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AgroParisTech
INSTITUT DES SCIENCES ET INDUSTRIES DU VIVANT ET DE L'ENVIRONNEMENT
PARIS INSTITUTE OF TECHNOLOGY FOR LIFE, FOOD AND ENVIRONMENTAL SCIENCES

Ecole Doctorale ABIES
Agriculture
Agriculture
Alimentation
Food
Biologie
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Doctorat ParisTech

T H È S E

pour obtenir le grade de docteur délivré par

L'Institut des Sciences et Industries du Vivant et de l'Environnement

(AgroParisTech)

Spécialité : Sciences Economiques

Thèse en cotutelle avec l'Università Commerciale Luigi Bocconi

présentée et soutenue publiquement par

Olivier CRESPI REGHIZZI

le 3 Octobre 2014

A long run perspective on urban water and sanitation infrastructure financing: essays in public finance

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"Unlike some economic purists of today, I admit to more than only a scientific motivation ; intelligent and civilized conduct of government and the delineation of its responsibilities are at the heart of the democracy. …Intelligent conduct of government requires an understanding of the economic relations involved; and the economist by aiding in this understanding, may hope to contribute to a better society. This is why the field of public finance has seemed of particular interest to me ; and this is why my interest in the field has been motivated by a search for the good society, no less than by scientific curiosity."

Richard Musgrave,

The Theory of Public Finance: A Study in Public Economy. McGraw-Hill 1959

Note from the author – September 2014

The original PhD thesis which has been defended includes six essays which are presently into the editiorial process for a publication in international journals and forthcoming collective books. Due to copyright reasons the full version of the thesis cannot be released.

This is an abridged version of the thesis for online diffusion. This version does not include the 6 essays in Part II and III. These essays will be available quite soon in the various forthcoming publications (see Appendix 2 for the references). Meanwhile, three working paper versions of the papers are available online at the following links:

http://ideas.repec.org/p/mil/wpdepa/2012-22.html

http://www.certet.unibocconi.it/wps/wcm/connect/cdr/centro_certet/home/working+papers/providing+and+financing+a+municipal+infrastructure

http://ideas.repec.org/p/crc/wpaper/1308.html

Abstract

This PhD research examines the financing history of water and sanitation infrastructure through the lens of public finance theory.

The urban water sector is highly capital intensive. How to finance water infrastructure is a key challenge for policy-makers both in Europe where it is necessary to upgrade an ageing water infrastructure and in developing countries where an expansion of water infrastructure is needed to provide access to water and sanitation services for all.

The core of this thesis is composed of six essays which are currently in the submission process to be published in journals and collective books.

The first three essays analyze how water infrastructure was financed in Paris and Milan during its early expansion phase between the 19th century and the 1920s. The two municipalities used municipal bonds and loans with fixed interest rate and long-term maturities to finance the infrastructure. Initially endogenous revenues (*Tariffs* according to the OECD 3Ts) were not high enough to cover the total costs (including debt service). Some costs were covered by exogenous revenues i.e. from municipal budgets (*Tax* according to the OECD). Indeed, at that time municipalities had a great financial autonomy: municipal budgets were mainly funded through local taxes (local exogenous revenues - *Tax* according to the OECD) and not through annual transfers from the central government (national exogenous revenues - *Transfer* according to the OECD). Only later did endogenous revenues became high enough to fully cover the total costs of the water and sanitation service. Two additional factors made it possible to lower the total costs: the high inflation of the years 1910-1930 which lowered the debt service in real terms and land value capture instruments largely implemented in Paris during Haussmann's urban renovation.

Two other essays examine the development of drinking water and wastewater services in Milan from the second half of the 20th century to present day.

A sixth essay compares the past and present institutional framework of urban water services in France and Italy regarding their legal status tariff regulation and how investments are financed.

In addition to the six essays, the thesis consists of an introduction and a conclusion. The introduction first discusses the key public finance theories in the field of local infrastructure financing. Then it focuses specifically on the water and sanitation sector and it proposes an original matrix of the trade-offs to be made by water and sanitation policy-makers. Among these: compulsory or voluntary membership ? Endogenous or Exogenous revenues? Institutional nature of the collective consumption unit ? fiscal or non-fiscal nature of the endogenous revenues ? Local or national exogenous revenues ? Which level of government is responsible of the infrastructure cycle ? Are there some tools of spatial equalization ?

The conclusion analyzes the long run evolution of Italian and French water and sanitation services using the trade-offs matrix previously developed. A comparative analysis based on existing literature and focused on the early expansion phase in other countries (UK, USA and Germany) is also made. Last but not least, based on the retrospective analysis, the thesis challenges present financing policies for the water sector both in Europe and in developing countries.

Résumé

Une analyse de long terme du financement des infrastructures urbaines d'eau potable et d'assainissement : essais en économie publique.

Cette thèse analyse l'histoire du financement des infrastructures urbaines d'eau et d'assainissement en France et en Italie à travers le prisme de lecture de l'économie publique.

Le secteur de l'eau en milieu urbain est hautement capitalistique et exige des infrastructures coûteuses et à très longue durée de vie. Financer ces infrastructures est un défi pour les décideurs publics, tant en Europe (où il est nécessaire de renouveler des infrastructures vieillissantes) que dans les pays en développement où l'expansion des infrastructures est nécessaire pour permettre l'accès à l'eau et à l'assainissement pour tous.

La thèse se compose de six essais indépendants qui ont été présentés à des conférences et des séminaires, puis envoyés à des revues et à des éditeurs internationaux en vue d'une publication.

Les trois premiers essais fournissent une analyse détaillée des modalités de financement des infrastructures d'eau et d'assainissement réalisées à Paris et Milan entre le 19ème siècle et les années 1920. Les infrastructures ont été financées par les deux municipalités grâce à des prêts et à des obligations municipales à taux fixe et à longue durée de remboursement. Dans un premier temps, les revenus endogènes (Tarifs selon l'OCDE) n'étaient pas suffisants pour couvrir les coûts totaux (y compris le remboursement de la dette) qui ont été partiellement couverts par des revenus exogènes c'est-à-dire par le budget municipal général (Taxes selon l'OCDE). Les municipalités avaient, en effet à l'époque, une grande autonomie financière : leurs revenus reposaient principalement sur de la taxation locale (Taxes selon l'OCDE) ; elles ne recevaient pas de subventions récurrentes de la part de l'Etat Central (Transferts selon l'OCDE). Dans un deuxième temps, les revenus endogènes étaient suffisamment élevés pour couvrir, à eux seuls, les coûts internes totaux du service public d'eau et d'assainissement. Deux autres facteurs ont permis d'absorber et de réduire une partie des coûts totaux: il s'agit de la forte inflation des années 1910-1930 et des instruments de captation de la plus-value foncière qui ont étés utilisés à Paris lors des rénovations urbaines Haussmaniennes.

Les essais quatre et cinq étendent l'analyse du service public d'eau et d'assainissement de Milan respectivement à la deuxième moitié du 20e siècle, et au temps présent. Un sixième essai compare les régimes institutionnels et les trajectoires passées et présentes des services urbains de l'eau en France et en Italie sur les thèmes du statut juridique, de la règlementation tarifaire et du financement des investissements.

En plus des six essais, la thèse comprend deux grandes parties introductive et conclusive. L'introduction discute d'abord les principales théories de l'économie publique applicable au financement des infrastructures publiques locales. Elle se concentre ensuite sur le secteur de l'eau et propose une matrice des choix à faire par les décideurs. Parmi ceux-ci: adhésion volontaire ou obligatoire? Coûts couverts par des revenus endogènes ou exogènes ? Nature fiscale ou non fiscale des revenus endogènes? Origine locale ou nationale des revenus exogènes? Statut juridique de l'entité en charge du service? Partage des responsabilités entre les autorités locales et le gouvernement central?

La conclusion reprend certains résultats issus des 6 essais et analyse l'évolution du secteur de l'eau en France et en Italie, à la lumière de la matrice des choix définie auparavant. Une analyse comparative du financement des infrastructures urbaines d'eau et d'assainissement dans la phase d'expansion initiale au sein d'autres pays (Royaume-Uni, Etats-Unis, Allemagne) a également été réalisée sur la base de la littérature existante.

Enfin, l'analyse historique réalisée fournit quelques éléments de réflexion qui visent à questionner et améliorer les politiques publiques d'aujourd'hui en Europe et dans les pays en développement.

Riassunto

Un'analisi sul lungo periodo del finanziamento dell'infrastruttura idrica urbana : saggi in scienza delle finanze

La presente ricerca fornisce un'analisi della storia del finanziamento dell'infrastruttura idrica urbana in Francia e in Italia attraverso il prisma di lettura della scienza delle finanze.

Il settore idrico urbano è caratterizzato da una forte intensità di capitale. Finanziare le infrastrutture idriche rappresenta una sfida per il decisore pubblico sia in Europa (dove è necessario rinnovare le infrastrutture idriche realizzate in passato) che nei paesi in via di sviluppo dove l'espansione delle infrastrutture idriche è necessaria per fornire l'accesso al servizio acqua potabile e acque reflue a tutta la popolazione. La tesi analizza le modalità di finanziamento delle infrastrutture idriche nel passato non solo in un ottica di storia economica ma anche per fornire elementi utili per l'elaborazione delle politiche pubbliche del presente e del futuro.

La tesi è costituita da sei saggi indipendenti che sono stati presentati in conferenze e workshop e poi inviati a riviste e editori internazionali in vista di una publicazione.

I primi tre saggi forniscono un'analisi dettagliata delle modalità di finanziamento dell'infrastruttura idrica realizzata a Parigi e Milano tra il 19esimo secolo e gli anni 1920. Le infrastrutture sono state finanziate dalle due municipalità tramite obligazioni e prestiti a tasso fisso e a lungo termine. In un primo tempo i redditi da fonti endogene (Tariff secondo l'OCSE) non permettevano di coprire i costi totali (incluso i rimborso del debito) che erano in parte coperti da fonti esogene ossia dai bilanci comunali (Tax secondo l'OCSE). In effetti all'epoca i comuni avevano una grande autonomia finanziaria : i loro redditi provvenivano principalmente da tasse locali (Tax secondo l'OCSE) e non ricevevano trasferimenti annuali da parte dello stato centrale (Transfer secondo l'OCSE). Solo in una seconda fase i redditi endogeni divennero sufficientemente alti da coprire interamente i costi totali del servizio acque potabili e acque reflue. Due fattori aggiuntivi permisero di assorbire e diminuire una parte dei costi totali : l'alta inflazione degli anni 1910-1930 e gli strumenti di land value capture usati a Parigi durante le operazioni urbane di Haussmann.

Altri due saggi estendono l'analisi del servizio acqua potabile e acque reflue di Milano rispettivamente alla seconda metà del 20esimo secolo e al tempo presente. Un sesto saggio confronta l'assetto istitutionale presente e le traiettorie passate dei servizi idrici urbani in Francia e in Italia per quanto riguarda la forma giuridica, la regolazione tariffaria e le modalità di finanziamento degli investimenti.

In aggiunta ai sei saggi, la tesi è composta da due ampie parti di introduzione e conclusione. La parte introduttiva discute le principali teorie di scienza delle finanze in materia di finanziamento delle infrastrutture publiche locali prima di focalizzarsi nello specifico sul settore idrico e fognatura e proporre una matrice di analisi dei principali trade-offs a cui il decisore pubblico deve rispondere. Tra questi citiamo : adesione obbligatoria o volontaria ? costi coperti da redditi endogeni o esogeni ? natura fiscale o non fiscale dei redditi endogeni ? origine locale o nazionale dei redditi esogeni ? forma giuridica dell'ente gestore del servizio ? ripartizione delle responsabilità tra enti locali e governo centrale ?

