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Abstract

In 1979, Paolo Ranuzzi, a senior economist within the Commission's Directorate General for Economic and Financial Affairs (DG II), led the development of 'EUROLINK', a short-term macroeconometric multi-country model of the European Economic Community (EEC). EUROLINK was used by the Commission for a few years, for producing macroeconomic forecasts, the EEC budget, and various studies about the dynamics of the EEC economy. However, after two years of intense criticisms, the use and development of EUROLINK was abandoned in 1983.

This article documents the history of the short-lived EUROLINK model. We highlight the reasons pushing the DG II to develop such a multi-country model, then the reasons bringing to its abandonment. We argue that, compared to single-country macroeconometric models, multi-country models were considered more suitable to analyse, theoretically and quantitatively, interdependencies across national economies and spillover effects of national policies. To address these issues, EUROLINK combined, via original bilateral trade equations, four heterogeneous large-scale macroeconometric models of European countries, developed by national modelling teams. We characterise this methodology as the "decentralised approach." Thanks to original archives, we show how this approach was deemed overly complicated and costly by the DG II.

After EUROLINK, DG II economists shifted to a different modelling approach (the "centralised approach"), in which the multi-country model (COMPACT, then QUEST) combines identical models of national economies, all entirely built by the DG II team. This approach was considered as one preserving DG II's "intellectual command" over the modelling activities.

Keywords: Multi-Country Models, European Macroeconomics, Commission of the European Communities, Eurolink

JEL Codes: B22, B27, F41

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1. Introduction

How does macroeconomics account for interdependencies across national economies? How does a macroeconomic model quantify and predict trade and capital flows, the evolution of exchange rates, and the spillover effects of national fiscal or monetary policy? Multi-country macroeconomic models have traditionally provided one tool to address these questions.[1] Since the 1960s, the economic, political, and (later) monetary integration of the European Economic Community (EEC hereafter) sparked an increasing interest in producing qualitative and quantitative assessments of macroeconomic interdependencies. Furthermore, macroeconomists were called to contribute to the building of EEC policy and institutions by providing expertise on these questions. Hence, quite naturally, multi-country models came to be part of the macroeconomic tools developed by policy-making institutions in various European countries (Whitley, 1992). Since the 1970s, the development of multi-country models became one the activities of the Commission of the European Communities ('the Commission' hereafter), and more particularly of the Commission's department in charge of economic analysis and forecasting: the Directorate General for Economic and Financial Affairs (DG II hereafter).[2] As summarised by Table 1, the DG II established thus a long (and ongoing) tradition in developing multi-country models of the EEC.

This article focuses on one specific episode in this long history: the first, sustained effort to equip the DG II with an in-house multi-country model. In 1979, the DG II set out to build

[1] By "multi-country model" we mean a system of simultaneous equations that includes (1) equations representing more than one national economy, and (2) a set of equations describing the linkages between these economies. Multi-country models are thus distinct from single-country models (which represent only one country's national economy) insofar as the latter treats all foreign countries as an exogenous "rest of the world". Conversely, in multi-country model, national economies are related by mutually determined variables. For a retrospective survey on the early development of multi-country models, see Hickman (1991); for a more contemporary survey, see e.g. Welfe (2013).

[2] Along the article, the reader can refer to the Appendix to navigate the administrative layers of the Commission and of the DG II.

EUROLINK, a short-term multi-country model of the EEC countries. The task was entrusted to Paolo Ranuzzi, a senior economist within the DG II's Direction C ("Macroeconomic Research and Policy), assisted by a very small team (2-3 DG II staff). EUROLINK was built by combining existing large-scale macroeconometric models of various European countries into a multi-country model, the same approach that Project LINK had championed a decade before (Hickman 1991). However, in 1983, EUROLINK was scrapped and the DG II shifted to a different modelling approach. The DG II's modelling team, now headed by André Dramais, built an entire multi-country model of their own (first 'COMPACT', then 'QUEST'), instead of relying on existing large-scale national models. This article discusses the reasons for this shift by documenting—using original archives—the debates that took place inside the DG II.

We shall refer to these two modelling approaches—the one adopted by EUROLINK, and the one adopted by COMPACT and QUEST—as, respectively, "decentralised" and "centralised" approaches to multi-country modelling. The decentralised approach—spearheaded by Project LINK since the late 1960 (Hickman, 1991)—consisted in combining into a multi-country model several existing single-country models, developed by national teams. It was a decentralised approach insofar as these models were, for the most part, built for other purposes and by independent teams (in universities, central banks, governments, …)—which naturally led to differences in notation, periodicity, production sectors included, theoretical mechanisms, and other modelling choices. The centralised approach, on the contrary, was characterised by the use of very similar, if not identical country models, all built and combined into a multi-country model by the same team of modellers. This approach was developed since the early-1970s, notably by macroeconomists based in Belgium—at the Free University of Brussels (ULB) and at the Catholic University of Leuven's Center for Operations Research and Econometrics (CORE)—and with some funding from the DG II. CORE's COMET model, in particular, was commissioned by the DG II, and at one point developed in parallel to EUROLINK. The scrapping of EUROLINK could thus be characterised as a shift from the decentralised, inspired by Project LINK, to the centralised approach, already present in COMET and later incarnated in the COMPACT and QUEST models developed at the DG II during the 1980s and 1990s.[3]

[3] To our knowledge, the DG II was the only international organisation that pursued the ambition of reproducing, with its own in-house model, the approach developed by Project LINK. This makes EUROLINK a singular and original episode in the broader history of multi-country models.

It should be noted, however, that while these were certainly alternative modelling approaches, they should not be interpreted as competing ones. Multi-country modellers (including Ranuzzi) were involved in projects implementing both of these modelling approaches. A central contribution of our article is thus to document how the DG II chose between these two approaches, based on their respective virtues and limitations. The EUROLINK episode is an example of how one modelling strategy came to be seen as less appropriate for a specific purpose, at a particular institution, at a particular moment in time. More specifically, we show that EUROLINK, which was initially conceived as a tool for integrating and coordinating macroeconomic analysis across national modelling teams in the EEC, ultimately came to be seen as too expensive and unnecessarily complicated. Indeed, the heterogeneous specifications, sizes, and data sources of national models integrated into EUROLINK made it difficult for its DG II users to have "intellectual command" over the forecast and simulations produced by EUROLINK. Furthermore, EUROLINK also suffered from a crucial theoretical limitation: national economies were linked only through trade equations, while financial and monetary international interactions remained exogeneous. Although this limitation was common to most multi-country models of that time, it constituted a crucial mismatch between EUROLINK and the policy needs of the DG II—most notably due to the challenges posed by European monetary integration at the turn of the 1970s. These circumstances led the DG II to adopt the more manageable centralised modelling approach.

Our article provides the first case study on the development of multi-country macroeconometric models since the end of the 1960s A growing literature in the history of economics has recently discussed the rise of single-country macroeconometric models in the US and in some European countries, highlighting how this intellectual movement was driven by changing scientific standards and the ambition of macroeconomists to contribute to policy making (e.g. Acosta and Pinzón-Fuchs 2019; Acosta and Cherrier, 2021; Acosta *et al*., 2021; Rancan, 2020). Multi-country models certainly resulted from the same general ambition, but they also served the more specific purpose of addressing, theoretically and quantitatively, the interdependencies across national economies. As a result, multi-country models faced distinctive methodological and theoretical challenges, which our article contributes to document.

Table 1 - Summary of multi-country models used by the DG II					
Period of development	**Model**	**Developers and documentation**	**Approach**	**Trade linkage system**	**Periodicity**
1971-1975	DESMOS[4]	ULB; Dramais, Grinwis, Waelbroeck	Centralised	Bilateral trade equations, "two-step approach"	Annual
1975-1984	COMET	CORE; Barten, Carrin, D'Alcantara	Centralised	Bilateral trade equations, "two-step approach"	Annual
1970?-1978	METEOR	Dutch Central Planning Bureau; van den Beld	Centralised	Total imports and exports	Quarterly
1974-1975	EURO	DG II; Ranuzzi	Centralised	Total imports and exports	Annual
1978-1983	EUROLINK	DG II; Ranuzzi	Decentralised	Bilateral trade equations, "two-step approach"	Quarterly
1983-1986	COMPACT	DG II; Dramais	Centralised	Aggregate block of EEC countries	Annual
1988-1991	QUEST (version 1988)	DG II; Bekx, Bucher, Italianer, and Mors under the direction of Dramais	Centralised	Bilateral trade equations, "two-step approach"	Quarterly
1991-1997	QUEST (version 1990)	DG II; Brandsma, op de Beke, O'Sullivan and Roger under the direction of Bakhoven and Dramais	Centralised	Bilateral trade equations, "two-step approach"	Quarterly
1997-2003	QUEST II	Roeger and i'nt Veld	Centralised	Total imports and exports	Quarterly
2003-present	QUEST III	Roeger, i'nt Veld, and Ratto	Centralised	New open macroeconomics	Quarterly

[4] On DESMOS, see Grinwis and Waelbroeck (1971), Waelbroeck and Dramais (1974), Dramais (1974, 1975a, 1975b); on COMET, see Barten *et al*. (1976) and Barten (1981); on METEOR, see Hoare (1977) and Italianer (1986, 25); on EURO, see Ranuzzi (1975); on EUROLINK, see Ranuzzi (1978; 1981); on COMPACT, Dramais (1986); on QUEST, Bekx et al. (1989); on QUEST II see Roeger and i'nt Veld, 1997; for QUEST III, see Ratto et al. (2008).

We start by highlighting how the DG II's General Director Tommaso Padoa-Schioppa (1979-1983) encouraged the development of in-house macroeconometric modelling as a means to enhance the "professionalisation" of the DG II's work. We then discuss the connection between EUROLINK and Project LINK as examples of the decentralised approach. We also emphasise the original linkage system adopted by EUROLINK (in comparison to Project LINK), relying on a "two-step approach" bilateral trade equations (Barten, 1971). Finally, we document the debates within the DG II that brought about the end of EUROLINK. To conclude, we briefly outline some distinctive characteristics of COMPACT and QUEST, the two models developed by the DG II after EUROLINK, following the centralised approach.

2. Macroeconometric modelling at the DG II

For several decades until the mid-1990s, the DG II was, within the Commission, the Directorate employing the highest number and share of economists (see e.g. Maes, 1996, 251-252). This naturally resulted from the missions entrusted to the DG II. From the outset, these were related to economics-related issues, notably the monitoring of the evolution of both EEC economies and the economic policies implemented by member states, the definition of the EEC's budget, and providing forecasts and economic analysis for the Commission. The DG II constituted thus a central node of a dense and changing network of EEC (later EU) institutions (see e.g. Mourlon-Druol, 2020), where economists played a key role (see e.g. Schmidt-Wellenburg, 2017 and Mudge, 2015).

There was, however, by the end of the 1970s, a fundamental reconsideration of the intellectual and professional standards that should drive the activities of the DG II (see notably Maes, 1996, 1998, 2000, 2006). This reconsideration and the ensuing changes resulted from at least two factors. First, the members of the EEC were taking further steps towards a closer economic and, most importantly, monetary integration. The inception of the European Monetary System (EMS), in 1979, is emblematic of such steps. In this context, the DG II assumed greater responsibilities, including supporting the coordination of national economic policies and coordinating the implementation of the necessary actions to maintain the EMS. This latter task was entrusted most particularly to the DG II's Direction of "Financial and Monetary Affairs" (Directions C and D before 1980, Direction D afterwards).

