	-0.37	-0.36	0.05	0.04	0.04	0.07	0.07	0.08	-0.16	-0.17	-0.18
Industry	25.8	%	..	0.015	0.02	-0.30	-0.25	-0.24	0.04	0.03	0.03	0.05	0.06	0.06	-0.12	-0.13	-0.13
Real Wages																	
Formal Skilled	16.82	th$/indiv	..	-0.005	-0.02	0.12	0.10	-0.16	-0.01	-0.01	-0.04	-0.01	-0.02	-0.06	0.04	0.04	0.15
Formal Unskilled	9.29	th$/indiv	..	-0.003	-0.01	0.09	0.07	-0.05	-0.01	-0.01	-0.02	-0.01	-0.01	-0.03	0.03	0.03	0.08
Informal Unskilled	9.29	th$/indiv	..	0.058	0.04	-1.29	-1.27	-2.00	0.16	0.10	0.06	0.22	0.22	0.17	-0.52	-0.47	-0.34
Physical Capital	0.20	% of stock v.	..	-0.014	-0.06	0.29	0.10	-1.20	-0.01	-0.03	-0.13	-0.02	-0.05	-0.19	0.07	0.15	0.51
Working Capital	0.35	% of stock v.	..	..	0.66	..	..	13.79	..	..	1.44	..	..	2.30	..	..	-5.46
Factor Income Shares																	
Formal Skilled	13.2	%	..	-0.001	0.00	0.02	0.03	0.04	0.00	0.00	0.00	0.00	0.00	-0.01	0.01	0.00	0.01
Formal Unskilled	37.7	%	..	-0.003	0.00	0.09	0.10	0.15	-0.01	0.00	-0.01	-0.02	-0.01	-0.02	0.03	0.02	0.03
Informal Unskilled	14.1	%	..	0.008	0.01	-0.19	-0.17	-0.21	0.02	0.01	0.01	0.03	0.03	0.03	-0.07	-0.07	-0.07
Physical Capital	31.7	%	..	-0.004	-0.01	0.08	0.05	-0.21	-0.01	-0.01	-0.03	-0.01	-0.02	-0.05	0.03	0.04	0.12
Working Capital	3.3	%	..	..	0.01	..	..	0.22	..	..	0.02	..	..	0.04	..	..	-0.09
Household Income Shares																	
Skilled	14.1	%	..	0.000	0.00	-0.42	-0.42	-0.42	-0.01	-0.01	-0.01	-0.02	0.00	-0.01	0.05	0.03	0.03
Unskilled	64.6	%	..	0.024	0.02	-2.50	-2.45	-2.46	0.01	-0.01	-0.01	0.01	0.07	0.07	-0.02	-0.09	-0.08
Capitalist	21.3	%	..	-0.024	-0.02	2.92	2.88	2.88	0.01	0.02	0.02	0.01	-0.07	-0.06	-0.03	0.06	0.05

* Relative deviations from base (%) except for shares and other rates, where absolute deviations from base are reported

Δ: In the balance of payments, following national accounts system, a + (-) means that the flow leads a country's international reserves holdings to increase (fall).