La parte conclusiva riprende quanto dimostrato nei 6 saggi e analizza il finanziamento delle infrastrutture idriche urbane in Francia e in Italia alla luce della matrice dei trade-offs elaborata nella parte introduttiva. Basandosi sulla letteratura esistente si realizza un'analisi comparativa del finanziamento delle infrastrutture idriche urbane nella fase di espansione iniziale in altri paesi (Regno Unito, Stati Uniti, Germania).

Infine basandosi sull'analisi storica realizzata si forniscono spunti di riflessione per ripensare le politiche publiche odierne in Europa e nei paesi in via di sviluppo.

Preface

Infrastructure, Water, Public Finance and History. These four keywords summarize my PhD thesis. These four keywords evoke some key personal experiences and choices that made me so passionate about these issues. This passion is why I was very happy to devote three years of my life to this subject.

Infrastructure

Just after finishing High School, in 2002, I spent two weeks in Bosnia as a member of a group of young Italian volunteers. The scars of the recent war were still largely visible both in Sarajevo and in the rural village where we spent some days helping people rebuild their houses which had been destroyed. Of course the efforts of nineteen year old boys and girls were more a symbol than a significant help in Bosnia's reconstruction.

I had left Italy with the naïve idea of helping to rebuild Bosnia, but I came back with the feeling that I had received much more than the two bricks that I helped to move. I returned more mature with an awareness of how much a war can negatively affect a country, particularly in terms of infrastructure endowment. This may be why, after my experience in Bosnia, I chose undergraduate studies in Civil Engineering at *Politecnico di Milano*.

Water

My interest in water dates from my last year in High School when I decided to choose "water" as the interdisciplinary research topic to present at the *maturità* (Italian High School final exam).

A few years later, in 2005, a short internship at the EU delegation in Mauritania made me aware of the key importance of water in such an arid country. Back in Europe, I chose the hydraulics branch within the MSc in Civil Engineering and pursued two internships in hydraulics engineering and hydrology consultancies and research centres.

Between 2009 and 2011, water also brought me to Senegal where I spent more than two years working on infrastructure projects financed by the *Agence Française de Développement* (AFD).

Public Finance

As an AFD officer in Senegal, I had the perfect standpoint for observing the infrastructure challenges faced by a developing country and its financing needs. However, as a freshly graduated engineer, I became frustrated with not having a thorough enough background in economics and finance to fully understand what was going on.

This made me increasingly thirsty to deepen my knowledge in economics and public policies related to infrastructure and public services. This thirst led me a few years later to choose to analyze water and sanitation services through a public finance theory lens in my PhD thesis.

History

In Dakar, I was staying in a building up to European standards with water and electricity available 24 hours a day thanks to a large water tank on the rooftop and to an independent power generator. At the same time, most of the Senegalese households in Dakar were facing the real life challenges of a discontinuous electricity[1] supply even if they were paying water and electricity at relatively high rates. Additionally, in most sectors, the country had huge infrastructure gaps and no easy solution for the short or medium term.

I was puzzled. While I was living in Senegal, from time to time I would travel back to Europe for vacations. Each time I would realize how good our network infrastructure and public services are. Progressively, I became curious to understand what public policies around water services in Europe have rendered it possible to have "the best water and sanitation services in the world[2]"

Thanks to Bernard Barraqué, I was able to formulate a research project on how European municipalities managed to finance their water and sanitation in the expansion phase of modern water and sanitation services which started in the 19th century. *Eau de*

[1] At that time water shortages were not present in Dakar. Critical water shortages happened in September 2013 in Dakar.

[2] *On peut considérer que l'Europe a en moyenne les meilleurs services publics d'eau et d'assainissement* […], Barraqué and Isnard on ParisTechReview, http://www.paristechreview.com/2012/10/23/eaux-urbaines-ingenierie/ retrieved online on April 7th 2014

Paris, the *Association Nationale de Recherche en Technologie* and the *Agence Nationale de la Recherche* were kind enough to fund such a research project.

This research question made it possible to focus my research efforts both on European Water and Sanitation policies and on the urban infrastructure challenge in rapidly developing cities like Milan and Paris were more than a century ago.

The present situation of many cities in the global south has many similarities with the past experiences of European cities. Looking into history can inform and give more depth to the present policy debate in developing countries.

Remerciements

C’est en écrivant ces remerciements que je me rends réellement compte du nombre de personnes qui m’ont aidé et sans qui cette expérience de thèse n’aurait pas été aussi formidable et enrichissante qu’elle l’a été. C’est impressionnant.

Tout d’abord, je tiens à remercier particulièrement Bernard Barraqué sans qui cette thèse n’aurait même pas vu le jour. En effet, je vivais encore à Dakar il y a 4 ans lorsque j’ai commencé à chercher un projet de thèse dans lequel m’investir à mon retour en Europe. Heureusement, Bernard Barraqué a su me faire confiance et, sans trop me connaître, m’a fortement aidé à monter ce projet de thèse. Merci de tout cœur pour l’encadrement et les riches échanges lors de ces trois belles années.

Ce travail n’aurait pas été possible sans le soutien financier d’**Eau de Paris**, de **l’Association Nationale pour la Recherche en Technologie**, à travers le dispositif CIFRE, et de **l’Agence Nationale de la Recherche**, à travers le projet de recherche **EAU & 3E** sur la durabilité des services d’eau dans les grandes villes. Je remercie ces trois institutions pour m’avoir permis de réaliser ce travail de recherche dans de très bonnes conditions. Je remercie particulièrement Hortense Bret, ma directrice à Eau de Paris, qui m’a permis de tirer le meilleur parti de ma double casquette de doctorant à AgroParisTech et d’ingénieur à Eau de Paris.

Ce projet de recherche s’est déroulé dans le cadre d’une cotutelle internationale de thèse entre AgroParisTech et l’Università Commerciale Luigi Bocconi. Je remercie Lanfranco Senn d’avoir rendu possible cette cotutelle, d’avoir co-dirigé cette thèse et de m’avoir si bien accueilli au sein du Centro di Economia Regionale dei Trasporti e del Turismo (CERTET) lors de mes passages à Milan.

Mes remerciements vont également aux membres du jury ainsi qu’aux membres du comité de pilotage de cette thèse pour leur disponibilité : Aymeric Blanc, Guillem Canneva, Kostantinos Chatzis, Christophe Defeuilley, Gabriel Dupuy, Hugh Goldsmith, Antonio Massarutto, Claude Menard, Caty Werey.

Je remercie tous les membres du projet de recherche EAU&3E : cela a été un réel plaisir de travailler ensemble. Merci aussi aux chercheurs du projet de recherche EIBURS (The History of European Infrastructure Finance) qui m’ont accueilli parmi eux et, en

particulier, à Damir Agic, Giuseppe de Luca, Massimo Florio, Hugh, Goldsmith, Nico Grove, Marcella Lorenzini, Arnold Picot et Bjoern Wuendsch.

Je remercie les participants aux différents colloques auxquels j'ai présenté mes travaux pour leur retour précieux. Je remercie en particulier les participants aux éditions 2012 et 2013 du Milan European Economy Workshop ; Denis Bocquet, Danny Fougères et les autres participants à la World Water History Conference de Juin 2013 à Montpellier ; Stefano Clo' et tous les participants à la session 2013 du CESIFO Venice Summer Institute, François Bourguignon et les autres participants à la session « histoire économique » du congrès 2013 de l'Association Française de Sciences Economiques à Aix-en-Provence, Martina Rama et tous les autres participants aux journées d'échange et de sensibilisation sur la solidarité internationale organisées par Ingénieur Sans Frontières à Orléans en Février 2014. Je suis également gré à tous les étudiants du Mastère Spécialisé Gestion de l'Eau d'AgroParisTech et du Master EMIN et ETT de l'Université Paris Sud d'avoir aimablement subi la présentation de certaines parties de ma thèse.

Construire un projet de thèse est une entreprise en soi, bien avant qu'elle commence. On a vite fait de se décourager. Je remercie les nombreuses personnes qui m'ont aidé à mûrir la construction de mon projet de recherche et à ne pas en démordre : en premier lieu mes anciens collègues à l'AFD : Mathieu Bommier, Denis Castaing, Bertrand Clochard et Lionel Goujon ; mais aussi de nombreux chercheurs : Gabrielle Bouleau, Guillem Canneva, Laetitia Guérin-Schneider, Silvy Jaglin, Yann Laurans, Stéphane Straub, Sebastien Treyer et bien d'autres personnes qui m'ont dédié un peu de leur temps.

Enormément de personnes m'ont consacré du temps et m'ont donné de précieux conseils tout au long de ces trois années. Je les remercie toutes très chaleureusement, en incluant celles et ceux que j'aurais oublié de citer par mégarde : Giorgio Bigatti, Marine Colon, Olivier Jaques, Simon Godefroy, Martin Lemenager, Andrea Mangano, Cedric Prevedello, Carine Staropoli et Sophie Tremolet, Michelle Tavernier; Caty Werey, Jacques Tcheng et les autres participants aux groupe de réflexion « Gestion Patrimoniale et immobilisations » de l'ASTEE ; Charlotte Ginsburger et Regis Taisne pour la FNCCR ; Elisa Vanin, Daniele Russolillo Franco Bechis pour la Turin School of

Local Regulation ; Sébastien Guenegou et Clémence Penin pour Finance Consult ; Florestan Groult et tous les autres participants au Groupe Thématique Eau d'Ingénieurs Sans Frontières.

J'adresse une grande reconnaissance à toutes les personnes qui m'ont accordé un peu de leur temps pour un ou plusieurs entretiens. Je remercie également toutes les personnes qui m'ont aidé dans mes recherches bibliographiques et dans l'accès à mes sources écrites: en premier lieu Patricia Jeannes au service documentation de l'ENGREF mais aussi le personnel de la Bibliothèque de l'Hôtel de Ville de Paris, de l'Archivio Storico Civico (Biblioteca Trivulziana) et de la Ragioneria Comunale à la municipalité de Milan.

Merci aussi à mon amie américaine de Dakar Jennifer Browning qui a accepté de relire patiemment certaines parties de mon manuscrit. Les corrections de certaines expressions en anglais étaient si minutieuses que j'ai parfois regretté d'avoir eu une relectrice aussi rigoureuse! Peut-être le lecteur devinera-t-il quelles parties ont été patiemment relues ?

Ce travail s'est déroulé au sein de trois bureaux différents avec trois groupes de collègues formidables dont la compagnie a rendu ces trois années si sympathiques!

Si l'ENGREF à Paris a été un endroit si agréable pour travailler, c'est surtout grâce aux doctorants et assimilés avec qui j'ai partagé mon bureau, les mots du jour, des discussions épiques et plusieurs soirées mémorables. Je tiens à tous les remercier pour les belles amitiés qui ont su se créer : Benoît, Clément, Emmanuel, Laure, Karine, Julien, Pauline, Suzanne et tous les autres qui nous ont rejoint pour quelques temps (Adrien, Chloé, Diane, Thélème). Il y a aussi beaucoup d'autres personnes que je remercie à l'ENGREF pour leur aide précieuse et pour les bons moments passés ensemble: Monsieur Breger, Aline Cattan, Samuel Courjol, Emmanuel Grossetete, Chinh Hoang, Paola Pentier.