The second factor driving changes at the DG II was the vision brought by the Italian economist Tommaso Padoa-Schioppa, who served as the DG II's General Director from 1979 to 1983.[5] Padoa-Schioppa ambitioned a renewal of the type of economic analysis conducted at the DG II; a renewal that should bring the DG II closer to the scientific and professional standards of academia, of the other international organisations, and of the national policymaking institutions of EEC countries. In the "Activity Report," written at the end of his tenure, Padoa-Schioppa lamented the lack of credibility of the DG II (and hence, of the Commission) at the turn of the 1970s:

> *I knew, having been a national official, that the documents, analyses, and positions issued by the Commission in matters of economic and monetary policy did not draw the same attention as those of the other international organisations […] [The Commission's works were] too numerous, often inaccurate, analytically poor, and unoriginal.* (Archives, Item A, 14)

Padoa-Schioppa thus set out to remedy "the backwardness of the DG II in terms of economic and policy analysis" (Archives, Item A, 14). His motivation was centred on increasing the policy relevance of the DG II's work, and it was not guided by a wish to align with academic standards for their own sake (Archives, Item A, 7). Padoa-Schioppa thought that developing the ability to persuade national policymakers would constitute the only way in which the Commission could gain relevance and steer the course of national economic policies. Such ability to persuade would only be gained by increasing the professional standards ("*professionalisme*") of the Commission's economic analysis, carried out at the DG II (Archives, Item A, 7). The professional standards that Padoa-Schioppa had in mind broadly coincided with those promoted in academia by other European macroeconomists, through the renewal of national professional bodies and by establishing international (cross-European and trans-Atlantic) initiatives, such as seminars, conferences, journals, and training programmes (see e.g. Coats, 1996, 2000; Goutsmedt *et al*., 2021, and the other contributions to this special issue). Several initiatives taken by Padoa-Schioppa

[5] Well beyond and besides this role at DG II, Padoa-Schioppa had been a key contributor to the political project of European integration, and a key player in several European institutions. As summarised by Mudge (2015, 83), Padoa-Schioppa even came to be celebrated as "the father of the Euro". On Padoa-Schioppa's life and career see notably Maes (2012) and James (2012).

at the DG II aimed at fostering internal intellectual efforts towards sharpening economic analysis, while simultaneously building a more systematic dialogue with academia and national policy institutions. In 1980, Padoa-Schioppa reorganised the DG II's administrative structure, creating notably a new Direction for "Macroeconomic Research and Policy" (Direction C). Michael Emerson, who was entrusted with leading this new Direction,[6] fully shared Padoa-Schioppa's vision about the need for "professionalisation" of DG II:

> *The economic part of the Commission at the time [1979] was not very strong professionally, economists would say. The reputation in the eyes of administrative finance was not very high. IMF, OECD set the standard and DG II was scratching around but not quite up to the mark. (Emerson, 2010, 9-10)*

To encourage and to circulate economic research at the DG II, Padoa-Schioppa created a DG II working papers series, "Economic Papers", and established a series of seminars and "study groups" with external advisers—notably the "CEPS Macroeconomic Policy Group" (also known as the "Dornbusch Group," chaired by Rudiger Dornbusch). These and other changes have been investigated by the existing scholarship on the history of the DG II, notably by Maes (1996, 1998). However, there has been, in this secondary literature, a relative neglect of the emphasis put by Padoa-Schioppa on the in-house development of macroeconometric modelling. Padoa-Schioppa's archives contain a significant amount of material devoted to modelling issues that emphasises the crucial role modelling would play in his plans for the DG II. As Padoa-Schioppa noted at the end of his tenure, macroeconometric models had become an "essential tool" for policymaking institutions, although one that, to be useful, needed to be "part of a whole"—together with, for instance, forecasting procedures and statistical work (Archives, Item A, 56). Again, this mirrored the changes happening beyond the DG II: during the 1970s, most European policymaking institutions had built or extended their macroeconometric modelling activities. As nicely summarised by Jean Waelbroeck, a Belgian macroeconometrician and Project LINK coordinator

[6] Emerson, a British national trained at Balliol College (Oxford), had joined the Commission in 1973. He already had a significant seven-year experience as an economist at OECD. Emerson remained a DG II Director until the late 1990s.

for Europe: “The possession of a model is becoming as inevitable a symbol of national sovereignty as a flag, an input-output table, a delegation of the U.N., or an airline” (Waelbroeck, 1975, 423).[7]

Upon his arrival in 1979, Padoa-Schioppa considered that the DG II's experience with modelling was “long and uneven” (Archives, Item A, 55). On the one hand, the DG II relied on the analyses and forecasts done autonomously by national modelling teams, then collected through DG II country desks. On the other hand, for analysing the trajectory of the EEC as a whole, the DG II relied on multi-country models developed by external collaborators—some, with financial support from the DG II (Waelbroeck 1975, 449). The main DG II “partners,” providing them with multi-country models, were the Catholic University of Leuven’s CORE and the Free University of Brussels (ULB). The former had developed the "COmmon market MEdium Term model" COMET during the 1970s and 1980s, led by Anton Barten and Gonzague D’Alcantara (Barten *et al.* 1976; Archives, Items R, S, T, U).[8] COMET provided medium-term analyses of the trajectory of the EEC economy, and eventually simulations of ‘structural’ policies. At ULB, Waelbroeck and Dramais (Waelbroeck’s PhD student) led an effort to develop a small, short-term, multi-country model, ‘DESMOS’ (Dramais, 1974, 1975a, 1975b). DESMOS was conceived as a short-term model, providing forecasts of the quarterly trajectory of the EEC economy as well as analysis of the effect of national or coordinated fiscal policies. In the beginning of the 1970s the DG II also sponsored the building of another short-term econometric model, named ‘METEOR’, under the supervision of Cornelius A. van den Beld at the Netherlands’ Centraal Planbureau. After some unsuccessful attempts to merge it with COMET, however, the DG II halted its collaboration with METEOR’s modellers in 1978 (Archives, Item K, 551; O’Hoare, 1977).

At the DG II, the only first-hand experience with building a macroeconometric model was that of Paolo Ranuzzi.[9] Shortly after joining the DG II in 1973 as a senior economist, Ranuzzi had attempted to build a small multi-country model, nicknamed ‘EURO’, “to test alternative economic policies in the EEC member countries” (Ranuzzi 1975, 173). EURO followed the centralised

[7] Waelbroeck contributed decisively to this development, with his work at ULB (Maes and Buys, 2006). He was also the first and longest-serving editor of the *European Economic Review* (1969-1991) and he played a key role in fostering the development of European economics (Goutsmedt et al., 2021).

[8] Two of these modellers were also affiliated with the OECD. On the history of CORE see Maes and Buys (2006) and Düppe (2017).

[9] Ranuzzi held a degree in economics from the University of Florence (1964) and a PhD from Cornell University (1967). Before joining the DG II, he had been an associate professor of economics at the University of Bologna. He left DG II in 1983 to join the Italian Treasury.

approach, that is, it used "the same explanation for endogenous variables in each country" (Ranuzzi, 1975, 174). An initial version of the model, consisting of four countries, was ready by the end of 1974, but it was ultimately never completed. Thus, until 1979, all the modelling, simulation, and forecasting work of the DG II was overwhelmingly commissioned to outside consultants.

For Padoa-Schioppa, Ranuzzi's first-hand experience was a crucial aspect of the adequate use of macroeconometric models. His previous experience at the Servizio Studi of the Banca d'Italia had convinced him that:

> *in order to be useful, a model should be built by the user himself, and it should be constantly revised and modified in ways suggested by its use. It was thus essential that the DG II established, within its own services, a sufficient modelling capability (Archives, Item A, 55)*[10]

The adequate course of action wasn't fully clear at the beginning of Padoa-Schioppa's tenure, and he consulted—both internally and externally—several macroeconomists to gather advice about the adequate linkage mechanisms and feasibility of building an in-house multi-country macroeconometric model (Archives, Item V, 230).

3. Modelling choices for EUROLINK

In 1979 Padoa-Schioppa entrusted the task of building the DG II's first in-house model to Ranuzzi, working with a small team of 2-3 DG II staff.[11] Their goal was to build a short-term (12-18 months) model that could fit into the regular activities of the Commission—such as writing reports and establishing the EEC budget—as well as "day-to-day" economic policy discussions. EUROLINK

[10] On the arrival and development of macroeconometric modelling at the Banca d'Italia see Rancan (2020).

[11] Pier Luigi Lischi and V. Basano seem to have been Ranuzzi's two closest collaborators. They seem to have contributed to the econometric (Lischi) and computer-related (Basano) aspects of EUROLINK, although their role is unclear from the archives (Archives, Item Q). The EUROLINK team was under the supervision of Giovanni Laina, who answered to Emerson (the Director of Direction C, "Macroeconomic Research and Policy").

would be used to produce economic policy simulations and forecasts at the European and national level, including the quantification of the degree of integration among EEC countries (Archives, Item C). The latter was particularly highlighted by Padoa-Schioppa:

> *The effects on neighbouring countries of the policy measures decided by one Member State within its borders are generally poorly acknowledged, because of the simplicity of the instruments and [single-country] models we use to this end. A [multi-country] model, as systematic as Eurolink, not only provides an accessible way to explore this question efficiently, but it also allows to conceive some solutions to the problem of convergence of the Community policies (Archives, Item Q,* 15*).*

In the meanwhile, the COMET model would continue to be used by the DG II for the purpose of building medium term forecasts and simulations. Thus, COMET and EUROLINK operated within a form of "division of labour" between short- and medium-term analysis. The exact shape that EUROLINK should take, however, was far from straightforward, and it ultimately combined the contemporary solutions to two crucial modelling choices: (1) whether to use existing national models or build their own—what we have termed the decentralised and centralised approaches; and (2) how to link all of these national models.

3.1 Centralised vs. Decentralised

Regarding the first choice, EUROLINK adopted a decentralised approach, deviating from the centralised approach that contemporary modellers based in Belgium—including Ranuzzi (1975) himself—had favoured until then. Dramais and Waelbroeck, who built DESMOS at ULB, had applied the same uniform structure to all individual country models, favouring simplicity and consistency over institutional details. According to Dramais and Waelbrock, policymakers were interested in the sign and order of magnitude of multipliers, rather than on their precise value. Their model was thus conceived as a tool for a better qualitative understanding of economic interactions and as a basis for negotiations, not as a tool for exact computation (Waelbroeck and Dramais 1974, 298-299). At CORE, developers of COMET made the same choice to use uniformly

specified country blocks to simplify the model and focus their attention on the interaction between countries, rather than on specific institutional details:

> *Project LINK is made up out of a set of mostly already existing, and hence differently specified, national models [...] A relatively general, but identical, specification of the structural equations can, however, be flexible enough to accommodate, the rather diverse economic conditions in the various countries. It should also be kept in mind that the first aim of the COMET project is not to describe with maximum precision what is going on in some economy, but to create an overall picture. It may be added that the communication between model builders and model users, the Staff of the Commission, was greatly helped by the fact that understanding a fairly large size model like COMET IV requires only the explanation and study of a relatively small number of elementary components which are simply replicated, of course, with separately adjusted coefficients. (Barten 1982, 31)*[12]

EUROLINK, instead, followed the decentralised approach that Project LINK had spearheaded a decade before. Initially[13] a project of the US-based Social Science Research Council's Committee on Economic Stability, Project LINK's goal was to

> *augment radically our factual knowledge of the nature and strength of the international economic relationships, which bind individual countries into an effective world economy and provide the channels for the propagation of stabilising and destabilising influences between countries (Hickman 1969, 55).*

Unlike other multi-country models, however, Project LINK tackled this problem using existing large-scale, single-country models (instead of building their own from scratch). Furthermore, the fact that most models of individual countries were developed by local teams was

[12] See also Barten *et al*. (1976, 63, 105). As Waelbroeck said, DESMOS, COMET, and METEOR (all sponsored by the EEC) shared "the similar aim of facilitating the appraisal of common Market economic developments by the modelling of both the internal economies of member countries and the relations between these economies" (Waelbroeck, 1975, 449).