Table VI-1 (cont.) Results of Additional External Shocks

	Base		Rate of tax on imports ↓10%			Rate of tax on exports ↓10%			Price of imports ↓10%			Price of exports ↑10%			Nominal exchange rate ↑10%		
	Amount	Unit	R	RF	RFA	R	RF	RFA	R	RF	RFA	R	RF	RFA	R	RF	RFA
Balance of Payments$^{\Delta}$																	
Current Account	-8.46	B$	..	0.55	0.64	..	0.02	-0.07	..	-0.96	-0.07	..	-10.84	-13.67	..	-89.12	-92.50
Trade Balance	3.44	B$	-0.05	3.35	3.12	0.08	1.04	1.28	-0.54	-8.34	-10.63	2.34	-44.88	-36.12	-39.61	-286.84	-279.40
Exports of Goods and NFS	21.51	B$	0.95	1.21	1.20	0.75	0.83	0.84	15.07	14.47	14.35	24.38	20.88	21.49	-3.03	-19.98	-19.15
Imports of Goods and NFS	18.07	B$	1.14	0.80	0.83	0.88	0.79	0.76	18.04	18.81	19.11	28.58	33.40	32.46	3.94	30.84	30.40
Investment Income	-11.90	B$	0.01	-0.58	-0.44	-0.02	-0.29	-0.42	0.16	1.73	3.03	-0.68	5.27	0.73	11.46	19.61	15.05
Interests	-10.91	B$	..	-0.65	-0.51	..	-0.29	-0.44	..	1.75	3.18	..	6.64	1.62	12.56	23.17	18.05
Profits and Dividends	-0.99	B$	0.16	0.26	0.24	-0.28	-0.27	-0.25	1.86	1.57	1.38	-8.12	-9.77	-9.08	-0.74	-19.47	-17.89
Capital Account	10.62	B$	..	-0.55	-0.64	..	-0.02	0.07	..	0.96	0.07	..	10.84	13.67	..	89.12	92.50
Non Financial Private Sector	7.50	B$	..	-0.82	-0.95	..	-0.03	0.09	..	1.45	0.23	..	16.09	19.98	..	131.30	135.89
Public Sector	1.99	B$	FIXED	FIXED	FIXED	FIXED	FIXED	FIXED	FIXED	FIXED	FIXED	FIXED	FIXED	FIXED	FIXED	FIXED	FIXED
Commercial Banks	1.13	B$	..	0.28	0.25	..	0.03	0.05	..	-0.62	-0.89	..	-5.04	-4.23	..	-34.61	-33.35
Public Deficit	11.99	B$	0.46	1.15	1.12	0.19	0.46	0.49	-1.10	-2.68	-2.99	-5.91	-13.63	-12.84	-5.53	-19.74	-19.42
Price of domestic goods	1.00	$	-0.24	-0.32	-0.31	0.22	0.20	0.19	-3.34	-3.17	-3.08	6.80	7.77	7.45	11.04	17.70	17.13
Real GDP	189.86	B$	0.02	0.02	0.02	0.02	0.02	0.01	0.35	0.35	0.46	0.32	0.33	0.07	0.01	0.08	0.29
Factor use																	
Formal Skilled	1.43	mill. Indi	0.01	0.01	0.01	0.01	0.01	0.01	0.23	0.23	0.27	0.21	0.22	0.14	0.01	0.07	0.15
Formal Unskilled	7.39	mill. indi	0.04	0.04	0.04	0.04	0.04	0.03	0.86	0.87	0.94	0.77	0.79	0.61	0.03	0.26	0.40
Physical Capital	288.65	B$	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Working Capital	17.15	B$	..	..	0.15	..	..	-0.19	..	..	2.31	..	..	-4.99	..	..	4.93
Tradables Value Added Shares																	
Agriculture	10.9	%	0.01	0.02	0.02	-0.01	-0.01	-0.01	0.12	0.10	0.10	0.10	0.02	0.06	-0.08	-0.56	-0.55
Industry	25.8	%	0.00	0.01	0.01	0.02	0.02	0.02	-0.04	-0.05	-0.07	-0.04	-0.11	-0.07	-0.06	-0.41	-0.36
Real Wages																	
Formal Skilled	16.82	th$/indiv	0.02	0.02	0.03	0.03	0.03	0.02	0.55	0.56	0.64	0.50	0.52	0.32	0.02	0.16	0.35
Formal Unskilled	9.29	th$/indiv	0.02	0.02	0.02	0.02	0.02	0.02	0.43	0.44	0.48	0.39	0.40	0.31	0.01	0.13	0.20
Informal Unskilled	9.29	th$/indiv	0.13	0.16	0.18	0.03	0.03	0.01	2.30	2.28	2.58	2.03	1.66	0.90	-0.26	-1.44	-1.83
Physical Capital	0.20	% of stock v.	0.09	0.09	0.13	0.08	0.08	0.03	2.04	2.08	2.58	1.84	1.78	0.57	0.03	0.61	0.56
Working Capital	0.35	% of stock v.	..	..	-0.18	..	..	0.41	..	..	-2.20	..	..	11.40	..	..	-9.41
Factor Income Shares																	
Formal Skilled	13.2	%	-0.01	-0.01	-0.01	0.00	0.00	0.00	-0.11	-0.11	-0.12	-0.10	-0.09	-0.06	0.00	0.01	0.06
Formal Unskilled	37.7	%	-0.01	-0.01	-0.01	0.00	0.00	0.00	-0.12	-0.13	-0.15	-0.11	-0.08	0.00	0.02	0.08	0.21
Informal Unskilled	14.1	%	0.01	0.01	0.01	0.00	0.00	0.00	0.09	0.09	0.10	0.08	0.04	0.00	-0.04	-0.23	-0.26
Physical Capital	31.7	%	0.01	0.01	0.01	0.01	0.01	0.00	0.14	0.15	0.23	0.13	0.13	-0.10	0.01	0.15	0.16
Working Capital	3.3	%	..	..	0.00	..	..	0.01	..	..	-0.06	..	..	0.16	..	..	-0.16
Household Income Shares																	
Skilled	14.1	%	-0.01	-0.01	-0.01	0.00	0.00	0.00	-0.15	-0.15	-0.16	0.04	0.04	0.04	0.16	0.13	0.09
Unskilled	64.6	%	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	-0.01	0.06	0.00	-0.06	-0.10	-0.72	-1.00
Capitalist	21.3	%	0.01	0.01	0.01	0.00	0.00	0.00	0.13	0.15	0.16	-0.10	-0.04	0.02	-0.06	0.60	0.91