J'ai énormément apprécié de travailler au sein d'Eau de Paris d'abord à l'Agence de Maîtrise d'Ouvrage et Patrimoine, puis ensuite à la Direction de l'Ingénierie et du Patrimoine. Je remercie tous les participants du groupe de travail sur la gestion patrimoniale des réseaux pour la richesse des réflexions réalisées ensemble. Un merci également à Clara Dallon, Antoine Guillier, Pierre Mahieu, Olivier Massias, Catherine Pankowska et Vicky Retuerto avec qui j'ai beaucoup apprécié de travailler. Merci

également à tous les collègues avec qui j'ai partagé un bureau à Eau de Paris. Si mon intégration initiale à Eau de Paris a été si facile, c'est grâce à la gentillesse et à la cordialité de tous mes collègues à l'AMOAP. Cela a été en particulier un plaisir de cuisiner ensemble et partager des repas en toute convivialité lorsque nous étions encore dans les murs de Wallace. Cela c'est poursuivi lors de nos moments de pause à Module 19.

Enfin, mes séjours de travail à l'université Bocconi à Milan n'auraient pas été si agréables sans la gentillesse et la cordialité de Paola Calogero, Alessandro de Carli, Laura Montanari, Federico Pontoni et de tous les autres membres du CERTET.

Enfin, un dernier remerciement spécial va à toutes les personnes qui, d'une façon ou d'une autre, m'ont aidé à réaliser et à porter à terme cette thèse en cotutelle au sein des deux écoles doctorales et des deux centres de recherche : Barbara Contaldo, Claudio Dordi, Paola Mascia, Mario Molignoni et Gualtiero Valsecchi à Milan ; Corinne Fiers et Irina Vassileva à Paris, Naceur Chabane et Eléonore Tyma au CIRED.

Key terms and acronyms

In the table here below we make a list of the most important terms and acronyms developed in Part I. For each term the table gives the acronym and the paragraphs in which the term is detailed. When multiple terms with the same meaning do exist they are also listed in the table.

Key term	Acronym	Other similar term	§
Ability-to-pay approach			2.2.2
Allocation Branch		Government intervention in the case of market failure	2.1
Autonomy			4.3
Benefit approach			2.2.1
Capital expenditures	CAPEX		
Club-finance		Endogenous revenues Toll-finance Tariff	2.6 2.9.2 2.10 5.1.5
Collective Consumption Unit	CCU		2.5 4.6
Club good & common pool resources			2.4
Comité National de l'eau	CNE	National Water Comittee	
Decentralization principle			4.2
Delegated model	DM	Affermage Lease contract	 Box 1
Direct Public Management	DPM	Public provision and production	 Box 1
Equalization			4.4 4.7
Financial Economies of Scale			5.2
Fiscal equivalence principle			2.10
Full Cost Recovery	FCR		5.1
Generations			3.1
Key Trade Offs Matrix			5.3
Local Government Unit	LGU		4
Local Public Good	LPG		4.2
Membership & exclusion			2.6
Merit good		Merit wants	2.3
Millenium Development Goal	MDG		1.1.1
Natural Monopoly			2.9
Organisation for Economic Cooperation and Development	OECD		
Operational Expenditures	OPEX		
Pay-as-you-use finance		Repayable finance Loan-finance Debt-finance	3.3
Producing Unit	PU		2.5
Production of public services			2.8
Provision of public services			2.8
Public good		Social wants	2.4, 2.3

Ramsey Price	RP	Average Cost Pricing	2.9.1
Regulated Monopoly	RM	Concession	Box 1
Run-of-river-finance			3.2
Sustainable Cost Recovery	SCR		5.1.4
Tariff, Taxes, Transfers	3T's		5.1.4
Tax-finance		Exogenous revenues, Taxes (Local Exogenous Revenues) Transfers (National Exogenous Revenues)	2.6 2.9.2 2.10 5.1.5
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Part I. Introduction

1 A thesis built on three pillars

The core of this thesis is composed of six essays which are inserted in Part II and Part III. The six essays are currently in the submission process to be published in journals and collective books (see Appendix 2). In addition to the six essays, this thesis is composed of an introductive part (Part I here below) and a conclusive part (Part IV).

This thesis is built on three pillars: from a **disciplinary** point of view it is deeply rooted in **public finance**, it focuses on the **water and sanitation sector** and from a **methodological** point of view it is based on the use of a **long run perspective**. Part I focuses on those three pillars and in particular on an in-depth discussion of some key aspects of the public finance theory.

In this Section we start by discussing in the next paragraph why financing the infrastructure is so relevant for the water and sanitation sector (§1.1). Afterwards we review the literature on the historical approach (§1.2) and we detail our own research approach (§1.3).

In Section 2 we review some public finance theory with a specific focus on the membership rules and financing mechanisms which apply to public goods and club goods. Land value capture tools are also analysed.

Section 3 focuses on the use of repayable finance to finance infrastructure.

Water and sanitation infrastructure is most of the time a local issue: that is why Section 4 gives some details on local public finance.

We chose to keep the literature and theoretical discussions in Sections 2, 3 and 4 as general as possible on infrastructure without limiting its relevance to the water and sanitation sector. On the contrary, in Section 5 we specifically focus on the water and sanitation sector. Using the theory developed in Sections 2, 3 and 4 we build a trade-offs matrix for the water and sanitation sector (§5.3).

1.1 Urban water and sanitation infrastructure : relevance of the issues

1.1.1 Expanding the infrastructure in developing countries

Access to clean water and sanitation is a key factor of development as it implies many positive externalities on the community (eg. epidemics control and mortality reduction). Improved access to water and sanitation is still a key issue for many developing countries (DCs) and has been included as one of the millennium development goals (MDGs) targets.

While on a global scale the 2015 MDGs[3] water access target has been already met in 2010 (UN 2013), international institutions estimate that 768 million[4] people still lack of access to an uncontaminated water distribution point. If one adds additional criteria such as enhanced drinkability standards and continuity of supply, the estimation jumps to 2 billion people in the world not meeting the criteria.

On the sanitation side of the equation, the situation is worse as access to improved sanitation is still far behind the 2015 global targets[5]. More than 2.5 billion people in the world still lack of access to an improved sanitation.

These average estimations at global scale hide huge disparities among countries and among regions. Think for example of Sub-Saharan Africa where only 63 % and 30% of the people respectively have access to clean water and improved sanitation[6].

In terms of static equilibrium the water and sanitation infrastructure gap is particularly striking in rural areas while urban areas are better endowed. This is however not true if one thinks in terms of dynamic equilibrium as in many regions of the world a fast and furious migration process is taking place from rural to urban areas. As pointed out by the OECD general secretary “With urbanisation outpacing connections to water, there are now more city dwellers without water access than in 1990”(Gurria 2012). Under a huge demographic pressure many cities in the developing world are turning into megalopolis with vast peri-urban areas. Developing the water and sanitation

[3] Millenium Development Goals
[4] Figures from the *Agence Française de Développement* water and sanitation strategy (AFD 2014, 1)
[5] 77% of the people having access to an improved sanitation
[6](AFD 2014, 20)

infrastructure at the fast rhythm imposed by rural migration and demographic growth is a key challenge which implies large financing needs.

1.1.2 Reproducing a mature infrastructure in Europe

Sufficient and sustainable financing for water infrastructure is a crucial factor not only in developing countries where modern water services are still in an expansion phase but also in Europe where they are now a "mature industry with an increasing need to reproduce the (huge) infrastructure capital which was set up over decades"(Barraqué 2009).

Such a fact had been pointed out by the OECD general secretary at the Marseille World Water Forum :

> "In fact, OECD economies face huge costs to replace and modernise ageing water infrastructure, and to upgrade systems to meet stricter quality standards. The global capital costs of maintaining and developing water and sanitation infrastructure in OECD countries, together with Brazil, China, India and Russia, could amount to between 0.35 and 1.2% of their GDP. This corresponds to total projected annual needs of nearly 800 billion dollars by 2015, up from a current estimated expenditure on water infrastructure of close to 580 billion dollars annually."(Gurria 2012)

In France a report focused on the financing and on the sustainability has been published by the National Water Comittee (*Comité National de l'eau*) in February 2013 (CNE 2013). Based on an Ernst & Young study, it estimates the financing required to reproduce the French water and sanitation infrastructure between 5.4 and 9.7 billion euros per year (CNE 2013, 47).

These kinds of figures at a national or at a global scale are only imprecise estimations full of uncertainties. Nevertheless, the financing need is real and takes place in a context where sold water volumes are decreasing and the full cost recovery principle has rigidified the system.

Indeed, the sustainability of water services in Europe is presently challenged by two contradictory changes. On one hand, compliance with stricter sanitary and environmental standards and networks renewal's burden induce an increase in water

costs. On the other hand water consumption is decreasing in many large cities such as Paris (Barraqué et al. 2011; Souriau 2011) and Milan (Crespi Reghizzi forthcoming e). Water industry is characterised by costs which are mainly fixed while income is mainly proportional to sold volumes. The economic, social and environmental sustainability (as defined by Correia 2001; Barraqué 2003a; Barraqué 2005; Lejars and Canneva 2009) of water industry is thus challenged. This is the field of research of the EAU&3E project which seeks to analyze this major sustainability challenge (http://eau3e.hypotheses.org/) from various points of view (environmental, social, economic, governance).

1.2 History and long run perspective

We have shown that financing needs for water and sanitation infrastructure are huge both in developing countries and in the western world. How to finance them is an open question on which a rich policy debate is going on (refer to Section 5).

For example, the water financing issue was at the core of the 2012 World Water Forum in Marseille within the "Condition for Success 2 - Financing water for all*"* theme. In those sessions many speakers made references to what were the financing solutions adopted in the past stating that "looking back at how water investments have been financed in the past can give us clues as to which solutions could be defined in the future" (Tremolet 2012a). From the beginning, how to finance infrastructure has constantly been a major concern, not always easy to solve. To what extent can we look into the past to enlighten the present policy debate?

That brings us to the wide debate on whether history can be used to enlighten the present policies. Additionally, what are the interlinks between history, economics and other social sciences? How can each discipline dialogue with the others in interdisciplinary approaches? This is a rich controversy on which much has been written by historians, economists and other social scientists. We do not have the ambition to enter into such a debate but we wish to discuss the ideas of some authors that helped us to define our approach.

1.2.1 History and the present

In 1958 Fernand Braudel pointed out already to « the utility of history within the debate which takes place among all human sciences". He stressed the importance of the "time

dialectics" (*la dialectique de la durée*[7]) and of the long run (*la longue durée*[8]) as considered and used by historians:

> « Raison de plus pour signaler avec force dans le débat qui s'instaure entre toutes les sciences de l'homme, l'importance, l'utilité de l'histoire, ou plutôt de la dialectique de la durée, telle qu'elle se dégage du métier, de l'observation répétée de l'historien ; rien n'étant plus important, d'après nous, au centre de la réalité sociale, que cette opposition vive, intime, répétée indéfiniment, entre l'instant et le temps lent à s'écouler. Qu'il s'agisse du passé ou de l'actualité, une conscience nette de cette pluralité du temps social est indispensable à une méthodologie commune des sciences de l'homme » (Braudel 1987, 10).

In his paper, Braudel strongly argued in favour of interdisciplinarity between history and other social sciences :

> « Aussi bien, n'imaginons pas entre l'historien et l'observateur des sciences sociales les barrières et différences d'hier. Toutes les sciences de l'homme, y compris l'histoire, sont contaminées les unes par les autres. Elles parlent le même langage ou peuvent le parler » (Braudel 1987, 18).