[13] Project LINK is still ongoing as part of the United Nations' Department of Economic and Social Affairs.

seen as a crucial virtue of the project. It was considered that "each model builder knows his country's economy best, both from the viewpoint of specifying the structure of his country's model and for applying it to his country's situation" (Klein and Van Peeterssen 1973, 429).[14] This expert knowledge resulted in detailed and heterogeneous national single-country models, each of which could have hundreds of equations and differ in terms of its periodicity, number of production sectors included, etc. 'LINK central', a small group led by Lawrence Klein at the University of Pennsylvania's Wharton Econometric Forecasting Associates (WEFA), was the main responsible of dealing with these complications, combining individual models into the world multi-country model—eventually reaching thousands of equations—and carrying out simulation and forecasting exercises.[15]

At the DG II, Ranuzzi embarked on a similar task, though at a smaller scale. The EUROLINK project included, at the beginning, three national single-country models: the METRIC model, developed by the French National Institute for Statistics and Economic Studies (INSEE); the West German SYSIFO model, developed by the University of Hamburg and the University of Frankfurt; and the Italian model, developed initially at the University of Bologna for Project LINK, then handled by the Association Prometeia. The three modelling teams had already "got together and formed an informal club" (Archives, Item B, 567), looking for ways to link their models and carry out simulation and forecasting exercises.[16] The DG II's project provided a convenient avenue to this goal.[17] As Ranuzzi furthermore recalled, there were no significant financial contracts

[14] That said, Project LINK did develop place-holder models when there were no local models available. Additionally, expert teams at the United Nations developed models for collections of countries, such as the developing countries and the soviet countries (Hickman 1991).

[15] Developing the software needed for these tasks was also an important part of the work done at LINK central. Over time, however, other groups in Tokyo, Brussels, Stanford, and Toronto would also share some of the tasks involved in developing the world model.

[16] Three key figures in the development and use of these models—George de Ménil, Uwe Westphal, and Giorgio Basevi—were also closely connected by their activities in building a European network of macroeconomists, through initiatives like the International Seminar on Macroeconomics (ISoM; Goutsmedt *et al.* 2021). A joint simulation exercise between SYSIFO and METRIC was presented at the ISoM seminar (de Ménil and Westphal, 1981, 1985).

[17] Padoa-Schioppa had originally proposed using models developed at the Italian and German central banks, thinking it would "transfer" to the EUROLINK project some of the credibility and policy relevance these institutions had already built (Archives, Item B, 568-569; Item K, 553fn1). After some further consideration, however, the Bologna and SYSIFO models were found to be more suitable for the project (Padoa-Schioppa 0290, 568-569).

involved: each national team had handed over its model to the DG II freely, in a spirit of cooperation (Archives, Item B, 567). Shortly afterwards, and after considering other alternatives, the UK Treasury's model was also integrated into EUROLINK. A model of the Belgian economy, built at the ULB (for Project LINK, under the direction of Waelbroeck), was also made available in 1980 and was meant to be included eventually (Archives, Item Q, 7).

Table 2: Country models included in EUROLINK

Model	**Country**	**Developers and original documentation**	**Size**[18]	**Periodicity**
METRIC	France	INSEE; de Ménil and Nasse. (1977)	424 behavioural equations and 250 identities	Quarterly
SISYFO	West Germany	University of Hamburg and University of Frankfurt; Hansen and Westphal (1983)	120 behavioural equations	Quarterly
PROMETEIA	Italy	University of Bologna, and Prometeia; D'Adda *et al*. (1976)	53 behavioural equations and 69 identities	Quarterly
HMT model	UK	H. M. Treasury; Shepherd *et al*. (1975)	50 behavioural equations and 50 identities	Quarterly

All these national models shared a common theoretical basis. They were demand-led, in the sense that changes of the demand-side of the economy (consumption, investment, etc.) would determine economic fluctuations. The supply-side was modelled with significantly less detail. Furthermore, all models aimed at portraying the economy in the most disaggregated way possible, notably by distinguishing several production sectors. All models had a monetary and financial

[18] Reported sizes of each model are approximative, and mostly refer to the initial versions (referenced in the table). These large-scale models were, by in constant evolution: modelling teams would regularly update and develop the models by disaggregating sectors, endogenizing variables, adding new relations, etc. It is thus difficult to accurately report the number of equations in each model at any given point in time. For instance, the initial documentation on METRIC (1977) reports a total of 674 equations while Ranuzzi, in 1981, mentions "about 800" equations (Archives, Item K, p. 553). Similarly, for the Bologna model, Ranuzzi mentions 76 behavioural equations (Archives, Item K, p. 553), while the 1976 version of the model (D'Adda et. al) included 53 behavioural equations.

sector, although some were more rudimentary than others.[19] Although able to produce dynamics (forecasting and simulation), all models were based on expectations formed from a weighted sum of past variables. Finally, all these models were estimated econometrically, proceeding equation by equation. In a nutshell, METRIC, SISYFO, the Bologna/Prometeia model and the HMT model showcased the most emblematic features of the large-scale macroeconometric modelling research programme that had consolidated in the 1960s—particularly in the US (see e.g. Pinzón-Fuchs, 2019; Acosta and Pinzón-Fuchs, 2019).

Besides this common ground, there were still significant differences across the national models integrated into EUROLINK. Some of these differences resulted from idiosyncratic theoretical choices, as for instance the "tension block" in the METRIC model—a block endogenizing "rationing" across various markets, based on survey indicators (see de Ménil and Nasse, 1977)—which was directly inspired by the disequilibrium approach.[20] Other differences resulted, more plainly, from the heterogeneous levels of disaggregation of the models (number of sectors and markets), which resulted in significant variability in size (for instance, METRIC was more than sixfold the Bologna model; see Table 2). Finally, there were also variations across econometric specifications, which were driven by issues such as different data availability in each country. Ranuzzi was well aware that these heterogeneities entailed several complications for EUROLINK, complications that would not have arisen with a centralised approach:

> *There is considerable variation in the size and specification of individual models, ranging from about a hundred behavioural equations for the Italian model to about eight hundred for the French one; overall they produce a system which cannot be compared with a centrally structured multi-national model that has a uniform structure across countries. (Ranuzzi 1981, 153-154)*

[19] For instance, the PROMETEIA model had 8 behavioural equations for the determination of short and long run interest rates, and demand for money (short and long run deposits and reserves…), while the METRIC model was built with 14 equations for the determination of short- and long-term interest rates, credit, and demand for money.

[20] This resulted from Edmond Malinvaud's influence on METRIC, both intellectually and hierarchically (since Malinvaud was at the head of the INSEE, which had built METRIC). On Malinvaud and macroeconometric modelling, see Renault (2022). On the development of the disequilibrium approach in Europe see Plassard and Renault in this issue.

Nonetheless, Ranuzzi was convinced of the advantages of a decentralised strategy both in terms of analytical details but also in terms of policy interactions between institutions at European and national levels, making all of these efforts worthwhile.

3.2 The linkage system

Despite following Project LINK in the use of existing national models, when it came to linking these models EUROLINK followed the approach used in previous multi-country models of the EEC (see Table 1). These models, and notably COMET, relied on the specification of a set of bilateral trade equations, which linked individual countries following a "two-step approach": first, the total amount of imports was determined by describing firms' (or consumers') optimal (cost-minimising) choice across domestic and foreign goods, based on relative prices; then, a separate set of equations determined the allocation of imports across different exporters, based again on relative prices—this time, across foreign goods from different origins. This approach had been suggested by Taplin (1967) and developed, in particular, by Barten as part of his work on COMET (Barten 1971; Barten *et al*., 1976). Based on this framework, Ranuzzi had already developed a set of two-step bilateral trade equations for the DG II that was used during the GATT Tokyo Round (Ranuzzi, 1978). Ranuzzi then turned these bilateral trade equations into EUROLINK's linkage system.

More precisely, in EUROLINK, the two-steps approach was set in the following manner. Imports of country *i* from country *j* ($M_{i,j}$) are an estimated function of two independent variables: total imports of country *i* from all *n* partner countries ($\sum_{j=1}^{n} M_{i,j}$), and of relative prices, i.e. the price of imported goods from partner country *j* ($P_{M_{i,j}}$) compared to the average price of good *k* across all partner countries (P_M).[21] Imports can be then further disaggregated as the sum of bilateral imports for each *k* different type of goods (*k = 1 … K)*. In this import equation, domestic demand (imports) for each foreign (*j*) good (*k*) is expected to depend negatively on the relative price of the good *k* (the lower the relative price, the higher the level of imports) and positively on the overall volume of trade (the higher the overall demand for all goods, from all countries, the higher the

[21] Note that there is no wedge between export price (the revenue of the exporter) and import cost (the amount paid by the importer); see identities 5 and 6 in Ranuzzi, 1981, 156).

demand for the good *k* from country *j*). Thus, the estimable form for the equation representing bilateral imports of country i from country j ($m_{i,j}$) corresponds (with all variables in logarithm) to:

$$m_{i,j} = \beta_0 + \beta_1 \sum_{j=1}^{n} m_{i,j} + \beta_2 \left(p_{m_{i,j}} - p_m \right) + \varepsilon \qquad (1)$$

Where $\beta_{0,1,2}$ are the regression coefficients and ε the residual. p_m is the price index representing the average price of imported goods. All variables are real (measured at constant prices): hence, changes in exchange rates have no effect on trade. The same logical structure is translated to each of the *k=4* goods in EUROLINK (equation 10 in Ranuzzi, 1981, 157). Within the EUROLINK model, the above equation is embedded in the national models' price mechanisms. This means that the independent variables of the bilateral trade equations are determined within the system of equations representing each national economy. Notably, domestic prices, and henceforth prices of tradable goods, are determined within each national model—that is, prices depend on the heterogeneous specifications and mechanisms of each national model (*cf. supra*).

The use of this two-step approach had the advantage of simplifying the specification of the bilateral trade equations and, thus, the data requirements needed for the linkage system. An "ideal" system of linkage, where *direct* bilateral trade equations were estimated for every country and every type of good—and simultaneously with the domestic variables of the model—would have required much more data, some of which was simply not available (Rhomberg 1973; Italianer 1986, 25-26). This was seen as a good compromise, particularly for a model with only a handful of highly interconnected countries, such as EUROLINK (Ranuzzi 1981, 154; Waelbroeck 1973, 53-54; Ball, 1973; Courbis, 1981). For Project LINK, however, given the number of countries and regions included in the model, even this two-step approach was judged to be too demanding, because quantifying the aggregated price index for overall imports (p_m above) posed several challenges in terms of aggregation (as also outlined in Ranuzzi 1981, 160-161). Instead, Project LINK used a matrix of export shares—initially provided by the IMF—that allocated each country's imports between the other countries and guaranteed that both imports and exports summed up to

world trade (Hickman 1991, 487). The use of two-step bilateral trade equations by EUROLINK was hence praised by Padoa-Schioppa as a significant novelty with respect to Project LINK.[22]

EUROLINK did not feature any other link across national economies, namely financial or capital flows. Moreover, exchange rates were exogeneous. The other model used by the DG II, COMET, suffered from the same limitations. It was hence expected that EUROLINK would overcome this deficiency, although it was planned as a later step in the project (Archives, Item B, 567), building on the fact that the individual country models included in EUROLINK had monetary and financial sectors—some more detailed than others.[23] However, the EUROLINK linkage via capital flows and exchange rates was never completed by Ranuzzi (Archives, Item H, 510 and 553).

The linkage via capital flows and exchange rates was also of interest to Project LINK's participants, but it turned out to be considerably harder to arrive at any satisfactory way of implementing them. The first solutions of the model of the world economy using the trade flows linkage were ready by 1971. Conversely, capital flows and exchange rates were only endogenized for the main developed countries by the end of the 1970s (Hickman 1991, 491-495). In a nutshell, the fact that EUROLINK was limited to an estimation of bilateral trade flows was not an uncommon limitation for a multi-country model of the time.

4. The end of EUROLINK

The first operational version of EUROLINK was ready by the end of 1980, and simulations of the transmission of exogenous shocks to the entire model were carried out to investigate the model's convergence (Archives, Item C). In January of 1981, additional simulations were carried out and the model was used to support the elaboration of the EEC's economic budget. These activities

[22] "M. Ranuzzi [...] built a trade link block for the original four countries, and this is working"; Archives, Item B, 568).