* Relative deviations from base (%) except for shares and other rates, where absolute deviations from base are reported

Δ: In the balance of payments, following national accounts system, a + (-) means that the flow leads a country's international reserves holdings to increase (fall).

- This domestic appreciation shifts the demand for factors towards the non-tradable sectors and lowers the demand for the (informal unskilled) factors intensively used in the (primary) export sectors, affecting in turn their relative wages and their factor income share.
- The income increase enjoyed by the capitalist households leads to an increase in their household income share. The income share of the skilled and unskilled households falls, especially for the unskilled ones, which are affected by the fall in the factor income share of informal unskilled workers.

Real Financial Model

- The results are driven by the mechanisms explained for the real model, which also lead to domestic inflation, higher employment and output levels, a worsening of the trade balance, and a shift of income distribution that benefits the capitalist households.
- However, differently than in that model, there are movements in the capital account of the balance of payments: the increase in the world interest rate leads capitalist households to increase their deposits abroad, generating a capital outflow from the domestic economy. This outflow, together with the increase in payments to non-residents in the form of increased net imports and dividends, offsets the increase in the interest payments paid by non-residents to residents, with a final worsening in the balance of payments with non-residents.
- The rates of return on financial assets move in the following way: as the public deficit shrinks, the rate of return paid by the public sector on its debt goes down. The capital outflow generates a fall in the monetary supply that, combined with domestic inflation, reduces domestic liquidity in real terms and drives bank lending and borrowing rates up. Finally, with the increase in the activity level, equity return goes up in every sector except the primary one - which is particularly hit by the fall in exports.

Real Financial Augmented Model

- The behaviour of the model is similar to the real financial model in relation to i) the increase in the world interest rates shifting household income distribution in favour of the (capitalist) households who hold deposits abroad; ii) the increase in domestic inflation; iii) the changes in the balance of payments.
- However, in contrast, the capital outflow lowers the supply of working capital and leads to a fall in the productivity of the other factors, in turn generating a fall in the use of

formal workers. The fall in factors use contracts the activity level, more than offsetting the positive effect of higher prices on factor demand.

