

**UNIVERSITA' CATTOLICA DEL SACRO CUORE  
MILANO**



**Dottorato di ricerca in Politica Economica**

**ciclo XXII**

**S.S.D: Economia**

**International price shocks and development:  
A general equilibrium approach with applications to  
Burkina Faso**

Coordinatore: Ch.mo Prof. Luigi Campiglio

Supervisori:

Ch.mo Prof. Francesco Timpano, Università Cattolica del S.C.

Ch.mo Prof. Marco Missaglia, Università degli Studi, Pavia

Tesi di Dottorato di Lorenzo Giovanni Bellù

Matricola: 3580130



## **Acknowledgements**

This thesis is the result of work carried out at different times and in different contexts, largely during week-ends and leave periods. I must credit my wife Maria Angela and my daughters Gloria and Silvia for the support provided, but also for the patience exerted when renouncing to the time and energies I could have dedicated to them. For the remainder of the work, I relied on my professional experiences at FAO. In particular, I strongly benefited from the work I carried out in Burkina Faso. For that, I would like to sincerely thank the national team of policy analysts at the Ministry of Agriculture, in particular Moussa Kaboré, Mamadou Hebié, Adama Ouattara, Richard Guissou and Remi Pale for providing data, information and clarifications about the country. I cannot forget to also thank my colleagues at FAO, in particular Paola Landolfi, Materne Maez, Nathalie Guilbert, Piera Tortora, Ilaria Tedesco, Azeta Cungu and Francesca Battistelli, who provided support, very useful comments and relevant references.

I must also admit that my sisters, brother, relatives and all my friends, who kept asking me “when are you finished with this thesis?”, stimulated and supported me to come to an end. Recognition has also to be given to my supervisors, who, during the long process of reading and commenting on the various drafts, became good friends: thank you very much, Francesco and Marco. Significant contributions to improve the thesis also came from two anonymous referees. While thanking them, I also free them (and the supervisors) from responsibility for any mistake or unforgivable omission in the papers.

Last but not least, I feel grateful to my parents: my daddy, who left us a long time ago, and my mummy, to whom I owe what I am.



# **International price shocks and development: A general equilibrium approach with applications to Burkina Faso**

## **Table of contents:**

### **General introduction.**

#### Part 1:

*Development and development paradigms: a (reasoned) review of prevailing visions.*

#### Part 2:

*Analyzing policy impacts and international price shocks: Alternative Computable General Equilibrium (CGE) models for an aid-dependent less-industrialized country.*

#### Part 3:

*International price shocks in Burkina Faso: assessing development impacts with a Computable General Equilibrium (CGE) approach.*



## General introduction

This thesis, structured in three individual but logically interlinked papers, aims at addressing select development issues, ideas and perspectives. More specifically, it aims at: 1) examining the recent (and less recent) development thinking; 2) exploring the implications of applying alternative Computable General Equilibrium (CGE) models to analyse development issues of a “paradigmatic” less-industrialized, oil-importing, aid-dependent country; and 3) assessing select development impacts of the international price shocks of food, oil, fertilizers and cotton, experienced in recent years by Burkina Faso.

The main subject of this work is the “development” of socio-economic systems. In general terms, “development” means an event constituting a new stage in a changing situation or the process of change *per se*. If not qualified, “development” is implicitly intended as something positive or desirable. When referring to a society or to a socio-economic system “development” usually means the improvement either of the general system’s situation or of some of its constituting elements. Development may occur due to some deliberate action carried out by single agents or by some authority pre-ordered to achieve the improvement, or it may simply occur due to favourable circumstances. Development policies and private investment, in all their forms, are examples of such actions.

Development processes of socio-economic systems present some fundamental features. These include:

1. **Multi-dimensionality.** “Development” is a multi-dimensional concept by nature, because any improvement of complex systems, as indeed actual socio-economic systems are, can occur in different parts, in different ways, at different speeds and driven by different forces. In addition, the development of one part of the system may be detrimental to the development of other parts, giving rise to differing objectives (trade-offs) and conflicts. Consequently, promoting and measuring development, i.e. determining whether and quantifying the extent to which a system is developing, are intrinsically multidimensional exercises, impinging on economic, human, territorial, and environmental dimensions.
2. **Cross-sectoral and macro-micro interdependencies.** A socio-economic system is a set of interconnected elements. Changes in one part of the system are to a greater or lesser extent affecting all the other parts. For instance, changes in factors’ availability, allocation, remuneration or mobility affect the entire economic system. Labour, capital, land, as well as natural resources, are used by different sectors which compete for their use. Factors move from one sector to another according to, among other things, the capacity of the different sectors to remunerate them. The development of one sector attracts certain factors, e.g. capital, and releases others, e.g. labour, affecting the factor use in all the other sectors. In addition, the purchasing power of households and their entitlements to food depend on the employment and entrepreneurial opportunities in different parts of the economy, as well as in different geographic locations (e.g. rural versus urban areas). Furthermore, cross-cutting development objectives such as food security and poverty reduction, as well as “balanced” economic growth are better

achieved by adopting a holistic view of the socio-economic system, rather than through isolated sectoral approaches.