However Braudel was conscious that the dialogue between history and the other social sciences is not so easy as these tend to discard historical approaches: « il faut bien convenir que les sciences sociales, par goût, par instinct profond, peut-être par formation, tendent toujours à écarter l'explication historique » (Braudel 1987, 19). The long run (*la longue durée)* was considered by Braudel as a one of the possible common languages between all social sciences[9].

Another possible common language is the "change of scene" (*le dépaysement*) which provokes amazement and surprise which are powerful tools of analysis (Braudel 1987, 21 quoting; Ariès 1954, 298). The change of scene may be provoked by travel either around space or through time[10] : it is the essence of comparative and historical analysis

[7] This is the title of a 1950 book by Gaston Bachelard

[8] Franck Scherrer thesis adopts the *longue durée* concept to analyze the sewer system in Lyon (Scherrer 1992).

[9] « *Ce que je voudrais souligner aussi pour conclure, c'est que la longue durée n'est qu'une des possibilités de langage commun en vue d'une confrontation des sciences sociales* » (Braudel 1987, 36)

[10] « *Philippe Ariès a insisté sur l'importance du dépaysement, de la surprise dans l'explication historique: vous butez, au XVIe siècle, sur une étrangeté, étrangeté pour vous, homme du XXe. Pourquoi cette*

respectively. Our research applies both approaches since it focuses on two countries and on the long run.

Braudel argued that the relationship between history and the other social sciences is not an adverse but rather a complementary one, where "past and present enlighten each other of their mutual light":

> « Historiens et *social scientists* pourraient donc éternellement se renvoyer la balle sur le document mort et le témoignage trop vivant, le passé lointain, l'actualité trop proche. Je ne crois pas ce problème essentiel. Présent et passé s'éclairent de leur lumière réciproque » (Braudel 1987, 21).

Lucien Febvre wrote "history, science of the past, science of the present[11]" and inspired Braudel who considered history as being able to explain our society in its present reality:

> « L'histoire, dialectique de la durée, n'est-elle pas à sa façon explication du social dans toute sa réalité ? et donc de l'actuel ? »(Braudel 1987, 24)

According to Braudel, "history is the sum of all the possible stories and based on a wide collection of skills and points of view of yesterday, of today and of tomorrow"[12](Braudel 1987, 18).

Economics and History

In a famous 1924 essay on Alfred Marshall's life John Maynard Keynes stated that

> "[…] the master-economist must possess a rare combination of gifts. […]. He must be mathematician, historian, statesman, philosopher—in some degree. […]He must study the present in the light of the past for the purposes of the future." (Keynes 1924, 322)

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différence ? Le problème est posé. Mais je dirai que la surprise, le dépaysement, l'éloignement — ces grands moyens de connaissance — ne sont pas moins nécessaires pour comprendre ce qui vous entoure, et de si près que vous ne le voyez plus avec netteté. Vivez à Londres une année, et vous connaîtrez fort mal l'Angleterre. Mais, par comparaison à la lumière de vos étonnements, vous aurez brusquement compris quelques-uns des traits les plus profonde et originaux de la France, ceux que vous ne connaissiez pas à force de les connaître. Face à l'actuel, le passé, lui aussi, est dépaysement. » (Braudel 1987, 21)

[11] « *Histoire science du passé, science du présent* »(Lucien Febvre quoted by Braudel 1987, 24).

[12]Author's translation. « *Pour moi, l'histoire est la somme de toutes les histoires possibles, — une collection de métiers et de points de vue, d'hier, d'aujourd'hui et de demain* » (Braudel 1987, 18).

In more recent times, Harold James[13] discussed some other interesting views on the interplay between economic history and present policy issues in the context of financial crisis (James 2012). From his point of view history can achieve three goals:

1. Firstly "history can be a source of policy advice. It can instil a sense of the predictability of policy outcomes, and also justify a particular policy approach."(James 2012, 1021)
2. "Secondly, there is history as a source of patterns […]. History would be a way of making for a better knowability of outcomes."(James 2012, 1022).
3. "Thirdly, history shows us something about the multiple possibilities of any given moment. In technical language, it constantly tells us multiple equilibria stories."(James 2012, 1025)

And to sum up, "the best way of thinking about history is as a way of testing conventional hypotheses"(James 2012, 1025)

1.2.2 Social scientists and policy analysts looking into the past

Not only long run history can contribute to present policies but also researchers concerned with present-time issues might look into the past. Indeed there are many social scientists (economists, sociologists, urbanists…) concerned with present policy issues which adopt retrospective long run analyses to look into the past.

This was for example the approach followed by the members[14] of the *Groupe Réseaux* (an interdisciplinary research group composed of urbanists, geographers and other social scientists) founded in Paris[15] in the 1980's and at the origin of the *Cahiers du groupe Réseaux* which in 1989 became the journal *Flux*. Gabriel Dupuy and the *Groupe Réseaux* were in contact with the works of Joel Tarr who is an historian "particularly interested in using history to understand contemporary problems[16]". In 1985 he produced a paper with the purpose of using "the history of government intervention in the provision of water, electricity, and cable television to gain greater insight into the

[13] Harold James is professor of economic history at Princeton university
[14] Among which Bernard Barraqué, Gabriel Dupuy, Kostantinos Chatzis et Franck Scherrer
[15] Many members were professors and researchers at the *Institut d'urbanisme de Paris* and at the *Ecole Nationale des Ponts et Chaussées.*
[16] http://www.history.cmu.edu/faculty/tarr.html, retrieved online on March 21st 2014

kinds of activities that can be efficiently performed by the public and private sectors"(Tarr, Klepper, and Jacobson 1985, 2).

Tarr is particularly concerned with technology. In the 1970's he coordinated a research group on retrospective technology assessment and theorized the idea of using retrospective analysis to nourish technology assessment. "Unlike the future, history has data, and these data should be useful in forecasting and anticipation" (Tarr 1977, 655). "History, because of its long time perspective, its perception of social values, and its holistic nature, would be of value to technology assessment"(Tarr 1977, 658)

Another attempt to link history research and policy analysis for the water sector has been made by Juuti and Katko who coordinated the research project "Water Time" (Juuti and Katko 2005). The subtitle of their final report was "history matters for the futures". Indeed in another paper by some of the same authors it is written that "Future Research and Historical Research could jointly form a decision-making framework, which seeks to integrate both historical and future perspectives into today's decision-making processes"(Kaivo-oja, Katko, and Seppälä 2004, 540) ensuring that both "the diversities of the past and pluralities of the future […] are taken into account in decision-making". Future research "points out the need to ''look in the rear-view mirror while driving the car into the future''(Kaivo-oja, Katko, and Seppälä 2004, 545).

1.2.3 The history of infrastructure finance

In 2010 the European Investment Bank launched a call for proposals to award a research grant focused on "The History of European Infrastructure Finance" since the issue "has resonance today[17]". Although our PhD was not funded on the EIB research project we had the chance to be associated with the interdisciplinary research team and participated to the 2012 Milan European Economy Workshop. Its focus was "the analysis of the outcomes of public engagement in public infrastructure provisioning in Europe as well as an identification and exploration of European best practice examples for infrastructure financing that provide lessons learnt for contemporary policy debates"[18]. After the workshop our paper on the financing of Paris urban water and sanitation

[17] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2010:142:0030:0032:EN:PDF, retrieved online on March 21st 2014

[18] http://www.massimoflorio.com/milan-european-economy-workshops/milan-european-economy-workshops/retrieved online on March 21st 2014

infrastructure (CrespiReghizzi forthcoming a) was then selected for inclusion as one of the chapters of a forthcoming collective book.

1.2.4 Precautions to be used

In the same context of that EIB funded research project, De Luca and Lorenzini (2013) made a very rich and complete historical long run review of infrastructure financing mechanisms in Europe. Their work was motivated on the grounds that "the analysis of how infrastructure has been financed in the long run may allow us to better delve and grasp the inner dynamics of infrastructure provision, concentrating on one of the most determinant, as well as bias-reconstructed, elements of its success or failure"(De Luca and Lorenzini 2013, 2). Their research hypothesis "is that the effectiveness of an infrastructure financing system is correlated with a set of variables that embraces both supply-side and demand-side factors, whose interplay is path-dependent"(De Luca and Lorenzini 2013, 3). This brings them to the conclusion that "history teaches us that one single model or pattern, fitting all at the same time, does not exist. The same financing system can be successful in one country while it can fail in others, or even in other parts of the same state"(De Luca and Lorenzini 2013, 26).

The same kind of warning is made by Jacobson and Tarr when they write that "lessons of the past cannot be uncritically applied by contemporary decision-makers without close attention to context"(Jacobson and Tarr 1995, 32). Retrospective analysis should "emphasize the generalizable rather than the particular features of the historical event" (Tarr 1977, 658).

Harold James also points out that "A simple-minded application of historical lessons can provide a really bad policy guide. It does not offer self-evident patterns either. The best way of thinking about history is as a way of testing conventional hypotheses"(James 2012, 1025).

This is something that Braudel had also thought when he looked at the long run as an ocean where models and hypothesis could be tested:

> "L'intérêt pour moi, le navire construit, est de le mettre à l'eau, de voir s'il flotte, puis de lui faire monter ou descendre, à mon gré, les eaux du temps. Le naufrage est toujours le moment le plus significatif"(Braudel 1987, 30).

The long run can be used to test conventional hypotheses. Nevertheless, we should always keep in mind that history is a whole "field for research and analysis rather than the simple aggregate of facts to pillage in order to corroborate a theory"(De Luca and Lorenzini 2013, 2)

1.3 A long run perspective on water and sanitation infrastructure

1.3.1 Existing literature on water and sanitation history

There has been already a large amount of research on the history of water and sewer systems from the point of view of the history of technology and of environmental and urban history. A research branch on the history of the networks has been very active in France[19] (but also in the USA with Joel Tarr, Martin V. Melosi and others) and produced very interesting pieces of literature (Dupuy and Knaebel 1982; Tarr and Dupuy 1988; Guillerme 1983; Goubert 1985; Chatzis 1993). More recently a collective book has been published in honour of one of the engineers at the origin of Paris water system Eugène Belgrand (Deutsch and Gautheron 2013).

Indeed, the socio-technical history of Paris water and sanitation infrastructure has been largely treated in the previous literature (Cebron de Lisle 1991; Bellanger, Pineau, and SIAAP 2010; Beaumont-Maillet 1991; Bocquet, Chatzis, and Sander 2008; Chatzis 2006; Graber 2009). This is not the case for the history of Milan's water service on which the literature is not largely developed (Bigatti 1997; Bigatti 2000; Colombo 1984; Motta 1989a; Gentile, Brown, and Spadoni 1990).

In both countries much less has been written on water and sanitation services (WSSs) from the economic history perspective. There are very few (if any) economic history studies on the financing history of water infrastructure. Sometimes financing solutions adopted in the past are mentioned in the literature quoted above and referred to in the policy-makers circles. However the financing solution is not the main focus of those studies and often it is not treated with the necessary quantitative in-depth analysis.

1.3.2 Our research approach

There is a knowledge gap on how water infrastructure was financed in the past and no quantitative and detailed studies are available on how was the network expansion

[19] See above the references to the *Groupe Réseaux* and to its journal *Flux*.

financed[20](Barraqué 2011a, 4). One of the goals of our research is to start filling such a gap.