- While the fall in the productivity of the other factors leads to a fall in their real wages, the drop in the supply of working capital generates excess demand for it and leads to an increase in real wages, increasing the financial cost of physical investment and lowering the level of investment in the economy, construction activity and the demand for physical capital – intensively used in the construction sector, leading to a fall in the real wage and the income share of physical capital.
- Asset returns move as in the real financial model, except for the fall in the return of equity in the construction sector, linked to the abovementioned cut in physical investment.

VI. 2 10% cut in non-residents deposits in domestic banks ($\overline{\Delta DEP}_R$)

Real Model

- As non-residents withdraw part of their deposits in domestic banks, the current account deficit that the domestic economy is allowed to finance falls. This, in turn, calls for increasing exports and cutting imports, with the equilibrating mechanism - given elastic import demand and export supply - being provided by a real devaluation, particularly in the form of a drop in domestic prices.
- The domestic price cut reduces firms' profits and the dividends paid to residents and non-residents. They also lead them to lower their factor demand, and thus employment and production levels, in turn affecting national income and domestic absorption.
- Public savings fall as falling prices and activity level lower the tax revenue base.
- At the sector level, the economy provides signals for producers to move factors toward the tradable sector - especially the primary one - benefitting informal unskilled workers.
- The wage increase for informal unskilled workers leads to an increase in their income share, and therefore that of unskilled households. In parallel, as the nominal income of labour and capital shrinks, the relative importance of the (nominally fixed) interest flows as a source of household income increases, lifting the income share of the (capitalist) households who are net interest recipients.

Real Financial Model

- The shock has similar effects on the balance of payments than in the real model, except that, as public and foreign savings fall, and households savings need to increase to fill the

savings-investment gap which is opened, part of these savings are deposited abroad, increasing capital flight[1]. As non-residents reduce their deposits in domestic banks, interest payments to non-residents fall. Together with the increase in the interest inflow permitted by the increase in deposits abroad by capitalist households, net interest payments from residents to non-residents fall.

- Changes in the public deficit, domestic prices, employment and activity levels, sector allocation of resources and activity, real wages and factor income shares move similarly to the real model. Now, however, capitalist households benefit from increases in returns to their public bond holdings (linked to the increase in the public deficit) and bank deposits (linked to the fall in real liquidity in the economy caused by the capital outflows), as well as from the possibility of reallocating their asset portfolios. As a result, household income shares move in favour of the capitalist households and to the detriment of other households.

Real Financial Augmented Model

- The general effect of the shock goes in the same direction as in the real financial model. However, as deposits in domestic banks go down, working capital loans to firms falls too, aggravating the contraction of the economy.
- As the supply of working capital falls, an excess demand for it is generated, leading to a proportionately larger increase in its nominal wage (due to the low elasticity of factor demand) and an increase in its factor income share.

VI. 3 10% cut in equity stock held by non-residents ($\overline{\Delta EQE_e}$)

Real Model

- The shock is captured in the form of capital flight, similarly to a fall in deposits by non-residents, lowering the superavit in the capital account of the balance of payments, and involving the same transmission mechanisms as the previous shock. Given that the value of equity held by non-residents exceeds that of their deposits, the impulse and its results are both larger.

Real Financial Model

The model reacts similarly to a fall in non-residents deposits, with the following differences:

[1] Capitalist households also increase their deposits abroad because, as domestic deflation and the contraction of the activity level leads equity returns to fall, the relative attractiveness of depositing abroad goes up.

- The fall in payments to non-residents generated shows up in the current account of the balance of payments in the form of falling dividends instead of falling interest flows.
- As the capital outflow lowers domestic liquidity and domestic interest rates go up, banks' interest payments to domestic and foreign depositors increase, raising the net investment income paid by residents to non-residents[2].
- Faced with increasing domestic lending rates, banks shift away from their deposits abroad, partially offsetting the original worsening of the capital account.
- Besides the drop in income share of the skilled households (observed after non-residents cut their domestic deposits), the capitalist households lose income share due to a fall in their earned interest.[3]

Real Financial Augmented Model

Effects similar to those where non-residents cut their deposits at domestic banks apply:

- the general effect of the shock goes in the same direction as in the real financial model. However, as the capital flight takes place, working capital loans to firms fall, aggravating the contraction of the economy.
- As the supply of working capital falls, an excess demand for it is generated, leading to a proportionately larger increase in its nominal wage (due to the low elasticity of factor demand) and an increase in its factor income share.