[23] It was acknowledged that trade flows alone were an insufficient basis to investigate fiscal and monetary movements between countries, and that linkages through interest rates and capital flows were necessary. However, "data compatibility and quality still posed serious problems" (Archives, Item K, 554).

should have continued systematically, and new extensions of the model, as well as the inclusion of new country models, were planned.[24]

However, EUROLINK quickly came under active internal scrutiny. For over two years (1981-1983), debates questioned its adequacy to the DG II's needs, as well as its actual affordability. Concerns about EUROLINK were first sparked by the exhaustion, in February of 1981, of its annual budget. The budget cut-off resulted from the unexpected cost of simulations: "the computer cost went over 1 million Belgium francs in two months," reported Giovanni Laina, the supervisor, within Direction C, of the Modelling Unit (Archives, Item Q, 5).[25] Laina addressed, in March 1981, a first note to Emerson assessing the "one year experience" with the use of EUROLINK (Archives, Item Q). Based on further discussion with Laina and the modelling group, Emerson addressed his own report to Padoa-Schioppa in November 1981 (Archives, item E). Ranuzzi also personally wrote to Padoa-Schioppa (Archives, Item F).[26] Although they adopted different tones in their writing (Laina being more critical, Ranuzzi rather enthusiastic, and Emerson more neutral), their assessments focused on the same issues.

Cooperation between the DG II and the national modellers was reported by Emerson to work in a "warmly, efficient, pragmatic manner" (Archives, item Q, 3). Ranuzzi believed in the "political benefits" of such a cooperation, building up the DG II's "credibility" in the eyes of national administrations (Archives, Item F). Laina rather emphasised several unsolved issues with fitting national models into EUROLINK's linkage system: price equations in the Italian model were not sufficiently robust, and they were updated only annually; the UK model used trade data

[24] Later that year a deal was reached with the Federal Reserve Board that made their Multi Country Model (MCM) available to the DG II. Besides the US, the MCM also included Canada, Japan, and equations for "the rest of the world" (Archives, Item Q, 7).

[25] EUROLINK was implemented on the IBM-370/185 computer located in Diegem (Brussel region), the DG II "service bureau". Two other computer facilities were available to DG II staff: a mini-computer (therefore not powerful enough to support EUROLINK) and a mainframe of the British manufacturer ICL, located within the Commission main computer facility in Luxemburg. EUROLINK was not compatible with the ICL computer since the software used, TROLL (developed at MIT), was designed to run on IBM machines (Archives, Item I).

[26] An additional evaluation was completed by John Walker, an advisor to the DG II (Archives, Item W). Walker's conclusion concurred with the main points emphasised by Laina.

that were inconsistent with those of EUROLINK.[27] The French model was made available to DG II with "incomplete updated data," while the model for West-Germany posed the practical issue of a different "computer structure" than those of the other models (Archives, Item Q, 3).

Both Laina and Ranuzzi pointed out that the decentralised strategy had made EUROLINK, "at its origin, the most elaborated and yet the cheapest" project of the DG II (Archives, Item Q, 5), since national models had been obtained for free. Ranuzzi further argued that there were no maintenance costs (i.e., the task of developing the model and of re-estimating equations as new data came in; Archives, Item F). Each national team took charge of this maintenance for their own model, thus ensuring the maintenance of EUROLINK at no cost for the DG II. However, both Laina and Emerson concurred that EUROLINK still had some significant maintenance costs, related to the re-estimation of the linkage system. This, plus other modelling duties related to such a large model, would actually require hiring at least "2.5 additional full-time econometricians" (i.e. doubling the staff of the modelling unit) for EUROLINK to run efficiently (Archives, Item E; Item M). As Emerson also argued, the computer facilities available for the DG II were insufficiently equipped to perform simulations of such a large model at a "reasonable" cost (Archives, Item E). Nevertheless, the solution to this problem was technically at hand, if only the DG II (or the Commission) decided to invest in new computer equipment. Alternatively, the DGII could envision putting EUROLINK 'online' (moving to an "experimental" IBM network system) across the different local modelling teams and their respective computer facilities, which would then provide the additional computing capacities at a lower fixed cost for DG II (Archives, Item E).[28] Finally, another solution was simply to abandon policy simulations with EUROLINK and to limit the use of the model to forecasting (Archives, Item E).

A final and crucial issue concerning the use of EUROLINK was described at length by Laina: most of the staff outside the modelling unit and Direction C were rather "sceptical" about the model, even if they acted with "open-minded neutrality" (Archives, Item Q, 9). DG II

[27] This henceforth entailed problems "on both sides" of the bilateral trade equations (inaccurate national prices estimations will enter as independent variables, while inconsistent trade data will affect the dependent variables; *cf. supra*).

[28] Ranuzzi had been personally in touch with IBM to discuss this solution and its cost (Archives, Item F). The issue of the cost of computing constitutes a distinctive difference between EUROLINK and Project LINK: while Project LINK could fully rely on its own computer infrastructure, EUROLINK had to 'pay' its use of computing time on DG II machines.

economists commented on EUROLINK simulations and forecasts, when these were presented to them, but they did not really have "control over the different impulses given to the model." (Archives, Item Q, 9) Laina's comments suggest that Ranuzzi (and his small team) were the only ones that fully understood the functioning of EUROLINK, though they did not understand the views and needs of their colleagues:

> *The model must be in the hands of […] users for whom the numbers in the system correspond to some precise and familiar reality. It is not like that so far, since, for the group that handles the model, one exogenous variable is equivalent to another; this does not facilitate the understanding of what is of interest for the users and what can enrich their analysis. […] it is anyway illusory to think that a single person could be handling such a model alone […] (*Archives, Item Q, 9*)*

Laina hence warned that:

> *A condition for EUROLINK's survival is that it goes from the hand of the econometricians [the modelling unit] into the hands of the economists. If Direction A [Forecasts and Country Desks] were not to adopt EUROLINK as the main tool for its activities, it could be expected that the model progressively slips into oblivion. (*Archives, Item Q, 9*)*

Two solutions were envisioned to this issue. Besides hiring new staff for the modelling team, Laina also supported the idea of progressively dispatching the maintenance and the development of sectoral blocks of the model across the various DG II Directions (Archives, Item Q; Item P).[29] Emerson thought that, for this to be feasible, the DG II needed "more econometric

[29] Relying on modelling experiences in "other policy institutions," Laina envisioned for instance that the Divisions of Direction A (the DG II "country desks") would "progressively take charge of the trade and public finance blocks of the national models [… and] Direction D [Monetary Affairs] could manage the monetary part of the model" (Archives, Item P). Direction C would be in charge of coordinating these modelling efforts from other Directions and perform the simulation and forecasting exercises with the whole model, while putting in place a routine associating all Direction in assessing and orienting base-scenarios (*ibid*.).

skills of all categories, as well as in computer science" (Archives, Item E, 578).[30] Emerson pushed, anyway, for newly hired staff to be more proficient in econometrics, and he asked to set up DG II in-house training—both generic and focused on the use of EUROLINK and COMET—as well as external training at national institutions and at WEFA and Project LINK (Archives, Item Q). These arguments succeeded in getting EUROLINK an additional 45'000 ECUs from the DG II's "Research budget" for 1982 (Archives, Item M). Equivalent funding was allocated to the "improvement" of COMET,[31] making the expenses of both models a fourth of the 1982 DG II's total budget for "macroeconomics research," mostly conducted at Direction C.[32]

However, in February 1982, another internal assessment of the development of the DG II's economic analysis landed on Padoa-Schioppa's desk. This time, the report was signed by three DG II executives outside Direction C (George Demopulos, Francesco Papadia, and Alfred Steinherr). Their assessment criticised both EUROLINK and COMET's use of resources, claiming that "neither model corresponds closely to the needs felt in DG II" (Archives, Item P, 448). This echoed most of the arguments made by Laina about the insularity of the modelling activities with respect to DG II's staff beyond Direction C.[33] Emerson fought this report. First, he reiterated that the use of resources for modelling by Direction C was "parsimonious" since maintenance was efficiently outsourced (Archives, Item O, 425). Second, he pointed out that the modelling team was in fact severely understaffed, due to problems in both external hiring and internal promotion

[30] A questionnaire was even circulated to assess staff skills: it featured questions such as "Do you understand the basic properties of multiple regression equations that are central to macroeconometric models?" (Archives, Item E, 585).

[31] A new version of COMET (IV) was indeed delivered to the DG II by Barten and D'Alcantara in November 1982 (Archives, Item R).

[32] That is, 360'000 ECUs. This still is relatively modest compared to other DG II activities, such as, for instance, survey-based research (conducted by Direction A), which cost around 2 million ECUs (Archives, Item M).

[33] Note that discussions on models were surrounded by other conflicts, internal to the DG II, especially those opposing Direction A and C over their respective role and oversee of the forecasting process. This turf war took the form of a conflict between "economists [Direction A] and modellers [Direction C]," as Peter Van Den Bempt (Director of Direction A) summarised it (Archives, Item X). As a result, a new codification of the forecasting process was completed in June 1982 (Archives, Item J). However, the resolution of this conflict did not solve the doubts and discussions about models.

paths.[34] Finally, Emerson outright disagreed with the idea that models—both short- and medium-term ones—were not relevant to the DG II's needs.[35] Regarding EUROLINK, he passionately supported the need for a "quarterly macro simulation modelling facility, preferably one which is close to national policy centres" and designated EUROLINK as "the best tool available for this" while "not costing us much" or, at any rate, "considerably richer than either the Japanese EPA or US FED or OECD multi-country model systems, at much less cost" (Archives, Item O, 426). Although Emerson recognized that EUROLINK was "complex," he appealed to "patience and perseverance" in conducting this modelling effort and concluded that "It would be an illusion to suppose there exists somewhere a cheaper single model system" (Archives, Item O, 426).

To settle this internal debate, Padoa-Schioppa commissioned an external report on the DG II's modelling capacities. The task was entrusted to Clifford Wymer, a senior economist at the IMF's Research Department with relevant experience in macroeconometric modelling (see e.g. Knight and Wymer, 1978). His report, delivered in May 1982, sided with those within the DG II that had been most critical about EUROLINK (and COMET):

> *The current models, Comet and Eurolink, do not satisfactorily meet the needs of the Department [sic]. Comet does not include any financial variables so that many issues of interest […] cannot be addressed and [the model] is of limited use […] Eurolink includes only four countries, it does not incorporate DG II's view of the Community, it is much more detailed than is necessary for the work of the Department [sic], and it is consequently extremely difficult to understand and use.* (Archives, Item H, 503)

Padoa-Schioppa had also tasked Wymer with assessing the DG II's modelling strategy against the broader context of ongoing developments in macroeconomics, both in academia and in other policy institutions. More particularly, Padoa-Schioppa was aware that possibly a "second

[34] "The fact that present resources are insufficient is entirely due to the fact that we have to wait for long 'concours' procedures to fill vacancies that exist. […] a normal DG II career should include a year, or two in models […]" (Archives, Item O, 425).

[35] On COMET, Emerson writes: "DG II needs medium-term projections for all our Member States, and with all its limitations COMET is now serving a useful purpose here […] I wonder if you were aware that DGs III, V, VIII, XII, XVI, XVII and XIX all make demands for consistent medium-term projections for which COMET is now well adapted, and functioning" (Archives, Item O, 425).

generation" of macroeconometric models would emerge from, for instance, the debates about expectations and the rise of time-series analysis (Archives, Item Y) On these issues, Wymer endorsed a general scepticism against large-scale macroeconometric models, a scepticism that had gained ground in US academia—though not yet in policymaking institutions; see e.g. Goutsmedt et al., 2019 on the Lucas Critique. Models like EUROLINK and COMET, Wymer argued,

> *tend to become unwieldy and less amenable for evaluating the effects of policy changes or change in exogenous variables. Furthermore, the forecasting performances of large models have been poor, their costs are high both in terms of staff and computing resources, and their complexity makes it difficult to determine the reason for any peculiarities in their forecasts.* (Archives, Item H, 507)[36]

Consequently, Wymer suggested that any ongoing development of both COMET and EUROLINK "should cease" immediately and all resources should be devoted to building a new "small model," more adequate for DG II's policy needs (Archives, Item H, 504, 518). This meant building "a view of policy making which focuses on the interdependence of economic activities in the European Community and the coordination of the policies of its member countries" (Archives, Item H, 502) The new model should support both short- and medium-term forecasting, include financial and real variables accounting for the working of each EEC national economy, as well as for the interdependencies across EEC economies and between the EEC and the rest of the world (Archives, Item H).