L'histoire est fille du présent (History is the daughter of the present) is a famous expression[21]. We are conscious that we are not historians and that we are not defending a PhD thesis in History but in Economics. Our research originates from the knowledge of the real infrastructure challenges faced today both in the western world and in developing countries (§1.1). Infrastructure, and particularly in the water and sanitation sector, has a very long life time. This could be a reason *per se* for adopting a long run perspective. Clearly it is not the only one as the previous paragraphs showed (§1.2).

Our approach is deeply rooted in public finance theory which we shall discuss in detail (Sections 2, 3, 4 and 2.11). Based on such a theory we adopt a long run (*la longue durée*) time frame on one hand and a comparative approach on the other hand to fuel the research with the necessary amazement and surprise (*le dépaysement)*(Braudel 1987).

A thesis based on a core of six essays

Our time frame starts with the genesis of "modern" water and sanitation services and lasts till the end of the 20th century.

The core of this thesis is composed of six essays which are inserted in Part II and Part III. The six essays are currently in the submission process to be published in journals and collective books. By construction each essay is an autonomous piece of research. This implies that there might be some redundancies between the essays. In advance we invoke the reader's indulgence.

Most papers are the result of an initial study presented at one or more conferences or workshops which were later published online as "working papers". One or two papers have been produced from each of our three initial working papers. A summary table in Appendix 2 gives the full details on the working papers, on the conferences and workshops and on the final publications.

[20] « *On ne dispose malheureusement pas d'analyses historiques quantitatives pour reconstituer les modes de financement de l'extension des services et leur évolution* » (Barraqué 2011, 4).

[21] The expression has been used by Christophe Granger who wrote that « c'est dans le présent, dans ses hardiesses et ses inquiétudes, que l'historien tire de quoi soutirer du sens au passé et de quoi, en retour, le suturer au présent »(Granger 2013, 12).

Our analysis is based on the existing literature when available and on municipal documents (in particular the yearly financial reports) as primary sources.

Specifically, our analysis has been particularly deep and based on municipal primary sources for the genesis phase of Milan and Paris water services (1888-1925 and 1853-1925) which is analysed in the three papers present in **Part II** (CrespiReghizzi forthcoming a; CrespiReghizzi forthcoming b; CrespiReghizzi forthcoming c).

Part III includes two papers on Milan water service respectively today and in the second half of the 20th century (CrespiReghizzi forthcoming f; CrespiReghizzi forthcoming d). These two papers are based on existing literature, on primary municipal sources and on interviews for the more recent years.

The third paper in Part III (CrespiReghizzi forthcoming e) enlarges the frame to the long run financing paths of Water and Sanitation Services (WSSs) in Italy and France.

The other parts of the thesis

It was only after having finalized and submitted to editors the six essays that we started writing the introductive part (Part I) and a conclusive part (Part IV) of the thesis.

Through various sections of **Part I** we discuss many aspects of public finance theory. Section 5 discusses some general issues on water and sanitation services. Using the public finance theory we build an original matrix of the trade-offs faced by water and sanitation policy-makers (§5.3).

In the conclusive part (**Part IV**) we summarize the path of water and sanitation services in Paris and in Milan (and in France and in Italy) and analyze it in terms of the trade-off matrix (Section 6). We also draw some comparisons with other countries (Section 7). In the last Section (Section 8) we give some conclusions both from a policy and academic perspective.

2 Public finance theory and club goods

This section discusses some aspects from public finance theory. Some other aspects will be analysed in the forthcoming sections too (Sections 3, 4). We adopt a definition of public finance (or public economics) given by Rosen and Gayer: "the field of economics that analyzes government taxation and spending" (Rosen and Gayer 2010). This could also be the definition of "public economics" but we prefer to stick to the term of "public finance".

2.1 The trilogy of state functions

According to one of the most famous classics in public finance theory (Musgrave 1959) government intervention needs to respond to a trilogy of objectives implemented by three branches of the government :

1)The Stabilization branch – to secure economic stabilization.

2)The Allocation branch – to secure adjustment in the allocation of resources

3)The Distribution branch – to secure adjustments in the distribution of income and wealth.

Many decades after Musgrave (1959), the government intervention is still classified by public finance scholars according to a slightly revisited trilogy to which we shall also refer (Hindriks and Myles 2013, 119–123). Government intervention might take place to fulfil one of the three following objectives :

1) The Minimal State (including property rights, contract laws, police and defence).

2) Government intervention in the case of market failures (based on a positive criterion and on efficiency grounds).

3) Government intervention that do not involve market failure (based on a normative criterion and on equity grounds)

Within the "Minimal State" branch the first role of the public sector is to assist with the attainment of economic efficiency by providing an environment in which trade can flourish. The minimal state provides contract laws, polices it and defends the economy against outsiders" (Hindriks and Myles 2013, 120–121).

Once the Minimal state missions are fulfilled, there is room for government intervention either to solve market failures (Musgrave's Allocation Branch) or in fields where no market failures are involved (Musgrave's distribution branch). We let aside the first and third branch and focus our attention on government intervention in the case of market failures (Allocation branch).

Government intervention in the allocation branch is based on a positive criterion and justified to solve the inefficiency due to various market failures: externalities[22], public goods and case of imperfect competition (Hindriks and Myles 2013, 121).

2.2 Benefit Vs Ability-to-pay principles in taxation

One central question is how should be financed Musgrave's allocation branch and how this is linked with the transfers in income distribution made by the distribution branch. Historically, there were two distinct views[23] on taxation :

a) The *benefit* approach and

b) The *ability-to-pay* approach.

Before going further into each one of these approaches it is worthwhile to remember Adam Smith's point of view on the topic as expressed by Musgrave:

> On one hand "the cost of public expenditures should be allocated, wherever possible according to benefit ; and general contributions should be used only where expenditures cannot be allocated on a benefit basis".
>
> On the other hand "everyone is benefited by such services and everyone should contribute to the cost of sustaining them. But how is the individual benefit and cost-contribution to be measured? Since there is no practical way of doing this, a general rule of thumb is needed in place of individual imputation. This rule according to Adam Smith is provided by "*taxing individuals in proportion to their respective abilities; that is the revenue they respectively enjoy under the protection of the state*". Smith thus shrewdly inserted an ability element into the weak link of the benefit rule" (Musgrave 1959, 66–67).

[22]As pointed out by Cornes and Sandler (1996, 6): "public goods can be thought of special cases of externalities". Moreover "externalities represent not simply a further source of market failure, but a much broader family of market failures of which public goods constitute a member."

[23] These two views are discussed in detail by Musgrave (1959).

2.2.1 The Benefit approach

This is a very ancient view on taxation according to which "taxes were considered a price to be paid for protection or for a membership fee in the association of organized society"(Musgrave 1959, 64). The relation between the taxpayer and the government is essentially seen in *quid pro quo* terms.

At the end of the 19th century in Europe there was a *renaissance* of the benefit approach where "taxes were considered more or less as voluntary payments rendered by the individuals in exchange for services supplied by the government in accordance with personal evaluation of such services"(Musgrave 1959, 69). This new school included authors such as Pantaleoni, Mazzola and de Viti de Marco in Italy, Sax in Austria and Lindahl in Sweden[24]. This new view on the benefit approach introduced an important change compared to the traditional doctrine : taxation according to benefit was not based anymore on a "standard of justice" but as a "condition of equilibrium"(Musgrave 1959, 69).

According to Musgrave (1959, 62), on the one hand such a view makes sense for the allocation branch[25] as it has "the great merit of tying the choice of public services to the preferences of the individual members of the community. On the other hand he points out the great limits of the benefit approach when applied to public goods:

> "There remains the vital question of just how benefits are to be determined. […] If we think of the benefit principle as implemented by a market mechanism, as the later writers did, we must make the unrealistic assumption that the exclusion principle and, hence, the principle of voluntary exchange are applicable to the satisfaction of public wants"(Musgrave 1959, 63)

The benefit approach somehow considers taxation as a "membership fee" to an "association". This is something on which we shall discuss further in §2.5 in terms of "clubs" and "collective consumption units".

[24]Some of these essays have been translated and published in English more recently (Musgrave and Peacock 1994)

[25]While " the benefit approach by its very nature cannot solve the problem of the Distribution and Stabilization Branches" (Musgrave 1959, 62).

Indeed, the above quotation makes clear that two conditions are required for the benefit approach to be applied: i) possibility of exclusion and ii) voluntary exchange. We shall see that these are not always met or easily implemented (§2.6).

2.2.2 The ability-to-pay approach

Early views on this approach focused only on the tax collection part of the problem and were based on the ideas that taxation should be imposed by the state in an "equitable or just fashion". Later, a second view considered taxation as a matter of welfare maximisation rather than justice : the tax burden should be spread among citizen so as "to minimize the total sacrifice involved" or "equating the marginal sacrifice of all taxpayers"(Musgrave 1959, 90). As in the early views, the public expenditures side of the problem was not even considered.

A third view (Pigou 1962; Dalton 1923) considered welfare as the best approach to the determination of tax shares but it "extended the argument to the expenditure side of the budget". And the public budget as a whole started being considered by Pigou (published first in 1929) as aimed at maximising the welfare :

> "Public expenditures should be pushed to the point where the satisfaction from the last dollar expended is equal to the satisfaction lost from the last dollar taken in taxes" (Pigou 1962, 31; quoted by Musgrave 1959, 113)

In such a view the issue of how to charge public services to the user is treated independently from that of benefits received. "Taxes are seen as compulsory payments and the revenues-expenditure process is seen as a planning problem not subject to a solution by the automatic functioning of the market"(Musgrave 1959, 62). On one hand such an approach "has the merit of recognizing the compulsory nature of taxation and viewing the determination of the public household as a planning problem". On the other hand it "disregards the expenditure side of the problem or at best provides us with the dictum that expenditures should be planned so as to maximize welfare"(Musgrave 1959, 63).

2.3 Social wants and merit wants

According to Musgrave, the allocation branch has a role to play when an adjustment in the market resource allocation is required. In his opinion two major categories of goods

and services require an intervention from the allocation branch: *social wants* and *merit wants*.

> "**Social wants** are those wants satisfied by services that must be consumed in equal amounts by all. People who do not pay for the services cannot be **excluded** from the benefit that result ; and since they cannot be excluded from the benefits, they will **not engage in voluntary payments**. Hence, the market cannot satisfy such wants"(Musgrave 1959, 8).

In practice, Musgrave's "social wants" are somehow another expression for "public goods"[26].

Merit wants are goods or services which could be "subject to the exclusion principle" and which "are satisfied by the market within the limits of effective demand". They become "merit wants if considered "so meritorious that their satisfaction is provided for through the public budget over and above what is provided for through the market and paid for by private buyers"(Musgrave 1959, 13).

The concept of merit wants expresses the need of government-action based on a normative judgment of goods or services particularly meritorious. Merit goods raised some criticism as in Musgrave's conception merit wants were a "mysterious object, a sort of *deus ex machina"* (Massarutto 2013, 3).

Rosen and Gayer (2010, 49) quote Baumol and Baumol(1981) and their criticism on the merit good concept:

> "The merit good approach is not really a justification for support – it merely invents a bit of terminology to designate the desire to do so" (Baumol and Baumol 1981, 426–427 quoted by ; Rosen and Gayer 2010, 49)

Indeed, Massarutto reminds us that "liberal thought […] has always been reluctant to accept the idea that something could be superior to the sovereign will of the individual; to that extent the imposition of collective preferences built through a political process

[26] On the contrary we shall not retain Musgrave's definition of "public good" which implies public production too (Musgrave 1959, 43–44).

was considered as a paternalistic intrusion in people lives which violates the liberty principle[27]" (Massarutto 2013, 3).