VI. 4 10% increase in public bonds stock held by non-residents ($\overline{\Delta B}_R$)

Overall, and compared to a cut in non-residents' equity holdings, the effect here is larger in absolute value given that the value of bonds held by non-residents exceeds their equity holdings. It goes in the opposite direction (as holdings increase rather than decrease) and starts in a different item of the capital account of the balance of payments: that of the public sector.

Real Model

The table which signs the direction of the changes of the endogenous variables in this model evidences an exact mirror of that of the cut of deposits by non-residents (every + becomes a –

[2] The fall in dividends paid to non-residents only partially offsets the increase in interests paid to them.
[3] In turn, this fall occurs because their deposits in domestic banks fall in order to be consistent with the effect of the capital flight on the monetary base (critical in the model) and, subsequently, on required reserves held by banks, which are a fixed share of deposits. Most of the assets replacing deposits in the portfolio of assets of the capitalist households have a lower remuneration, including deposits abroad and equity in every sector.

and vice versa), indicating that the same transmission channels are at stake, just than running in reverse.

Real Financial Model

- The impulse is given to the model in a different place of the capital account than in the cut of non-residents deposits: that of the public sector, instead of that of the non financial private sector.
- As with changes in non-residents deposits, there are changes in foreign and public savings (now positive) which affects private savings (which fall), the amount of deposits abroad held by capitalist households (which also falls), and (now endogenously) the asset position of the non-financial private sector in relation to non-residents (as before, it worsens).
- As domestic liquidity increases, bank rates decrease, and interest payments to non-residents fall. With the activity level and domestic prices increasing, profits rise, and the dividends paid to non-residents increase, generating an increase in the investment income paid to non-residents which is only partially offset by the fall in interest payments paid to them.

Real Financial Augmented Model

The effects are similar to those in the real financial model, only that the capital inflow now leads to an increase in the availability and use of working capital, providing extra fuel to the expansion of the economy. Mirroring the changes in the market for working capital, as working capital supply increases, its real wages and its share in factor income falls.

VI. 5 10% cut in export taxes ($ter_{c,r}$)

Real Model

- While the cut in import taxes reduces the import price perceived by demanders, the cut in export taxes lifts the export prices perceived by producers, specially for the industrial commodities, which face an original export tax rate (5.9%) significantly higher than the one on primary commodities (1.8%). This shift resources and output towards the industrial (instead of the primary) activity. As the shift of production towards exports provides the domestic commodity market with excess demand, it increases (instead of reducing) domestic prices. As export and domestic prices increase, the producer prices increase. As producer prices increase, the nominal dividends paid to non-residents (and

residents) increase (rather than decrease), the trade balance shifts upward (to finance this increase in dividends paid to non-residents) and the real value of interest flows (which are nominally fixed) go down (rather than down).

- As with the cut in import taxes, public sector revenue falls, the public deficit increases, and the relative prices - of exports vis-à-vis non-traded goods and import vis-à-vis non-traded goods - shiftsm giving incentives to increase both imports and exports. Similarly to before, employment levels and real wages increase, now because of the producer price increases lifting factor demand at given nominal wages and also due to the CPI (the denominator of the real wage) including some goods (imports) whose price is fixed.
- As in the import tax case, the changes in the structure of the economy and the changes in the real value of interest flows alter the income distribution among factors and household groups. With the industrial sector growing, the demand for the factors intensively used in the sector grows, leading to an increase in the income shares of capital and the formal unskilled workers. The fall in the real value of interest flows leads the income share of the capitalist households to fall, offsetting the increase in the income share of capital in value added. The fall in the income share of the informal unskilled offsets the increase in that of the formal unskilled, letting the income share of unskilled households fall.