In 1982, Dramais was appointed Head of the newly created DG II's "Macroeconometric Modelling Unit" (Direction C). He reacted to Wymer's report in a letter to Padoa-Schioppa. Dramais agreed that COMET and EUROLINK did not meet the needs of the DG II, since both were flawed by the "absence of crucial variables" (that is, monetary and financial linkages), by the "incomplete geographical coverage" (only four EEC economies were included in EUROLINK), and by the "lack of involvement from end-users" (Archives, Item G, 537). Furthermore, Dramais also embraced Wymer's conclusion that a new model was needed, and he rejected the idea of

[36] Wymer also included among these 'unsuccessful' examples, Project Link ("the most ambitious"), the Federal Reserve Board's Multi Country Model, the Japanese Economic Planning Agency's model, and the OECD's Interlink model (Archives, Item H, 509-510).

adapting the existing ones, considering the cost and time this would entail. However, Dramais disagreed with Wymer's conclusion that the development and maintenance of EUROLINK and COMET should be stopped immediately, since this would create an "institutional void" during the prospected "three to four years" needed to build a new model (Archives, Item G, 538). Regarding the characteristics of such a new model, Dramais outlined seven modelling principles: (1) the new model should be oriented towards the DG II's needs, which did not coincide with those of the individual national models; (2) the new model should be "controllable and understandable," and thus based on "compactness of behavioural relations"; (3) "theoretical rigour" should be constructed in describing interactions between monetary and real variables; (4) the model should rely on in-house development, involving all DG II Directions; (5) the modelling team should circulate, internally at the DGII, "comprehensive documentation" all along the development steps of the new model; (6) the new model should be accompanied by a "user-friendly" software; and finally, (7) the modelling team should use the existing models' "materials", "whenever possible" (Archives, Item G, 537).

Regarding the development of the new model, Dramais suggested starting with a "theoretical prototype" or "skeleton model," which would involve—as suggested by Wymer—a limited number of relationships (e.g. "25 behavioural equations"; Archives, Item G). However, he also noted, model development for policy use—the forecasting and policy analysis that would be deemed useful by all DG II users—would later involve "putting flesh on the skeleton," i.e., developing a model of much greater size (Archives, Item G, 538). Finally, regarding the costs and funding, he argued that the modelling development group should be staffed with four to five full-time economists from Direction C.[37] Conversely, a new mainframe computer would be a waste of resources since "desktop computers" were now providing a valid alternative (Archives, Item G, 539).[38]

[37] Of which "one [should be] a good system analyst for data base management and software development or evaluation" (Archives, Item G, 539). Dramais downsized here considerably Wymer's original recommendation of 9 to 10 full-time staff for developing the new DG II model, although he sided with Laina and Emerson's earlier requests (*cf. supra*).

[38] Dramais argued: "nowadays, one can get for 5 to 10.000 dollars desk-top computers not larger than the average video terminal but with about the same capacity as some decent old mainframes (like the IBM 360 family) mobilizing one full room. In other words, computers are becoming sufficiently cheap for being task-affected at the individual level and the use of large mainframes in time-sharing is not necessarily the best or most convenient solution any more." (Archives, Item G, 539)

EUROLINK was funded again for 1983 (50'000 ECUs, i.e. about 15% of the "macroeconomic research" budget; Archives, Item L), probably following Dramais' concern about avoiding an "institutional void" if the model was abruptly abandoned. However, EUROLINK was listed as a "secondary priority," and an accompanying note indicated that "[s]ome people [in the DGII] are asking the question whether we should keep investing considerable funds into EUROLINK, given the new orientations in modelling" (Archives, Item L, 255). Additional 25'000 ECUs were granted for acquiring a "rest of the world sub-model" for EUROLINK, although this was again accompanied by a sceptical remark indicating that "[s]ome people have raised the issue that modelling work should be conducted within the DG II" (Archives, Item L, 255).[39]

Relegated to a "secondary priority" and abandoned by the new head of the modelling team, EUROLINK completely ceased operations after 1983. In a last-ditch effort to save the model, Ranuzzi wrote to Padoa-Schioppa suggesting that EUROLINK could be maintained by the DG II, by employing "some spare economists", and that EUROLINK could become "a self-service to central banks and other national institutions of the member countries" interested in checking their simulations over a common benchmark model (Archives, Item D, 557). This avenue, however, was not pursued, and a new era of modelling began at the DG II.

5. Towards a centralised approach: COMPACT and QUEST

In line with Wymer's suggestion, Dramais led, between 1983 and 1986, the DG II modelling effort for a new quarterly macroeconomic model, aimed at providing short and medium run forecasts and policy analysis. The resulting model was named 'COMPACT' (Dramais, 1986), which was conceived as a prototype model, a first step towards a more ambitious project. It was indeed a small-scale model: most importantly, he did not distinguish among the EEC member countries, which were all aggregated in an "homogenous whole," with no institutional details or national

[39] The 1983 budget shows that other modelling approaches were granted greater "priority". For instance, a proposal for building a "quarterly production model with quantity rationing" (a project led by Henri Sneessen) was given "first priority" (although funded with only 12'000 ECUs). Dramais' assessment of this proposal, addressed to Emerson, emphasised "the potentialities of the disequilibrium (or rationing) models for the description of the present situation." (Archives, Item N, 276) He also recommended extending such models "in order to switch to quarterly data and to extend the rationing gap approach from the labour market to the other markets of the economy, in order to obtain a comprehensive macroeconomic system." (Archives, Item N, 276).

specificities (Dramais, 1986, 115). The block of EEC economies in COMPACT counted 50 endogenous variables, determined by 28 behavioural equations and 22 identities, and was estimated yearly with data coming from the EEC aggregate series published by the DG II. The US and Japanese economy block in COMPACT was a reduced-form version of the Japanese Economic Planning Agency's model (the EPA model). Finally, the Rest of the World block was determined as a residual, in a way to ensure world accounting consistency for international trade. Three years later, an extension to COMPACT was published (Bekx et al., 1989). It was a more disaggregated quarterly model, with structural specification for the economies of Germany, France, the UK, and the US (and to be further enlarged to other EEC countries), estimated with national data. The new model was nicknamed 'QUEST' (Quarterly European Simulation Tool), and it was built by a DG II team constituted by Peter Bekx, Anne Bucher, Alexander Italianer, and Matthias Mors, under Dramais' supervision (Bekx *et al*., 1989).[40]

Each country model included in QUEST consisted of about 120 to 140 equations, 25 of which were behavioural, and resulted in the model as a whole having few thousand equations.[41] Despite its considerable size—comparable, for instance, to EUROLINK and Project LINK—QUEST was deemed manageable and capable of providing "a quick evaluation of the main aggregates of the European economies" with reference to short and medium term forecasts and policy analysis (Bekx *et al*., 1989, 3). Indeed, to maintain "the intellectual command" over QUEST and to allow for "inter-country comparison", QUEST modellers specified similar structures for all national model economies: variables and results for different countries referred to the same concepts (i.e., those used to calculate EEC aggregates); data coming from national sources were adjusted to be consistent with the European System of Integrated Accounts (ESA) and with DG II data used for short-term forecasts. The harmonisation of data was an important step towards the adoption of a system of European accounts, developing a common language in terms of concepts and variables relevant for policy analysis and simulations (on the history of national and

[40] COMPACT remained in use for policy simulations and medium-term projections, see e.g. Knoester and Kolodziejak (1994); also see QUEST (1991, 172). QUEST's modellers, except for Matthias Mors, had joined the DG II a few years before, coming from ULB (Beckx), the E.H.E.S.S. of Paris (Bucher), and the Catholic University of Leuven (Italianer).

[41] All other countries were modelled by trade-feedback mechanisms. In total, 25 countries or zones were included, corresponding to a geographical classification in use at the DGII for consistency and forecasting exercises.

international accounts systems, see Vanoli, 2005). In short, QUEST was built following what we termed the "centralised approach" to multi-country modelling.

The shift to a centralised approach was presented by QUEST modellers with reference to Wymer's report; they argued that Dramais' project of a new modelling strategy was concretely achieved with COMPACT and QUEST (Beckx *et al*., 1989, 2). Later, in the 1991 version, they emphasised even more the originality of this centralised approach, as one fit for the "new generation of models," in contrast with the "older generation" of Project LINK, whose models were built independently by national teams (Brandsma *et al.* 1991, 171; see also Brandsma, 1994, 146). This claim about the centralised approach as the one for a "new generation of models" appears however inaccurate, since early multi-country models sponsored by DG II in the 1970s, such as COMET, were already following the centralised approach; however, this emphasis indicates the faith that DG II modellers had on the centralised approach as the right way to overcome the most relevant shortcomings of EUROLINK. Nonetheless, among these shortcomings (as identified by Wymer, *cf. supra*), two were still left unsolved by COMPACT and QUEST: the modelling of the monetary sector and the financial linkages across countries, through capital flows and exchange rates determination. Even if COMPACT was a very simplified model, based on three highly aggregate regional blocks, the linkage system only relied on international trade, being drawn from Dramais (1974, 1975a, 1975b)' work on DESMOS. Similarly, Italianer's (1987) linkage system for QUEST did not model financial linkages and was still based on the two-step approach developed by Barten for COMET. COMPACT's monetary sector for the EEC block was only sketched, with a short-term interest rate specification that was deemed unsatisfactory, while long term interest rates were determined through a traditional term-structure approach. The money demand function was also a 'standard' one, having the two interest rates and nominal GDP as explanatory variables. As for the balance of payments, the external capital net inflows were determined following Marwah and Klein (1983)'s portfolio allocation model, with the exchange rates still exogenous.[42]

[42] As for the US–Japan module, of its 18 behavioural equations 3 where monetary equations for the determination of money demand, short and long run interest rates, and 3 were part of the balance of payments sector for the determination of net service balance, private capital balance and reserves or exchanges rate (Beckx *et al.* 1989, 126).

Similarly, the monetary sectors of QUEST's country blocks as well as the linkage system were seen as unsatisfactory, although they included some improvements over COMPACT. The monetary authorities' policy reaction function now determined the short term interest rate (which became the instrument of the monetary authorities), while long term interest rates were still determined as a term structure equation, and the demand for money also introduced expected inflation.[43] With respect to COMPACT, the model distinguished between internal targets such as growth of national income, inflation rate, and unemployment rate, and external targets with reference to current balance, exchange rates, and capital movements. The international trade was now split between goods—with a distinction between energy and non-energy goods to account for the oil shocks, and services. However, only the former were treated on a bilateral basis by applying the two-step import allocation model, while the flows of services were only incorporated as an element of the balance of payments but not linked. Exchange rates were still kept exogenous.

5.1 QUEST's linkages system

The linkage system was not improved as expected. Although widely recognized that along with goods and services the major linkages mechanisms were capital flows and exchange rates, and although country blocks now contained the balance of payments, only trade flows were modelled, with the transmission of international monetary effects only captured through price linkages. Thus, the most important behavioural equations of the QUEST linkage system were still the total imports and the bilateral imports equations within the neoclassical costs minimising framework.

As in EUROLINK, the division between domestic production and imports was first established within each national model of the EEC member countries, with producers that had to decide the amount to spend on the domestic inputs and on imports. Then, in a separate bilateral trade model (i.e. the linkage system) total imports were allocated across countries.

The relationship between final demand (F), domestic inputs (Y_1 … Y_K) and bilateral imports of goods in country *j* (M_{1j} … M_{nj}) was described by a production function (H) homogeneous of degree q:

[43] In the subsequent version of QUEST (Brandsma *et al.*, 1991), both interest rates and exchange rates were kept exogenous.

$$F = H\,(Y_1 \ldots Y_K;\ M_{1,j} \ldots M_{nj}, G) \qquad (2)$$

where G includes other factors, such as time. Under the separability assumption of H, it can be aggregated as follows:

$$F = H\,(y, m, G) \qquad (3)$$

where *y* is a function of $Y_1 \ldots Y_K$ and *m* is a function of all bilateral imports $M_{1j} \ldots M_{nj}$; *y* and *m* are proxies of value added Y and total imports M respectively. M is then estimated, while value added Y is defined through the identity Y = F - M (representing the adding up condition on final demand).