3. **Transnational interdependencies.** Countries do not develop in a vacuum. The developmental achievements of a country can be beneficial or detrimental to the development of other countries. Migrations, foreign investment, technology and innovation diffusion, environmental externalities, and international trade are some of the channels through which development processes in one country can “contaminate” other countries.
4. **Long term time-span.** Often policy makers and the development community tend to address development issues as they emerge, focusing on “symptoms” of development-related “diseases”, rather than on the “disease” per se. However, while immediate action may relieve direct and severe consequences of contingent crises, to be effective and sustainable, development processes require a long-term vision and lasting action. By way of consequence, immediate development issues need to be framed in a long-term vision for effective and lasting solutions to be found.
5. **Global constraints.** Given the limited amount of resources available globally (energy, metals, land, water, clean air, etc) development processes based on the intensive use of these resources, in particular those which are exhaustible or those which generate large undesirable side-effects or risks, are destined to face resource constraints. Conflicts generated by the need to gain control over scarce resources are the almost unavoidable consequence of such development options.

In light of the above-mentioned features of development processes, and of emerging global development issues such as the overuse of exhaustible energy resources, carbon emissions and climate change, recurrent food crises, the general social and political instability of entire regions, widespread inequalities and persistent poverty and food insecurity, it is particularly important to assess current and recent development processes and to design-redesign ongoing/future processes to find new perspectives for development and related policies.

In the first paper of this work: “*Development and development paradigms: a (reasoned) review of prevailing visions*”, an attempt is made to sketch prevailing *development paradigms*, i.e. specific modalities to achieve desirable objectives on the basis of: a vision regarding the functioning and evolution of a socio-economic system; a codified set of activities; and a path to implement them. This exercise aims at contributing to interpret recent and ongoing development processes and support the exploration of alternative development paradigms to address emerging and future development issues. I identify some key “ingredients” of recent and prevailing development “recipes” and explore their mutual cause-effect relationships. In particular, through select contributions in the relevant socio-economic literature, the interactions among economic growth, poverty reduction, agricultural versus industrial development, technological changes and external-transnational factors are highlighted. The analysis of these cause-effect relationships allows for the identification of select development paradigms prevailing in different countries, periods and contexts and the set of development policies designed to implement them. What emerges is that the consensus on how to support development processes is not unanimous, in particular on the desirable degree of openness to international trade, the importance of exports in sustaining development, the type and role of institutions, the

type and role of public policies suitable to govern development processes, and the magnitude of the impacts of external shocks on the domestic socio-economic systems.

A general consensus on all the above is missing despite the great efforts devoted by both academics and policy analysts to assess whether select policies are beneficial or detrimental to development and the extent to which external shocks, e.g. foreign direct investment, foreign aid, remittances and/or international price shocks, affect the development of different countries. Beyond ideological biases, the lack of consensus is partially explained by the complexity of the channels through which policies and external shocks influence socio-economic systems. This complexity is difficult to capture by the various approaches available in the tool-box of analysts, and opens the door to a good degree of subjectivity. This subjectivity is reflected in many aspects of the analyses such as: the choice of the variables to focus on, the benchmark chosen, the assumptions adopted to make the analytical framework manageable, the type of approach adopted (e.g. qualitative versus quantitative or econometric versus computable).

Some of these issues are addressed in the second paper “*Analyzing policy impacts and international price shocks: Alternative Computable General Equilibrium (CGE) models for an aid-dependent less-industrialized country*”. This paper, after focusing on the structure of a socio-economic system and on "entry points" of different types of shocks and policies, explores alternative CGE models focusing on macro-economic and factor markets closures. It also highlights how different closures imply different assumptions related to the way the economic system works and adjusts to policies and external shocks.