Real Financial Model

Most of the critical transmission mechanisms of the export tax cut in this model were captured in the real model, but the variations in the financial returns and in the allocation of financial portfolios have major effects on the balance of payments of the country and on income distribution.

- The abovementioned increases in the public deficit and in capital income have significant indirect effects on the balance of payments. The fall in public savings is offset by increases in private savings, with the bulk falling on capitalist households. As their savings increase, so do their asset holdings, including their deposits abroad[4]. This implies a capital outflow - captured in the capital account of the balance of payments – that lowers domestic liquidity, leading to an increase in the bank rates.[5] In parallel, the returns on other domestic financial assets increase: the higher public deficit, by increasing the public debt, increases the return on bonds; the increase in capital income translates into an increase in equity return. The generalised increase in the return of domestic assets leads to

[4] The implied fall in foreign savings only partially offset the effect on total savings.
[5] Also reinforced by the increase in nominal transactions as the economy expands and the domestic price level increases.

some capital inflow (by capitalist households and banks) that only partially offsets the observed capital outflow. The capital outflow restricts the current account deficit that the country can finance. With the return on domestic assets held by non-residents increasing, investment income paid to them increase, reinforcing the need to adjust the trade balance upwards.

- As the asset portfolio held by capitalist households and the returns on their domestic assets grow, so does their capital income, allowing their share in total household income to grow too. The effect is reinforced by the other RHGs being net debtors to banks, so that the increase in the loan rates adversely affects them.

Real Financial Augmented Model

The critical causal chains are those identified in the real financial model, with the only exception being that the mentioned presence of inflation lowers the supply of working capital in real terms, with the following effects:

- The real wage of working capital goes up, and its use falls, reducing the output increase. This affects tax revenue and the public deficit, lifting the return on public bonds.
- As the wage of working capital increases, the bank interest rates increase, shifting up the financial cost of physical investment, reducing the demand for the construction activity (with intensive use of physical capital), and reducing the share of physical capital in value added.
- The increases in the return of domestic assets (bonds, deposits and loans) attract capitalist households and banks, generating a capital inflow that allows the economy to finance a higher current account deficit.

VI. 6 10% fall in foreign price of imports ($pwmr_{c,r}$)

Real Model

The shock operates through the same causal chains that the fall in import taxes, with the following mentionable exceptions:

- The public sector revenue does not go down, and actually increases due to the increase in trade (imports and exports) already explained. This allows the public deficit to fall, so that households can allocate a lower share of their available income into savings.
- With private consumption increasing, the increase in imports is larger than before and, with imports being intensive in industrial commodities, demanders substitute away of

domestically produced industrial goods, so that the value added share of the sector now falls.

Real Financial Model

On top of the mechanisms operating in the real model,

- The fall in private savings reduces the size of the financial portfolios of the households. As a consequence, capitalist households withdraw a fraction of their deposits abroad, generating a capital inflow to the domestic economy.
- With the reduction in the public deficit and its effect on the public debt, the rate of return on bonds falls. With the capital inflow and the domestic deflation, domestic liquidity goes up in real terms, and bank rates fall. Both give incentives for capitalist households and banks to increase their shares of deposits abroad in their portfolios, in turn generating a capital outflow by banks and partially offsetting the capital inflow of capitalist households.
- As the return on bonds and deposits fall, the interests paid to non-resident holders shrink. Together with the capital inflow, they provide the means to the domestic economy to finance an increase in net imports.

Real Financial Augmented Model

On top of the causal chains in last model,

- Domestic deflation increases the working capital supply, leading in turn to a fall in its real wage and its value-added share.
- The associated fall in the loan rate leads to increase investment and the share of construction in total value added, lifting the value added share of capital (intensively used in the construction sector) enough to increase the income share of capitalist households and make that of the other household groups fall.

VI. 7 10% increase in foreign price of exports ($pwer_{c,r}$)

Real Model

The only critical differences with the export tax elimination simulation are:

- Public finances improve rather than deteriorate due to higher trade and non-decreasing tax rates.