With respect to previous specifications, Italianer (1987) distinguished between structural and cyclical factors that, along with final demand and relative prices, determined total imports:

$$Ln\,m = a + b.ln\,(F.Z(t)) - c.ln\,(PM/PF) + d.DCU \qquad (4)$$

where M is total imports in constant prices, PM the corresponding import unit value index, and PF the final demand deflator. The coefficient *b* is equal to the inverse of the degree of homogeneity (q), and *c* is the elasticity of substitution between the domestic aggregate (*y*) and imports (*m).* The Z(t) function accounts for secular effects on imports, such as, for example, abolition of trade barriers, and is derived from a transformation of G (t): $Z(t) = G(t)^{-q}$. Cyclical factors such as tensions in the goods market is measured by the introduction of the degree of capacity utilisation variable (DCU) among the explanatory variables.

The total amount of imports was then allocated between different exporters using bilateral trade equations, in the separate linkage system, which determines the trade flow from exporter *i* to the importer *j* as a function of the exporter price relative to the prices of its competitors (see Beckx *et al.* 1989 section 3.8.3.*;* Italianer 1987 section 4). The bilateral trade flow equation for exports from country *i* to country *j* was estimated in real terms as follows:

$$lnM_{i,j} = a_{i,j} + lnMZ_j + c_{i,j}ln(M_{i,j}/MZ_j)_{-1} + b_{i,j}(1 - c_{i,j})ln(P_{M_i}/PMZ_j) + d_{i,j}(DCU_i - c_{i,j}DCU_{i-1}) \quad (5)$$

with Mij bilateral exports; MZj equals to real imports of country *j*, the coefficient b_{ij} the relative price elasticity, c_{ij} a Koyck lag parameter, and d_{ij} a quasi-elasticity with respect to the degree of capacity utilisation, i.e. a coefficient measuring, for example, the positive effect of domestic slack in country *i* on exports in general and on exports to country *j* in particular.

In other words, through the linkage system all countries' export prices and import volumes, which represented the inputs of the system, determined export volumes, import prices, and an index of competitors' prices. Indeed, after correcting for adding-up properties, to ensure that all bilateral exports flowing to one importing country add up to given imports, the export volumes of one country were calculated by adding up the bilateral trade flows originating in that country. Import prices were then proxied by the weighted average of the bilateral export prices using shares in imports as weights (Italianer 1987, 75). Finally, using the export price indices and the bilateral trade flows, a weighted index of competitors' prices was also calculated as a by-product, and fed into the export price equation (Italianer 1987, 115-117).

Italianer's linkage system was also applied to the 1991 version of QUEST 1991, which still neglected linkage mechanisms other than international trade. By the end of the 1990s, however, the "traditional macroeconometric modelling approach [was] definitely abandoned" and replaced by an equilibrium rational expectations model (QUEST II; Roeger and Jan in't Veld, 1997, 2); then, from 2005, by a standard DSGE model (QUEST III; Ratto *et al*., 2008), still in use today. Both financial linkages and the endogenization of exchange rates were finally accomplished in these new versions.

5.2 QUEST model within the EU policy agenda

By looking at QUEST's early versions it clearly appears that moving from a decentralised to a centralised approach did not solve important deficiencies in modelling countries' interdependence during the 1980s. The need to extend international linkages by modelling endogenously international capital flows and exchange rate movements was largely acknowledged but remained an open and troubling issue. There was not yet a "generally accepted and unified theory of exchange rate determination", with model builders that selected and developed different pieces of theories (De Grauwe and Peeters, 1983, vii). Despite the spread of multi-country models, the only ones intentionally built to analyse the role of monetary variables and exchange rates in

international transmission were the Japanese EPA model and the Federal Reserve Board's Multi Country Model (see Helliwell and Padmore, 1982).

Even if mainly conceived as a tool for policy evaluation, QUEST was thus unable to provide 'complete' quantitative analyses of the costs and benefits of the European integration process, particularly of the completion of the European Single Market, set for the 1992 (see the 1988 *White Paper*), and the monetary union project. Regarding the latter, while it is true that the *One Market, one Money*'s (Commission, 1990) main sources of macroeconomic simulations also came from QUEST (the Becks *et al*., 1989's version), the model was only applied to assess the costs of losing the exchange rate instrument to face shocks (see Commission, 1990, Annex D). Indeed, because exchange rates were exogenous (and thus conceived as a policy tool), and because the model did not address the Lucas critique, it was considered inadequate to evaluate the effects of the European Monetary Union.[44] The task of assessing the macroeconomic stability properties of alternative exchange rate regimes was, instead, ascribed to the forward-looking IMF MULTIMOD model (Mason *et al.* 1988; see Annex E).[45]

QUEST was also absent in other evaluations of the economic impact of completing the European internal market, which relied on the OECD INTERLINK model and on a macroeconometric model the *Directorate General for Science, Research and Development* (DG XII) built in parallel to QUEST: HERMES, short for Harmonised Econometric Research for Modelling Economic Systems.[46] Curiously enough, this model responded closely to the same decentralised approach of EUROLINK that the DG II had just dismissed. The development of

[44] QUEST had been also employed for example in background studies of German unification, and in analysing the effects of the oil price shock (see Brandsma *et al.* 1991, 172).

[45] Bekx *et al.* did not apply a forward-looking approach, arguing that rational expectations "although theoretically appealing" relied "on informational assumptions that can hardly be called realistic" and indeed are rejected by most empirical studies. Practical reasons also prevented their introduction since their implementation was "normally extremely burdensome computationally" (Commission, 1989, 11). On the other hand, model builders at DGII were aware of the need of addressing the Lucas critique. Indeed, already in 1983 Dramais submitted to Emerson some research projects proposals also regarding new methodologies for introduction of reaction functions into macroeconometric models to face the Lucas critique, using new development in the field of dynamic and noncooperative game theory (Archives, Item Z). In *One Market, One Money* it was acknowledged that the theoretical relevance of the Lucas critique in the case of a regime change as the adoption of EMU and of a single currency was "indisputable", even if the extent to which agents' behaviour were affected was an empirical issue (1990, 55).

[46] See for example, the European Commission (1988) study on "The Economics of 1992," Catinat, *et al.* (1987, 1988), HERMES Club (1990), Italianer, (1983, 1986), and d'Alcantara and Italianer (1982).

HERMES began in 1980 with the aim of having a medium-term macro sectoral model especially focused on the economic implications of the new energy situation both at national and EEC level. Each country model was built and maintained by national teams in collaboration with a central team that coordinated all activities.[47] DG II was asked to participate (along with other Directorates and the OECD) and took part in the designation of the "Central Group", directed by D'Alcantara (previously engaged with COMET, *cf. supra*), and the identification of the 9 national teams of experts responsible for the country models.[48] However, as it happened for EUROLINK, the complexities involved in this kind of modelling strategy led Padoa-Schioppa to abandon the project since it went beyond the DG II's needs of reaching operational results.[49]

HERMES was completed in the mid-1980s and presented as a highly successful project, emphasising its originality, which lied on its combination of a "decentralised (by each team)" and "centralised (by the Commission)" methodology (Commission, 1993, 1), and the advantages of such decentralised approach:

> *despite the high costs involved it was essential for models to be developed and used by institutes already well versed in economic studies and forecasts in their countries and with very good knowledge of factual data and the peculiarities of each economy. This thus led to a veritable HERMES network of 12 institutes using harmonised data and relatively close*

[47] The model was designed to assess the effects of the energy sub-system on the structure of member states economies (see Commission of the European Communities, 1993, 3).

[48] The project originated from the EEC Conseil's request to the Commission to develop a program on research and development within the field of energy. The model should have been devoted to analysing the "energy performance" in the medium term of the main economic sectors of country members, in the context of their relationships with the rest of the world. National teams began to work in the mid-1981 with their models that should have been operative and transferred on the informatic system of the Commission in the mid-1983, and the complete model should have been in operation within the end of 1984 (Archives Item 1Z; Item 2Z).

[49] "I have clarified that a research initiative in a new sector, such as the building of a multinational system combining very large-scale and highly-disaggregated models, was undoubtedly consistent with the objectives of the DG XII, but that it was in contradiction with those of the DG II; that is, a Directorate General that, since it has not research goals, cannot engage with economic analysis from which we cannot expect operational results with a high degree of probability." (Archives, Item 3Z, 99).

instruments for their work, which greatly facilitates dialogue, exchange and cooperation at European level (Commission, 1993, 1).[50]

Thus, in the 1980s the two alternative modelling strategies – decentralised and centralised, still coexisted although located in different Directorates and for quite different aims: to provide sectoral, highly disaggregate empirical research (HERMES) and to model the effects of the increasing real and monetary integration process (QUEST). And yet, the integration process still had a long way to go, both in terms of common policies and in terms of econometric modelling.

Conclusions

The history of multi-country models at the DG II recounted in this article highlights important continuities and discontinuities in the way in which interdependencies across national economies have been studied, as well as the importance of the specific institutional context in which models are built and evaluated. On the one hand, all models developed or sponsored by the DG II during the 1970s and 1980s focused on modelling trade relations across EEC economies, and they did so use the same framework: the two-step approach developed by Barten for his work on COMET—and further extended by Italianer in the 1980s for QUEST. At the same time, and despite being of crucial interest to modellers, these models consistently struggled to integrate capital flows and exchange rate linkages. On the other hand, the abandonment of the decentralised approach to multi-country modelling was a crucial change of direction for the DG II. For EUROLINK—and unlike Project LINK and HERMES—the virtues of the decentralised approach did not outweigh its shortcomings, and it ultimately failed to integrate into the DG II's practices and meet their expectations for an in-house model. The institutional setting was a crucial difference between Project LINK and EUROLINK: contrary to Project LINK, where the model was the object

[50] However, differently from Project LINK and EUROLINK, it was asked to national teams to adopt the same structure of equations and data to favour good communication between the different countries, with the different teams who collaborated in developing and applying HERMES model, forming the so-called "HERMES club" (Commission of the European Communities, 1993, 5, 10) who extensively produced common empirical results for different sectors (especially energy and environment) both a national and European level.

around which all activity turned, EUROLINK was but a part of the DG II and the EEC—a tool meant to provide forecasts and policy analysis in the context of an increasing coordination of policies among member countries. As such, EUROLINK's fate was marked by the degree to which it could fit the existing organisation and practices of the DG II, as well as its ability to serve its intended purpose. Project LINK's modellers, on the contrary, had much more freedom in the sense that their work wasn't constrained by any higher purpose. EUROLINK's shortcomings and its inability to fit the DG II's organisation and practices sealed its fate, even if it could be argued that it wasn't as expensive as a comparable model would be—a point made even less defensible by the criticism raised by Wymer towards Project LINK and the decentralised approach in general.

The development of COMPACT and QUEST aimed at filling some of the shortcomings of EUROLINK, but in moving away from the decentralised approach it also crystalised a revaluation of the desired characteristics of a multi-country model at the DG II: An increased emphasis was put on studying the interconnection of the EEC economies, even if it meant working with simpler, homogeneous country models. Compared with Project LINK and EUROLINK—where the detailed modelling of national economies was seen as one of the top virtues—COMPACT and QUEST placed manageability and clarity in the interconnection between counties as a top priority. The parallel adoption of the decentralised approach by the DG XII—and the development of HERMES—further shows that the relative appreciation of a model's virtues is not universal. Additionally, the fact that many of the modellers involved in these various models worked on different approaches at different points in time further evidence the pragmatic, context-dependent manner in which choices between modelling approaches are made.

References

Archival sources

All Archive Items referenced in the paper are drawn from the following collection: Tommaso Padoa Schioppa. Documents from 01 January 1947 to 18 December 2010. Folder Padoa-Schioppa.B-02, "Activities of the Directorate for Economic and Financial Affairs. Documents from 1977 to 1983". Historical Archives of the European Union, European University Institute, Florence. Available at https://archives.eui.eu/en/fonds/281316?item=TPS. The references cited in the paper come from two folders, denoted below as "TPS 290" (Padoa-Schioppa.B-02-290, "Report of Activities. Documents from 07 January 1981 to 25 February 1983") and "TPS 291" (Padoa-Schioppa.B-02-291, "Report of Activities. Documents from 15 June 1977 to 22 December 1982"). Note that the pages referred to are those of the pdf file.