The focus here on CGEs comes from the long lasting tradition of using CGEs to analyse development issues and related policies. The origins of this tradition date back to the late fifties and early sixties of the past century, with the works of Hirofumi Uzawa, Hollis Chenery and Leif Johansen, who applied the contributions of Kenneth Arrow and Gérard Debreu to create a planning tool aimed at supporting public decision making in providing a better allocation of resources. Since then, CGEs evolved thanks to the evolution of both the solving algorithms and the computers. However, as Lance Taylor reports in his paper in memory of Johansen<sup>1</sup>, the evolution of CGEs also followed the flow of the prevailing thinking: in the early eighties, particularly under the influence of the World Bank, the CGEs, were increasingly applied to justify the withdrawal of the government from the economy. Since then, CGEs have been extensively applied in less-industrialized countries to analyze development policy issues and shocks in all those situations where macro-micro interrelationships, cross-sectoral and inter-institutional interdependencies were expected to play an important role. When dealing with development, as opposed to growth, the use of CGEs, which mostly present some degree of disaggregation, is justified because development implies the relative strengthening of some sectors to the detriment of others. This is due, among other, to income shifts affecting the composition of consumers demand. In addition, as demonstrated by Rosenstein-

---

<sup>1</sup> Taylor L. (2011): CGE applications in development economics. Schwartz Center for Economic Policy Analysis. SCEPA working paper 2011-1

Rodan<sup>2</sup> with his contributions on the “*big push*”, the “profitability” of investments, including those geared towards development, depends on the density of the matrix of interindustrial coefficients. Using a multi-sectoral tool such as the CGEs, along the path rooted in Leontief’s seminal contributions<sup>3</sup>, helps to understand not only how and why income is (or would be) generated, but also how and why it is (or would be) distributed. Of course, there is no need to say that these are important pieces of information for analysts dealing with development issues.

In the second paper, to test how different ways of designing general equilibrium models may influence actual decision making in less industrialized economies, a one-sector, two-household, two-factor general equilibrium model is designed and calibrated on an “archetypical” Social Accounting Matrix of a hypothetical less industrialized, aid-dependent country. Alternative macro-economic and factor market closures are tested focusing on the mechanisms through which the economic system adjusts to external shocks such as import price upward shifts. Conclusions highlight that: 1) different ways of modelling economic systems lead to significantly different impacts of the same simulated external shock on import prices; 2) the results are particularly sensitive to the level of the elasticities of substitution of domestic goods with domestic ones; and 3) in aid-dependent economies, characterized by an high foreign dependency ratio of the government budget and a high level of foreign borrowing due to the external trade deficit, trade shocks affecting the real exchange rate largely affect the system and the welfare of households. By providing and comparing alternative macro-economic model closures and assumptions on factor markets, this paper emphasizes the importance of reading model results in light of the assumptions made and carrying out appropriate sensitivity tests on most relevant parameters.

The third paper, “*International price shocks in Burkina Faso: assessing development impacts with a Computable General Equilibrium (CGE) approach*”, focuses on a concrete country case study, analyzing the implications on welfare and growth of recent international price shocks, notably energy and agricultural products, in Burkina Faso. Burkina Faso is an agriculture-based, less industrialised, low-income, food-deficit, and net oil-importing country. Given the importance of agriculture, and considering that all the price shocks at stake directly or indirectly influence agriculture, the paper opens by sketching in general terms the links between agriculture and development. Subsequently the price shock impacts are analysed by means of a CGE. The results show that oil price hikes in recent years had much greater impacts on the welfare of the poorer layers of the population than any other price shifts. The paper also discusses the extent to which technological changes in agriculture, specifically the introduction of “Good Agricultural Practices” (GAP) towards “conservation agriculture”, could mitigate the welfare and growth losses derived by international price shocks. It is shown that the technological changes explored in this paper, in spite of their significant impacts on agricultural productivity, cannot countervail the negative welfare and growth losses brought by international price shocks. Energy dependency, particularly in a context of high oil prices, appears

---

<sup>2</sup> Rosenstein-Rodan, P.N. (1943): Problems of Industrialization of Eastern and South-Eastern Europe. *Economic Journal* 53 (June-September 1943), 202-211.

<sup>3</sup>Leontief W.W. (1941): *The structure of American economy, 1919-1929: an empirical application of equilibrium analysis*. Harvard University Press in Cambridge, Mass.

to be a channel that systematically siphons out domestic resources, jeopardizing household welfare and seriously hampering domestic primary capital accumulation and related endogenous-growth potential. Policy implications for poverty reduction and food security are that suitable policies should favour not only the adoption of appropriate energy-saving agricultural technologies but also the exploitation of sustainable energy production potential of rural areas. These findings are likely to apply to other less-industrialised energy-importing countries with a similar socio-economic structure.

As a general lesson, reading across the three papers of this work, it emerges that factors such as: 1) the current and emerging issues affecting the development potential of less-industrialized countries; 2) transnational interdependencies, specifically those related to intensive use of non-renewable or hazardous energy, strongly questioning the sustainability of development achievements in industrialized countries; and 3) global constraints related to carbon emissions and related climate changes, impose a deep revisiting of global and national development paradigms and adjustments. This revisiting and adjustment will probably need to also involve the still prevailing vision according to which selected countries are considered “*developed*”, as opposed to others considered “*developing*”. There is a clear need to carefully reassess global development achievements to date and identify feasible and effective ways forward to ensure more equitable and sustainable development processes.