2.4 The continuum between private and public goods

Since Samuelson's works (Samuelson 1954; 1955)[28],economists have given an increasing attention to public goods.

> "At first economists focused on the two poles of a spectrum of goods, the poles consisting of pure public goods[29] and pure private goods"(Cornes and Sandler 1996, 3).

After Olson's and Buchanan's works (Olson 1965; Buchanan 1965) a growing attention was given also to impure public goods : meaning the broad spectrum of goods between fully private and fully public good (Figure 1). "Once economists understood that few **public goods** at the local, state, national or international level possess the **non excludability** and **strict indivisibility of benefits** properties required for pure publicness, the allocative principles of club theory as they applied to **impure public goods** took on added importance"(Cornes and Sandler 1996, 4).

In a 1977 essay (re-published later in 1999), Vincent and Elinor Ostrom (1999) underline the distinction between Club Goods and Common pool resources (Figure 1). **Club goods are not rival in consumption while their benefits are excludable. Common pool resources are instead rival in consumption while their benefits are not excludable.** We should bear in mind however that the 4 categories in the matrix below are not so sharply distinct. "In fact it is helpful to envisage a continuum of goods that gradually vary in nature as they become more rivalrous or more easily excludable" (Hindriks and Myles 2013, 149).

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[27] "Il pensiero liberale, culminato nella scuola chicagoana della *public choice,* ha sempre diffidato dell'idea che qualcosa si sovrapponesse alla volontà sovrana dell'individuo; l'individuo; l'imposizione di preferenze collettive costruite per via politica rappresenta un'intrusione paternalistica che viola il principio di libertà", our own translation.

[28]Using other terminology some early views on public goods had been given in the early 20th century by some European economists including Lindhal, Sax and Wicksell. Some of these essays have been translated and published in English more recently (Musgrave and Peacock 1994).

[29]"Private goods could be parceled out among individuals and efficiently allocated by markets, whereas public goods could not be divided among individuals, owing to non rivarly and non excludability problems" (Cornes and Sandler 1996, 3).

A good might be considered rival if an additional user generates additional marginal costs. This has a huge implication for infrastructure which has very low marginal costs in the short run : once the infrastructure is built the marginal cost of an additional user is not significant as long as some marginal capacity is available. On the contrary, in the long run, when one considers the capital expenditures required for building the infrastructure marginal costs are not negligible. Indeed, an infrastructure might be considered unrival in the short run but rival in the long run (Massarutto 2013, 6).

Exclusion might be theoretically possible but too costly to enforce. The cost of the exclusion mechanism might evolve significantly thanks to technological innovation. Thus, Massarutto reminds us that both rivalry and excludability are not an unchanging characteristic of a good or service and can evolve significantly through the time(Massarutto 2013, 6). This is why a long run analysis is a useful approach.

Figure 1 : Two-entry matrix on Rivalry in Consumption and Excludability of Benefits

		Rivalry in Consumption	
		yes	no
Excludability of Benefits	yes	Private or Market Goods	Toll or Club Goods
	no	Common Pool Resources	Fully Public Goods

Source : (Barraqué 2009), originally from (Ostrom and Ostrom 1999 first publication in 1977)

2.5 Club Goods and collective consumption units

According to Cornes and Sandler (1996, 347), “a club is a voluntary group of individuals who derive mutual benefit from sharing one of the following : production costs, the members’ characteristics or a good characterized by excludable benefits”.

Elinor and Vincent Ostrom introduced the twofold concept of "collective consumption units" (CCU) and "production units" (PU) to analyze clubs which deliver public services :

> "Governments, like households, might be viewed first as collective consumption units. Once the collective consumption aspects of governmental organization have been identified, we can turn to the production side" (Ostrom and Ostrom 1999, 83).

According to Bernard Barraqué, clubs imply the application of the two key principles of *liberté* and *égalité* as they developed with the Age of Enlightment*:* everybody is free to choose whether to become a member of the club or not and all members are equal. While we agree with this view in general terms, we find this definition of clubs too narrow for our purpose and prefer to use the concept of collective consumption unit.

We shall refer further to publicly run clubs as "**collective consumption units" (CCU)**. Moreover in §4.6 we shall discuss the variety of institutional forms that a CCU can assume fully within a local government or through autonomous or external legal entities.

2.6 Voluntary membership to the collective consumption unit ?

We have already summarized (§2.2) the debate on whether publicly provided goods could be considered to be voluntary exchanged through quasi-market mechanisms (as suggested by the benefit approach view) or not (as argued by the ability-to-pay view). Within the benefit approach school, Emil Sax[30] had made in 1924 a subtle distinction between "*personal collective wants* which can be met by voluntary payment of fees and *collective wants proper* which cannot be satisfied in this fashion".

More recent club theory tells us that while "privately owned and operated clubs must be voluntary" as "members choose to belong because they anticipate a net benefit from membership", this is not the case when the club good is publicly provided as "voluntarism, at least in terms of taxes, may not be possible" (Cornes and Sandler 1996, 347).

[30]This has been quoted by Musgrave (1959, 70) based on the 1924 version of Emil Sax works. The essay is available in English (Sax 1994).

Indeed, relying on the voluntary participation to the collective consumption units (CCUs - §2.5) is not always sufficient. "Arrangements must be made for levying assessments, taxes, or user charges on beneficiaries. Strictly voluntary efforts to supply public goods and services will fail to yield satisfactory results. Authority to levy taxes or assessments or to coerce user charges is necessary to avert holdouts and to supply funds for jointly used goods or services"(Ostrom and Ostrom 1999, 83).

The application of the exclusion mechanism implies that users' fees can be monitored and free-riders can be barred from the club (Cornes and Sandler 1996, 349). The above quotations show that membership to collective consumption units (CCUs) cannot be always be left on a voluntary basis since applying exclusion is not always feasible or wishable.

We shall make two working statements to clarify our thought on the issue of voluntary membership, exclusion and participation to a CCU:

> **Working Statement 1 : the application of an exclusion mechanism for a CCU is a necessary and sufficient condition for voluntary membership**. This statement defines a **CCU with voluntary membership and exclusion**. Indeed think of a CCU without an exclusion mechanism, how could the individuals wishing to be members show their interest to be members? How could non-members be separated from members?
>
> **Working Statement 2 : the lack of an exclusion mechanism for a CCU is a necessary and sufficient condition for everyone to be a coerced member of the CCU.** This statement defines a **CCU with coercion.**

To the purpose of our research collective consumption units may be classified according to two questions :

a) **Possibility of exclusion**: is it possible technically to implement exclusion from the CCU?

b) **Choice and degree of exclusion**: from a normative point of view is it desirable to apply an exclusion mechanism? Up to which level should the policy maker set the exclusion level?

Answers to these two questions give us 3 CCU categories:

a) **CCU A1 – CCU with voluntary membership and exclusion** : a CCU where the implementation of the exclusion mechanism is technically possible and is desirable

b) **CCU A2 – CCU open by choice** : a CCU where the implementation of the exclusion principle is technically possible but is not desirable

c) **CCU B – CCU open by constraint** : goods or services where the implementation of an exclusion principle is technically impossible or too costly

When the exclusion principle is not applied (CCU A2 or CCU B) all individuals are members and non-members do not exist. We shall refer to this situation as an **Open CCU with coerced membership**. This is clearly the case of a collective consumption unit providing a fully public good.

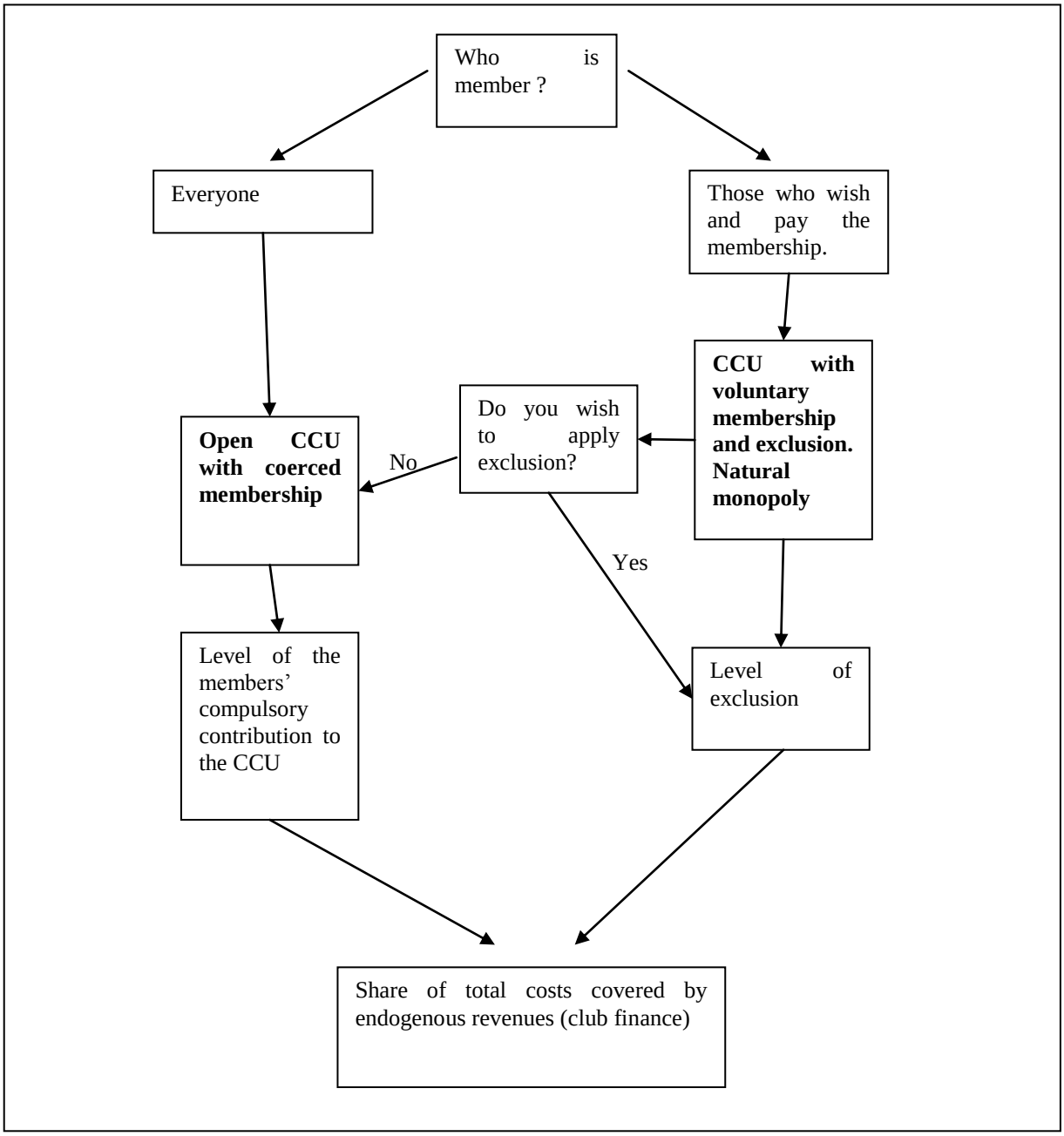
We showed that there is a continuum of different kinds of goods between fully public and fully private ones (§2.4). Similarly, there is continuum of possible choices in the degree of implementation of the exclusion mechanism. In practice, the degree of exclusion is often expressed in terms of level of collective consumption unit costs covered by user charges.