Item A, T. Padoa-Schioppa, "*Rapport d'activité*," 02/25/1983. TPS 290, pp. 2-66.

Item B, M. Emerson to C. Wymer, "A view of our present macroeconomic models policy and objectives," 10/11/1982. TPS 290, pp. 563-571.

Item C, T. Padoa-Schioppa, "Recherches économétriques" in "Note à l'attention de M. Strasser, Directeur Général des Budgets, sur la mise en œuvre des études et enquêtes effectuées en 1979 pour le compte de la DG II," 09/11/1981. TPS 291, pp. 226-240.

Item D, P. Ranuzzi to T. Padoa-Schioppa, "Further thoughts on Econometric modelling in DG II," 20/11/1981. TPS 290, pp.557-558.

Item E, M. Emerson to T. Padoa-Schioppa, "Use of econometric models in DG II," 20/11/1981. TPS 290, pp. 574-585.

Item F, P. Ranuzzi to T. Padoa-Schioppa, "Use of Econometric Models in DGII," 30/11/1981. TPS 290, pp. 571-573.

Item G, A. Dramais to T. Padoa-Schioppa, "Development and Use of Macro-economic Model in DG II. Proposals for implementation of Mr. Wymer's report," 09/07/1982. TPS 290, pp. 537-542

Item H, C. R. Wymer, 11/05/1982, "Report on the Use of Macro-Economic Models ln DG II." TPS 290, pp. 500-526.

Item I, Statistical Base Group (SBG)'s note to TPS, "Data Processing Facilities Open to DG II Computer users," 23/07/1981. TPS 290, pp. 305-307.

Item J, T. Padoa-Schioppa to “Tous les fonctionnaires A”, “Méthodes de prévision utilisées à la DG II: suite à donner au rapport établi par MM Steinherr, Colasanti and Jones (Doc. 824219)," 28/06/1981. TPS 290, pp. 476.

Item K, “Note for Mr. T. Padoa-Schioppa. Object: Econometric model building activities of DG II. Present state of affairs; Some propositions for a more efficient approach,” 23/01/1980. TPS 290, pp. 550-556.

Item L, N. Adami, “Programme d’études 1983. Réunion du Groupe présidé par M. Wegner, le 18 janvier 1983," 19/01/1983. TPS 291, pp. 254-256.

Item M, T.P. de Hora to Mr. T. Padoa-Schioppa, "Subject: survey-related research 1983/84 (art. 261 of the 1983 budget),” undated. TPS 291, pp. 278-284 .

Item N, A. Dramais to M. Emerson, “1983 research proposals,” 14/12/1982. TPS 291, pp. 276-277.

Item O, M. Emerson to G. Demopoulos, F. Papadia, A. Steinherr, “Report on Capacity of Economic Analysis (CEA),” 25/02/1982. TPS 291, pp. 425-426.

Item P, G. Demopoulos, F. Papadia, A. Steinherr, “Report on capacity for economic analysis,” 02/1982. TPS 291, pp. 441-465.

Item Q, G. Laina to M. Emerson, “Note a l’attention de monsieur M. Emerson. Object : Bilan d'une année d'exploitation du système EUROLINK et esquisse de perspectives,” 10/03/1981. TPS 291, pp. 5-17.

Item R, A. Dramais to T. Padoa-Schioppa, “Livraison du modèle Comet IV,” 26/10/1982. TPS 291, p. 27.

Item S, P. Toft-Nielsen to Emerson, “The COMET model and some possible outlines for its development until 1983,” EC. X. 1981. TPS 291, pp.18-23.

Item T, Note: “Simulation d’effets de mesures d’aménagement du temps de travail avec le modèle COMET,” 02/04/1981. TPS 291, pp. 24-26.

Item U, "COMET IV. General features by A.P. Barten and G. D’Alcantara,” 26/10/1982. TPS 291, pp. 28-50.

Item V, “Rapport sur la mise en œuvre des etudes et enquetes effectuees en 1979 pour le compte de la DG II." TPS 291, pp.227-240.

Item W, J. Walker to M. Emerson, “Models and forecasting within the Commission,” 20/10/1981. TPS 290, pp. 586-595.

Item X, P. Van den Bempt to T. Padoa-Schioppa, "Collaboration entre les Directions A et C," 27/11/1981. TPS 290, pp. 442-443.

Item Y, T. Padoa-Schioppa to C. Wymer, "Draft of mandate for econometric models," 02/03/1982. TPS 290, pp. 497-499.

Item Z, A. Dramais to M. Emerson, "1983 research proposals," 14/12/1982. TPS 291, pp. 276-277.

Item 1Z, P. Van den Bempt to T. Padoa-Schioppa, "Evaluation du projet de modèle macro-sectoriel; qu'il pose à la DG II," 18/03/1982. TPS 291, pp. 74-86.

Item 2Z, R. Hay to M. Emerson, "Macro-sectorial model," 15/10/1981. TPS 291, pp. 88-97.

Item 3Z, "Note à l'attention de Monsieur P. Fasella. Objet: Projet de modèle macro-sectoriel," 28/19/1982. TPS 291, pp. 98-99.

Published sources

Acosta, J., and Cherrier, B., 2021. The Transformation of Economic Analysis at the Board of Governors of the Federal Reserve System during the 1960s. *Journal of the History of Economic Thought 43*(3), 323-349.

Acosta, J., Cherrier, B., Claveau, F., Fontan, C., Goutsmedt, Sergi, F., 2021. Six Decades of Economic Research at the Bank of England. *Rebuilding Macroeconomics Working Paper Series*, nr. 44.

Acosta, J., E. Pinzón-Fuchs, 2019. Peddling Macroeconometric Modeling and Quantitative Policy Analysis: The Early Years of the SSRC's Committee on Economic Stability, 1959-1963. *Œconomia. History, Methodology, Philosophy* 9(3), 537-558.

Ball, R. J. (Ed.), 1973. *The International Linkage of National Economic Models*, North-Holland, Amsterdam and London.

Barten, A.P., 1971. An Import Allocation Model for the Common Market. *Cahiers Economiques de Bruxelles 50*(3), 153-164.

Barten, A.P., 1981. COMET in a Nutshell. Université Catholique de Louvain, Center for Operations Research and Econometrics (CORE), Working paper, No. 466.

Barten, A.P., 1982. Econometric Model Building for the Common Market. LIDAM Reprints Université Catholique de Louvain, Center for Operations Research and Econometrics (CORE), nr. 485.

Barten, A.P., d'Alcantara, G. and Carrin, G.J., 1976. COMET: A Medium-Term Macroeconomic Model for the European Economic Community. *European Economic Review 7*(1), 63-115.

Bekx, P., Bucher, A., Italianer, A., Mors, M., 1989. The Quest Model (1988 Version). *Economic Papers* 75, 1-99.

Brandsma, A., op de Beke, J., O'Sullivan, L., Roger, W., 1991. Quest. A macroeconomic model for the countries of the European Community as part of the world economy. *Economic Papers* 47, 161- 236.

Brandsma, A., 1994. The QUEST model of the European Economy. In: Ichimura, S., Matsumoto, Y., (Eds.), *Econometric Models of Asian-Pacific Countries.* Springer-Verlag, Berlin, 145-168.

Catinat, M., Cawley, R., Ilzkovitz, F., Italianer, A., Mors, M., 1987. The Determinants of Investment. *European Economy* 31, 5-60.

Catinat, M., Donni, and Italianer, A., 1988: "The completion of the internal market: results of macroeconomic model simulations', *Economic Papers* 92, 1-71.

Coats, A. W. (Ed.), 1996. *The Post-1945 Internationalization of Economics*. Supplement to *History of Political Economy*, 28, Duke University Press, Durham, NC.

Coats, A. W., (ed.). 2000. *The Post-1945 Development of Economics in Western Europe.* Routledge, London.

Commission of the European Communities, 1988. 'The economics of 1992, *European Economy,* 35, 15-219.

Commission of the European Communities, 1990. One market, one money. An evaluation of the potential benefits and costs of forming an economic and monetary union, *European economy*, 44, : 5-347.

Commission of the European Communities, 1993. *HERMES: Harmonised Econometric Research for Modelling Economic Systems*. North Holland, Amsterdam.

Courbis, R., 1981. *Commerce international et modèles multinationaux*. Economica, Paris.

D'Adda, C., De Antoni, E., Gambetta, G., Onofri, P., Stagni, A. 1976. *Il modello econometrico dell'Università di Bologna: struttura e simulazioni*. Società Editrice Il Mulino, Bologna.

d'Alcantara, G., Italianer, A., 1982. European project for a multinational macro sectoral model, MS11. *Commission of the European Communities,* DGXII, Brussels.

De Grauwe, P., Peeters, T. (Eds.), 1983. *Exchange rates in Multicountry Econometric Models*. The Macmillan Press Ltd., London and Basingstoke.

de Menil, G. and Nasse, P., 1977. Metric: Modèle économétrique trimestriel de la conjoncture. Présentation générale. A*nnales de l'INSEE,* 26/27, 11-28.

de Ménil, G., U. Westphal, 1982. The Transmission of International Disturbances: A French-German Cliometric Analysis, 1972-1980. *European Economic Review* 18(1), 41-73.

de Ménil, G., and Westphal, U. 1985. *Stabilization Policy in France and the Federal Republic of Germany*. Elsevier Science Ltd, Amsterdam.

Dramais, A., 1974. DESMOS III. Neuf modèles liés pour l'étude de la diffusion des fluctuations conjoncturelles et des effets des mesures de politique économique entre les pays membres du Marché Commun (1ère partie). *Brussel Economic Review* 64: 473-514.

Dramais, A., 1975a. DESMOS III. Neuf modèles liés pour l'étude de la diffusion des fluctuations conjoncturelles et des effets des mesures de politique économique entre les pays membres du Marché Commun (2ème partie), *Brussels Economic Review* 65: 53-108.

Dramais, A., 1975b. *Desmos*. Editions du Dulbea, Brussels.

Dramais, A., 1986. Compact. A Prototype Macroeconomic Model of the European Community in the World Economy. *European Economy* 27, 111-160.

Düppe, T., 2017. How Modern Economics Learned French: Jacques Drèze and the Foundation of CORE. *The European Journal of the History of Economic Thought* 24(2), 238-2

Emerson, M., 2010. "Histoire interne de la Commission européenne 1973-1986. Entretien avec Michael Emerson par Piers Ludlow". Bruxelles, le 26 juillet 2010. In *The European Commission 1973-1986. Memories of an institution,* Historical Archives of the European Union, European University Institute, Florence, item INT151. Available at https://www.europeenimages.net/docs/ressources/institution/HIST_COMMISS_1973_1986.pdf [retrieved 11/03/2022].

Grinwis, M., Waelbroeck, J., 1971. Model linkage for the international coordination of economic policies. *Recherches Économiques de Louvain - Louvain Economic Review* 37, 139-169.

Goutsmedt, A., Pinzón-Fuchs, E., Renault, M,. and Sergi, F., 2019. Reacting to the Lucas CritiqueThe Keynesians' Replies. *History of Political Economy 51*(3), 535-556.

Goutsmedt, A., Renault, M., and Sergi, F., 2021. European Economics and the Early Years of the International Seminar on Macroeconomics. *Revue d'économie politique 132*(4), 693-722.

Hansen, G., and Westphal, U., 1983. *SISYFO: Ein ökonometrisches Konjunkturmodellfür die Bundesrepublik.* Verlag Haag & Herchen, Frankfurt.

Helliwell, J. H., Padmore, T., 1982. Empirical studies of Macroeconomic Interdependence. NBER Working Paper Series, no. 1021.

HERMES Club, 1990. *Economic Prospects for Europe 1990-1994*. Bureau du Plan, Belgium.

Hickman, B. G., 1969. Linkage of National Econometric Models: 'Project LINK,' Sponsored by the Committee on Economic Stability. *ITEMS* 23(4), 54–56.