- The export prices perceived by the producers increase uniformly in the primary and industrial sectors (10%). Given that the primary activity is more export intensive than the industrial one[6], the increase in exports shifts factors to the primary activity away from the other sectors, increasing the income shares of the factors intensively used there - capital and informal unskilled workers against the other factors. Also, the increase in the income share of the latter allow unskilled households to increase their income share.
- With public savings increasing, private savings are allowed to fall, allowing private consumption to increase.

Real Financial Model

Compared to the real model:

- While the fall in the private deficit allows the return on bonds to fall, the higher activity and price levels increase the transactions demand for money and shift the bank rates up. The increase in public savings also allow households to lower their savings, with the capitalist households withdrawing deposits abroad and generating a capital inflow to the domestic economy which is only partially offset by the bank's increase in deposits abroad (allowed in turn by higher households' deposits). The capital inflow allows the economy to incur a higher current account deficit. As the bonds and deposit returns go down, the interest payments to non-residents fall, making the net investment income paid to non-residents fall and allowing the net imports to increase.
- While as in the real model, the value added share of informal unskilled workers grows and that of formal unskilled workers falls, in this model the latter offsets the former, allowing the income share of unskilled RHG to fall.

Real Financial Augmented Model

Compared to the real financial model, the main differences relate to income distribution at factor and household level. The mentioned inflation lowers the real supply of working capital leading to an increase in its remuneration - i.e. through bank rates – and in factor income share. Higher bank rates disincentivise physical investment, lowering the demand and the income share of physical capital. In turn, this allows to reinforcing the fall in private savings and the boost on final consumption. Given the heavy weight of private services on final consumption and the intensive use of formal unskilled workers in the services sector, the income share of the formal unskilled grows, letting those of the skilled and the informal

[6] Export shares being 25.3% vs 11.6%, respectively.

unskilled fall. The fall in the income share of the informal unskilled drives distributional changes at the household income level.

VI. 8 10% devaluation of the domestic currency (exr)

Real Model

- The devaluation reduces the dollar-denominated interest payments to non-residents holding local currency denominated assets. To keep dollar-denominated foreign savings fixed, the trade superavit shrinks, the adjustment mechanism being a real appreciation in the form of domestic inflation i.e. the price of domestic goods increases proportionately more than the nominal exchange rate. Domestic inflation increases the nominal dividends paid to non-residents even after accounting for the nominal devaluation, which in turn only partially offset the fall in net investment income paid to non-residents generated by the abovementioned fall in interest payments.
- The real appreciation make resources and production shift to non-tradables and make net imports grow. As in previous simulations (e.g. increase in export prices), inflation leads to expand the employment levels and the activity level, and to increase the nominal value of public revenue and shrink the public deficit.
- The shrinking of tradable sectors – in special that of the agricultural sector - reduces the real wages of informal unskilled workers (intensively used in the primary sector), their share in factor income and the share of the unskilled in household income. Given the nominal fixedness of the interest payments received and paid by the households, the presence of (factor wage) inflation operates against the income share of the capitalist households, who are net interest recipients.

Real Financial Model

On top of the causal chains operating in the real model:

- as the public savings crowd out private savings, the asset portfolio of the capitalist households shrink, making them withdraw some of their deposits abroad, generating a capital inflow that allows the economy to finance an increase in the current account deficit. Motivated by a fall in the return on bonds, banks increase their deposits abroad, only partially offsetting the mentioned capital inflow.

- income distribution at factor and household levels change similar than in the real model, except that capitalist RHG, by benefitting from a higher return in pesos on their deposits abroad, increase their income share.

Real Financial Augmented Model

This works similarly to the real financial model but with working capital supply growing as driven by 1) withdrawals of deposits abroad by capitalist households (as noted) and 2) a higher conversion of the dollar-denominated capital inflows in local currency given the appreciation of the foreign currency. As seen before, this leads to increases in demand for other factors, in their productivities and in activity levels, as well as reductions in the real wage and the income share of working capital.