> If the costs of the CCU are covered by revenues collected from the members of the CCU we shall talk of *club-finance* and of "*endogenous revenues*" (toll-finance in Musgrave's expression).
>
> If the costs of the CCU are covered by general taxation we shall talk of *tax-finance* and of "*exogenous revenues".*

The terms "endogenous" and "exogenous" sources of revenues have been proposed by Massarutto (2002, 3) who gives the following definitions applied to water and sanitation services :

> - "Endogenous sources are payments that are directly obtained from service users, regardless the nature of the payment (fiscal or not), with the only requirement that payments are correlated with service consumption and dedicated to the separate accounting of the environmental service.
>
> -Exogenous sources are payments that are made to general budgets, which on their turn contribute, yet without a direct relation, to the service balance."

Figure 2 : CCUs & level of exclusion



Source : author's elaboration

These concepts are schematized in Figure 2 and we discuss this issue in more detail in §2.9.2 and § 2.10. Also this concepts are addressed for the water sector in § 5.1.5.

2.7 User fees & information on user preferences

Elinor and Vincent Ostrom pointed out that "the income received for providing a private good conveys information about the demand for that good." On the contrary when the membership to a CCU is not voluntary, the user fees "collected under the threat of

coercion say little about the demand for a public good or service. Payment of taxes indicates only that taxpayers prefer paying taxes to going to jail. Little or no information is revealed about user preferences for goods procured with tax-supported expenditures"(Ostrom and Ostrom 1999, 84).

Indeed, user and CCU membership fees in presence of coercion fail to reveal the user's willingness to pay (WTP). Such an evidence generates at least two questions: a) how can we give voice to user preferences in collective consumption units? and b) what is the share of the costs to be covered by club-finance (toll-finance) and those left to tax-finance? The latter question is central in our research and shall be given a specific attention in §2.9.2 and § 2.10.

The first question is given some attention in Elinor and Vincent Ostrom's paper. A "set of rules" needs to be defined for each collective consumption unit in order to "take account of citizen-consumer interests". "Such rules provide mechanisms for articulating and aggregating demands in the absence of market prices and for translating demand into decisions about the level of service to be procured"(Ostrom and Ostrom 1999, 85).

Such an issue had been already pointed out somehow by Richard Musgrave as the "central problem" left unsolved both by the benefit and ability-to-pay theories (§2.2). According to Musgrave the solution could be found in "budget planning through voting" on which he focused an entire chapter.

> To solve it, "a technique must be found by which individuals are induced to reveal their preferences for social wants [public goods] (even though the exclusion principle cannot be applied) and by which a choice can be made among all the solutions that are optimal. Without this, neither the benefit nor the ability-to-pay approach has much content. […] Since these problems cannot be solved by the mechanism of the market, we must turn to a process of political decision making"(Musgrave 1959, 116).

Even if this is an interesting issue we shall leave it aside as it is not so key for our research topic.

2.8 Provision and production of public services

A public finance textbook distinction needs to be reminded to the reader: it is the one between “provision” and “production” of a public good. By “provision” we refer to the task of “organizing the consumption functions in a public economy” while by “production” we refer to the task of organizing the “production function”(Ostrom and Ostrom 1999, 86).

According to Musgrave the “provision” of the public good implies that the goods or services must be paid for out of general revenue. “The goods and services must be supplied free of direct charge to the user ; at the same time, they need not be produced under the direct management or supervision of the government”(Musgrave 1959, 15) Public provision of public goods does not necessarily require public production which can also be left to the private sector.

The distinction between provision and production initially thought for pure public goods applies in fact to impure public goods too and in particular to club goods / natural monopolies. The response to the imperfect competition can be either private production with public control (public provision) or full public provision and production. And either of these two solutions can be applied to the cases of a break-even, subsidized or profit-making collective consumption unit.

As stated by Musgrave :

> “Where controls over allocation are needed, the government may control the policies of private firms ; it may replace private firms by public production or it may adopt various in-between forms of ownership and control. The most efficient solution in any particular case depends upon the degree of control necessary and on the complexity of the tasks.[…] The choice of technique will frequently be a matter of judgement, not subject to a clear cut decision on the grounds of efficiency”(Musgrave 1959, 45–46).

One issue is the share of the collective consumption units costs to be covered by club-finance and those left to tax-finance (general taxation). A completely different issue is the choice of who produces: i) the collective unit could choose to produce on its own (publicly owned production unit) or ii) a contract could be signed with a private

production unit. This is the ever-lasting public Vs private debate on which so many words have been written.

While our research is very much concerned with the first issue (see next paragraphs) we chose to leave completely aside the public Vs private issue. The choice between public or private production is not central to our subject as we focus on infrastructure expenditures which are most of the time under the public sector responsibility in the water sector (CrespiReghizzi forthcoming e, 1). In the Box 1 here below we make the distinction between the three models of management in the water sector.

Box 1 : Three models of management of water and sanitation services

Management of water and sanitation services is schematized by Linares et al.(2012) through three models : Delegated Management (DM), Regulated Monopoly (RM) and Direct Public Management (DPM).

DM is also known as *affermage* or *lease contracts*, i.e. a contractual agreement through which the LGU keeps the responsibility on the infrastructure while it delegates to a private partner the management and daily operations (including maintenance).

RM is also known as the concession model where both the infrastructure investments and the daily operations are delegated to a private partner.

DPM refers to the case where the public authorities keep full responsibility of the service (infrastructure and daily operations responsibility)

Of course there are many possible hybrids between the three models. e.g. management contracts (*gérance, régie intéressée)*

With the notable exception of the RM model (full private concession) investment in bulk water and sanitation infrastructure is under the responsibility of the public sector.

Source : author's elaboration based on Linares et al.(2012)

2.9 Natural monopolies as collective consumption units with voluntary membership and exclusion

Natural monopolies are a classic topic in public and welfare economics. A good definition is given by Hindriks and Myles :

> "The essence of a natural monopoly is that there are increasing returns in production and that the level of demand is such that only a single firm can be profitable" (Hindriks and Myles 2013, 279).

Indeed, competition by duplication is not a viable solution to the market failure implied in natural monopolies (welfare loss due to the lack of competition). The classic policy response to natural monopoly consists of either public ownership or private ownership with an associated regulation. In other terms the policy response might be public provision with private production or public provision with public production too.

As we already stated (§2.8) we let aside the private Vs public debate and focus our attention instead only on the public provision part of the natural monopoly rather than on the production. In French terms this means that we focus on the *maitre d'ouvrage* of the infrastructure rather than on the *délégataire.*

While studying natural monopoly issues with club theory lenses, we consider a natural monopoly as a CCU with voluntary membership and possible exclusion (CCU A1- §2.6 and Figure 2). This view is very consistent for example with the classical natural monopoly example of a bridge in presence of toll or with a urban public transport system.

2.9.1 Pricing publicly run natural monopolies

In the case of a state owned natural monopoly firm, its price should be chosen to maximise social welfare subject to the budget constraint on the firm. This is the well known *Ramsey price* (Ramsey 1927):

> "The budget constraint may require the firm to break even or to generate income above production cost. Alternatively, the firm may be allowed to run a deficit that is financed from other tax revenues. Assume that all other markets in the economy are competitive. The Ramsey price for a public firm subject to a break even constraint will then be equal to marginal cost if it satisfies the constraint. If losses arise at marginal cost, then the Ramsey price will be equal to average cost" (Hindriks and Myles 2013, 280).

Indeed, utilities in natural monopolies have increasing return to scale (decreasing marginal costs) as they have very large fixed costs and relatively small operational

costs. This is particularly true for the water industry. When the first-best Long Run Marginal Cost Pricing (LRMC) does not allow break even, economics theory suggests Average Cost Pricing (AC) or Ramsey pricing (RP) as the second-best alternative allowing to recover fixed costs.

2.9.2 Club-finance or tax-finance in natural monopolies ?

Ramsey pricing theory does not tell much on whether the natural monopoly collective consumption unit should be asked to generate an income, to break-even or authorised to run a deficit that is financed from some tax revenues. This is what we called the trade-off between "club-finance" (toll-finance in Musgrave's terms) and "tax finance" (or between endogenous and exogenous revenues (§2.6). This had been already discussed by Musgrave who stated that "the choice between the two policies of toll finance and tax finance is a matter of judgment, depending on the specific case"(Musgrave 1959, 139).

While studying natural monopoly issues with club theory eyes, we argued that a natural monopoly is a CCU with voluntary membership and exclusion (CCU A1 - §2.6). The trade-off between club-finance or tax-finance raises an additional normative question: even when the exclusion principle can be applied from a technical point of view, should it be applied? In other terms should we keep the CCU membership voluntary in presence of exclusion (CCU A1) or should we open the door of the CCU to everyone (avoiding exclusion) and thus impose membership (CCU A2) ?

Once again, Musgrave gives us an answer:

> "We have then a paradoxical situation where the exclusion principle can be applied but where such application results in an inefficient solution. […]All this leads to the conclusion that the building of the bridge (and similar facilities) must be determined by the same political process that determines the satisfaction of social wants in the budget of the Allocation Branch. Even though the exclusion principle can be applied in the technical sense that barriers can be established, use of the principle is inadmissible because decreasing cost prevails"(Musgrave 1959, 138–139)

A natural monopoly is a voluntary CCU where exclusion is possible. Musgrave's analysis shows that applying the exclusion principle does not always make sense and is "a matter of judgment".

We add another issue to the discussion and argue that choosing the share of the costs covered by toll-finance and those covered by tax-finance is a key normative trade off to be made by policy-makers. Is the membership to the natural monopoly CCU to be left voluntary or should the policymakers encourage (or force) everybody to be member of the CCU ? The choice depends on the policy makers' judgment on the delivered good or service. To which extent do they consider it as a merit good (§ 2.3)?

Things in fact are not completely black or white and "some attempts can be made to compromise between the two policies [tax-finance or club-finance]." For example "the tax [...] might be drawn from people who are most likely to use the facility"(Musgrave 1959, 139).

This intermediate solution is very close to the "fiscal equivalence" principle which might be used to share the costs of a collective consumption unit without exclusion as we shall see next in §2.10.

2.10 Club-finance or tax finance in CCUs without exclusion ?

Let us try to extend the analysis of the trade-off between club-finance and tax-finance to a CCU where the implementation of the exclusion mechanism is not possible (CCU B) or not desirable (CCU A2).

We consider here a collective consumption unit in presence of coercion (no voluntary membership and no exclusion). The term "club-finance[31]" refers here to the money collected by the CCU on its members (compulsory contribution). A CCU membership fee in presence of coercion fails to reveal the user's willingness to pay (WTP). Nevertheless, the question here is how much should the collective consumption unit charge the coerced user for the specific good or service through membership fees (club-finance) ? Should the total cost be charged to the user (CCU member) ?or only a part of the costs? By definition costs uncovered by club-finance are covered by general taxation (tax-finance).

[31] This could also be referred to as 'common pool finance'.

An indication in favour of club-finance expressed as “fiscal equivalence” is given by Elinor and Vincent Ostrom(1999, 91):

> “Without market prices and market transactions, the act of paying for a good generally occurs at a time and place far from the act of consuming the good: individual costs are widely separated from individual benefits. Yet a principle of fiscal equivalence-that those receiving the benefits from a service pay the costs for that service--must apply in the public economy just as it applies in a market economy. Costs must be proportioned to benefits if people are to have any sense of economic reality. Otherwise beneficiaries may assume that public goods are free goods, that money in the public treasury is "the government's money," and that no opportunities are foregone in spending that money. When this happens the foundations of a democratic society are threatened. The alternative is to adhere as closely as possible to the principle of fiscal equivalence and to proportion taxes as closely as possible to benefits received”.