Hickman, B. G., Lau L. J., 1973. Elasticities of Substitution and Export Demand in a World Trade Model. *European Economic Review*, 4, 347-380.

Hickman, B. G., 1991. Project LINK and Multi-Country Modelling. In: Bodkin, R. G., Klein, L. R., Marwah, K. (Eds.), *A History of Macroeconometric Model-Building*, 482–506. Edward Elgar, Cheltenham.

Hoare, T. F., 1977. International Economic Interdependence. The Commission of the European Communities' Meteor Model. Directorate General for Economic and Financial Affairs of the EEC Commission., Brussel

Klein, L. R., and Van Peeterssen, A., 1973. Forecasting within Project LINK. In Ball, R. J. (Ed.), *The International Linkage of National Economic Models*, North Holland, Amsterdam, 429–64..

Knight M. D., Wymer, C. 1978. A macroeconomic model of the United Kingdom. *IMF Staff Papers 15*(4), 742-778.

Knoester, A., Kolodziejak, A., 1994. The Need for Economic Policy Coordination Between Europe, Japan, and the United States: Policy Recommendations for the 1990s, *Open Economies Review* 5, 327-346.

Italianer, A., 1983. A production block manual for the industrial branches of the HERMES model, MS17, Commission of the European Communities, DGXII, Brussels.

Italianer, A., 1986. Theory and Practice of International Trade Linkage Models. *Advanced Studies in Theoretical and Applied Econometrics*, 9, Kluwer Academic Publisher, Dordrecht, Boston, Lancaster.

Italianer, A., 1987. Estimation and simulation of international trade linkages in the QUEST model. *European Economy*, 31, 61-130.

James, H., 2012. *Making the European Monetary Union*. Harvard University Press, Cambridge, Mass.

Maes, I., 1996. The Development of Economic Thought at the European Community Institutions. *History of Political Economy* 28 (Supp), 245-276.

Maes, I., 1998. Macroeconomic Thought at the European Commission in the 1970s: The First Decade of the Annual Economic Reports. *Banca Nazionale del Lavoro Quarterly Review* 51(207), 387-412.

Maes, I., 2000. Macroeconomic Thought at the European Commission in the First Half of the 1980s. In Backhouse R. E., Salanti, A. (Eds.), *Macroeconomics and the Real World: Volume 2: Keynesian Economics, Unemployment, and Policy*, Oxford University Press, Oxford, 251–268.

Maes, I., 2006. The Ascent of the European Commission as an Actor in the Monetary Integration Process in the 1960s. *Scottish Journal of Political Economy 53*(2), 222-241.

Maes, I., 2012. Tommaso Padoa-Schioppa and the Origins of the Euro. *National Bank of Belgium Working Paper*, no 222.

Maes, I., Buyst, E., 2005. Migration and Americanization: The Special Case of Belgian economics. *The European Journal of the History of Economic Thought* 12 (1), 73-88.

Marwah, K., and Klein, L.R., 1983. International Capital Flows and Exchange Rates. In Dawson, J. C., *Flow of Funds Analysis: A Handbook for Practitioners*, ME Sharpe, Armonk (NY) and London, 468-485.

Masson, P., Symansky, S., Haas, R. and Dooley, M., 1988. Multimod. A multi-region econometric model. IMF Working Papers, no. 88/23.

Mourlon-Druol, E., 2020. Adjusting an institutional framework to a globalising world: the creation of new institutions in the EEC, 1957-1992. *Journal of Economic Policy Reform 23*(3), 273-289.

Mudge, S. L., 2015. Explaining political tunnel vision: Politics and economics in crisis-ridden Europe, then and now. *European Journal of Sociology/Archives Européennes de Sociologie 56*(1), 63-91.

Pinzón-Fuchs, E., 2019. Lawrence R. Klein and the Making of Large-Scale Macroeconometric Modeling, 1938–55. *History of Political Economy 51*(3), 401-423.

Rancan, A. 2020. On the rationalization of Italian policy making: At the origin of the Bank of Italy first macroeconometric model (1964-1970). *History of Economic Ideas* 28(2), 1-27.

Ranuzzi, P. 1975. EURO: An Econometric Model for the EEC. In: Masera, F., Fazio, A., and Padoa-Schioppa, T. (Eds.), *Econometric Research in Central Banks*, Banca d'Italia, Roma, 173-205.

Ranuzzi, P 1978. "Trade Creation and Substitution Effects of Multilateral Tariff Reductions: The Tokyo Round of Trade Negotiations within the Framework of the General Agreement on Tariffs and Trade (GATT)." *Economia Internazionale* 31 (3/4), 212-233.

Ranuzzi, P., 1981. "The Experience of the EEC Eurolink Project in modelling Bilateral Trade Linkage Equations." *Journal of Policy Modelling* 3(2), 153–173.

Ratto, M., Roeger, W., in 't Veld, J., 2008. QUEST III: An Estimated Open-Economy DSGE Model of the Euro Area with Fiscal and Monetary Policy. *Economic Papers*, nr. 335.

Renault, M., 2021. Theory to the Rescue of Large-scale Models: Edmond Malinvaud's View on the Search for Microfoundations. *History of Political Economy, Forthcoming*.

Rhomberg, R. R. 1973. Towards a General Trade Model. In Ball, R. J. (Ed.), *The International Linkage of National Economic Models*, North Holland, Amsterdam, 9-20.

Roeger, W., in't Veld, J. 1997. QUEST II. A Multi Country Business Cycle and Growth Model. *Economic Papers* 123 (October): 1-51.

Schmidt-Wellenburg, C., 2017. Europeanisation, Stateness, and Professions: What Role Do Economic Expertise and Economic Experts Play in European Political Integration? *European Journal of Cultural and Political Sociology 4*(4), 430-456.

Shepherd, J. R., H. P. Evans, and C. J. Riley. 1975. "The Treasury Short-Term Forecasting Model." In *Modelling the Economy*, edited by G. A. Renton, 38–65. Heinemann Educational Books.

Taplin, G.B., 1967. Models of World Trade. *IMF Staff Papers, 14*(3), 433-455.

Vanoli, A., 2005. *A History of National Accounting.* IOS Press, Amsterdam.

Waelbroeck, J., 1973. The Methodology of Linkage. In: Ball, J. R. (Ed.), *The International Linkage of National Economic Models*, North Holland, Amsterdam, 45–61.

Waelbroeck, J. 1975. A survey of Short Run Model Research outside the United States. Core Discussion Paper no 7309, 1973. Reprinted in Fromm G., and Klein, L.R. (Eds.), *Brookings Model: Perspective and Recent Developments*. North-Holland, Amsterdam, 421-468.

Waelbroeck J. and A. Dramais. (1974). DESMOS: A model for the coordination of economic policies in the EEC countries. In Ando et al. (eds), *International Aspects of Stabilization Policies*, Federal Reserve Bank of Boston, Boston,

Welfe W., 2013. Macroeconometric Multicountry Models. In: Welfe, W. (Ed.), *Macroeconometric Models. Advanced Studies in Theoretical and Applied Econometrics*, Springer, Berlin, 241-273.

Whitley, J.D., 1992. Comparative Simulation Analysis of the European Multi-Country Models. *Journal of Forecasting* 11(5), 423-458.

Appendix - Figures

Figure 1 - The Commission and the DG II

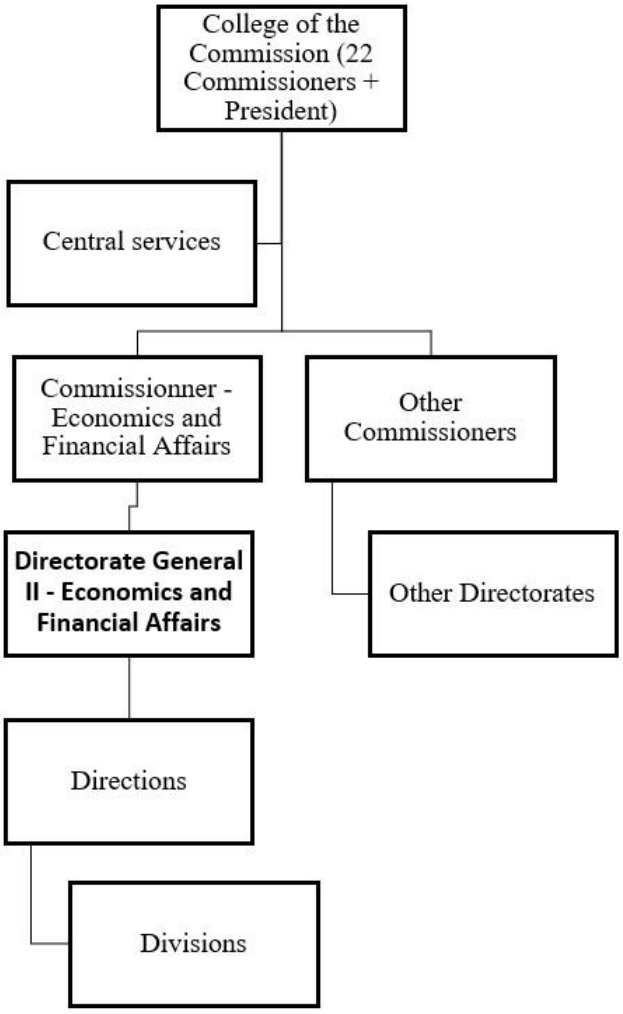

Figure 2 - The DG II before 1980

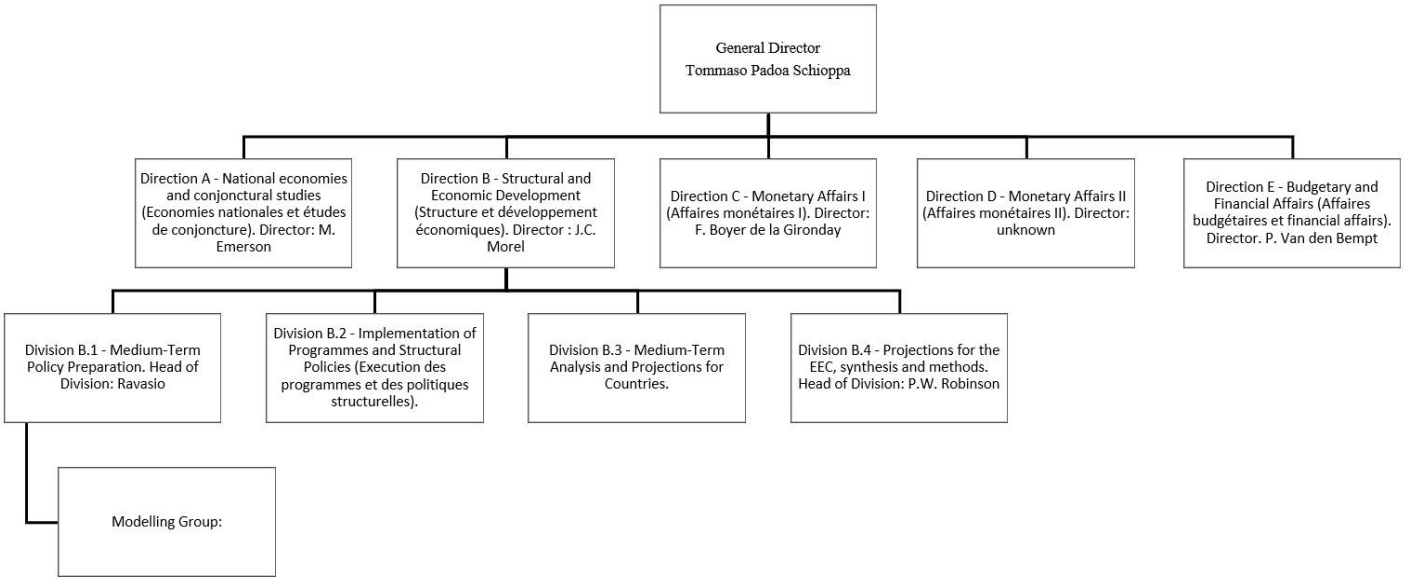

Figure 3 - The DG II after 1980