The fiscal equivalence principle is clearly very close to the benefit approach in taxation previously described (§2.2.1). In fact the “fiscal equivalence’ principle had been forged by Olson (1969) talking of “The Division of Responsibilities Among Different Levels of Government”:

> “We must argue that there is a need for a separate governmental institution for every collective good with a unique boundary so that there is a match between those who receive the benefits of a collective good and those who pay for it. This match we define as “fiscal equivalence”(Olson 1969, 483).

Olson argued in favour of a fiscal equivalence between the beneficiaries of a service provided by a given collective consumption unit and the citizen and voters fuelling the budget of the collective consumption unit through taxes.

In practice fiscal equivalence might be implemented through ear-marked taxes or levies which are set for a specific public service and flow into that public service specific budget.

This bring us to a key and useful distinction : from a legal point of view, endogenous revenues can be collected from the users as Tariffs (non fiscal) or as ear-marked taxes or levies with a fiscal nature.

Thus, two steps of distinction have to be made. Costs can be covered by :

1)Endogenous revenues

1a) Tariff (with no fiscal nature)

1b) Ear-marked tax or levy with fiscal nature

2) Exogenous revenues

Olson's fiscal equivalence is very much connected to the nature of intergovernmental relations and to the shape of Local Public Finance on which Section 4 focuses.

2.11 Urban development & land value capture tools

In the previous paragraphs we have discussed the key distinction between club-finance and tax-finance (between endogenous and exogenous revenues). We argued that by definition costs uncovered by endogenous revenues are covered by exogenous revenues. By "exogenous revenues" we were making reference to general taxation. In fact some revenues may also come from the land value increase due to the built infrastructure if specific arrangements are available to capture it.

Indeed, Jacobson and Tarr point out three kinds of funding arrangements for government owned utilities in the United States : " [a]Funded by user fees, [b] Free to users, funded by tax assessments and [c] Free to users, funded by assessments on abutting property holders [or d] a combination of any of the above"(Jacobson and Tarr 1995, 3).

In the following sub-paragraphs we discuss how land value capture tools may be implemented to make the property holders contribute to urban infrastructure projects.

In our papers in Part II, we shall discuss the role of land-value capture tools in the financing of Paris and Milan water infrastructure (Crespi Reghizzi forthcoming a; Crespi Reghizzi forthcoming b; Crespi Reghizzi forthcoming c).

2.11.1 Land value capture

The idea of taxing land value had already been proposed in 1879 by Henri George as a tool for confiscating rent on land:

> "It is not necessary to confiscate land—only to confiscate rent. Taking rent for public use does not require that the state lease land; that would risk favoritism, collusion, and corruption. No new government agency need be created; the machinery already exists. […] Government already takes some rent in taxation. With a few changes in our tax laws, we could take almost all.[…].Therefore, I propose that we appropriate land rent for public use, through taxation"(George 1879, 239; quoted by Sumiraschi 2013).

According to present day value capture theory, urban infrastructure can be financed endogenously if the local authorities are able to design proper legal mechanisms to capture the added value created by urban growth. In other terms through a value capture financing scheme a public administration can monetize a part of the positive externalities of an infrastructure project (Brugnoli 2010, 15).

There is a large variety of land value capture financing tools which can allow to do this as the table below shows. The first classification we make is whom do we capture the contribution from, i.e. who is the payer ? a) The Developers or b) the Community ? "The community consists of all property owners in the direct vicinity of the infrastructure (direct beneficiaries)"(ReUrba 2006). The other useful distinction is the one between "mandatory tools" based on coercion and "voluntary ones" based on cooperation between actors. The last line in the table below mentions another category of land value capture tools based on an internalization of all costs when the developer undertakes jointly a profitable operation and a less profitable operation with an implicit cross-subsidy taking place.

Table 1 : Value capture financing tools

Capture from (Who is the payer?)	**Voluntary tools**	**Mandatory tools**	**Comments**
Developers	Joint development	-Development exaction and impact fees - Public land acquisitions and resale	Expansion areas / integrated urban renovation operation
The community	No	-Betterment levies -General tax on land value gains	Built up areas
Within	-Internalization (integrated urban developer) -Linkage capture	No	

Source : author's elaboration based on concepts from various sources (ReUrba 2006; Peterson 2009; Brugnoli 2010)

2.11.2 Mandatory tools capturing funds from the community

According to Peterson(2009) a distinction has to be made between

-"**betterment levies**" *stricto sensu* which raise a lump-sum tax among property owners in the neighborood of an infrastructure and,

-a "**general tax on land value gains"** which is paid on a broader base by property owners. Such a tax is less tightly connected to a specific infrastructure. To be effective in capturing the land value gains, this solution requires to constantly monitor and update the cadastral values of properties.

2.11.3 Mandatory tools capturing funds from the developers

In this category one has to distinguish:

-**Development exaction :** "Developer installs on-site and neighbourhood-scale infrastructure at own expense"(Peterson 2009, 14).

-**Impact fees :** "Developers pay the cost of system wide infrastructure expansion needed to accommodate growth" (Peterson 2009, 14).

-**Public land acquisition and resale policy** : the municipality owns or acquires "lands near by an infrastructure project and then sells it upon completion of the project" at a higher value (Peterson 2009, 41).

The latter policy was largely implemented in Paris in the second half of the 19th century. It contributed to financing a significant part of the water supply and sewer system infrastructure costs (Crespi Reghizzi forthcoming a).

2.11.4 Some historical facts on land value capture fiscal tools

In the second half of the 19th century various countries (England, USA, Prussia) were taxing property value increases in order to finance investments in urban infrastructure[32]. In England, according to the 1895 Victoria act, municipalities could impose a "betterment-tax" on all side-residents if their property had received a value increase thanks to the realization of a public infrastructure. The yearly betterment-tax amount was computed as follows : 3% on the half of the property value's increase[33]. Similarly

[32] Most of the following informations are taken from Marongiu (2001, 83–87).
[33] deducing from the betterment-tax all other taxes eventually weighting on such a property value's increase

in the USA "special assessments" were used by various cities (Boston for example between 1866 and 1870) to finance their urban infrastructure expansion. In Prussia too in 1875 and 1893 two laws[34] made provision for the infrastructures burden to be covered by side-residents.

In Italy the principle that "those who had some earnings from an infrastructure should give a contribution to the betterment costs" had been included in the June 25th 1865 law on expropriation for public utility (Marongiu 2001, 86). Other laws approved in those years for specific urban transformation were based on such principle. However the 1865 law required very specific conditions to be applied. Conversely to the English, Prussian and American cases, in Italy a law allowing to systematically capture a share of property value increase did not exist and was not approved in the 19th century.

In 1904 however a tax on building land areas is approved in Italy[35]. According to that law 1 % of the land value increase was to be paid by the owner. In order to encourage truth declaring in 1907[36] it was established that, if an expropriation was needed, the expropriation amount to be paid by the municipality to the land owner would be the same property value amount declared by the owner (Marongiu 2001, 161–165). The 1904 law was designed however to incentivize building rather than capturing a share of property value increase[37]. Indeed the idea of allowing local authorities to control land rent was still not present (Dorigati and Molon 1982, 184). Obviously the approval of the tax on building areas and its application met a strong opposition by land owners and the tax was more effective in creating a harsh political debate than in giving more funding to municipalities (Marongiu 2001, 165). Indeed in Milan it was estimated that the tax could collect a total amount of only 341 709 lira (1% of a tax base of 34 M lira) which

[34] Law July 2nd 1875 and Lax July 14th 1893. According to the 1893 law betterment taxes were included among the ordinary municipal fiscal revenues.
[35] *Tassa comunale sulle aree fabbricabili*, approved by the July 8th 1904 Law n°320
[36] *Legge 11 luglio 1907 n°52*
[37] Such a tax was initially conceived for the Rome municipality but then extended to all municipalities who needed to incentivize to build houses. It was to be paid until a building had been completed on the area. "*…imporre una tassa sulle aree fabbricabili, la quale anzichè avere uno scopo fiscal, tendesse essenzialmente a stimolare i proprietary di aree fabbricabili a costruire sulle medesime nell'interesse di quell maggior sviluppo edilizio, che era vivamente reclamato dalle condizioni della città*."(Municipio di Milano 1907a).

appears not relevant at all if compared with the total fiscal revenue of the Milan municipality at that time[38].

Indeed in 1914, Milan's municipal administration was still asking for a legislative act allowing to capture a part of property value increase caused by municipal infrastructure since the tax on building areas was not judged sufficient (Sai et al. 1970, 229–230).

Not only did Italy not manage to design a proper tax to collect a share of property value increase but also the property tax[39] provided for by the 1865 law was collected not rigorously since the tax base (property values) was not kept up to date (Dorigati and Molon 1982, 263). Indeed a general property value review was realized only in 1870 and 1890 while partial property value reviews implemented after 1910 (according to the 1865 law) were not sufficient to modify the tax base (Sai et al. 1970, 229–230).

As a matter of fact, Italy was not able to implement effectively a tax system allowing to capture land value neither through betterment levies neither through a general tax on property values increase.

Land value capture tools were implemented in Paris under Haussmann's ruling as we show in the papers in Part II. However, in France, the case of "Haussmann's *caisse des travaux* and *bonds de delegations* remained exception. Indeed, Morizet suggests that Haussmann was fired because *petits bourgeois* opposed government taking part in land speculation (Morizet 1932).

[38] 1905 rough values : 23.8 M Lira of total fiscal revenues composed mainly of 13.4 million Lira from the excise duty, 5.8 million Lira from the additional tax on property and 1.2 million Lira from the *Tassa di esercizio e rivendita dei generi non riservati al monopolio dello Stato* and 1.2 million Lira from the *imposta sul valore locativo delle abitazioni* (Atti del Municipio di Milano 1906-1907)

[39] Including the additional tax (*sovraimposta comunale*) on property.

3 Infrastructure and repayable finance

This section focuses on infrastructure and investments undertaken by production units within Musgrave's Allocation branch. Capital expenditures require an upfront payment in front of benefits released along the whole life span of the infrastructure. Infrastructure implies a temporal mismatch between its implementation and payment and its benefits production. That's where *repayable finance* is concerned. By "repayable finance" we refer to all the financing tools (loans, bonds…) which allow a production unit to borrow and get money upfront in order to finance its investments. Such a debt shall be then paid back according to the loan or bond amortization schedule.

Using repayable finance to fund infrastructure needs raises more than one question both from the theoretical and practical point of view.

The use of public debt is a widely debated issue in public finance and it is far behind our research scope to make a fully comprehensive review on the topic. Nevertheless repayable finance plays such a major role in infrastructure and in the water and sanitation sector that some recalls from public finance theory are useful.

This section focuses on what public finance theory tells us on the use of public debt to finance infrastructure needs.

3.1 Generations and the burden of the debt

To discuss repayable finance, one needs the concept of generations. Two different definitions of a generation have been used in public finance.

On one hand there is the Lerner's position where a generation is composed of everyone who is alive at about the same time. This definition has been largely used in the 1950's and 1960's to argue that in macroeconomics terms the burden of the debt does not always shift to future generations. Lerner'view distinguishes in particular internal debt from external debt. Internal debt is not seen as a burden since it consists only of an internal transfer of income among members of the same generation: in the future, bond-holders will receive money from taxpayers. However the consumption level of the future generation is preserved (Lerner 1948).

Another way of defining a generation is "everyone who was born at about the same time"(Rosen and Gayer 2010, 467). This definition of a generation is at the root of

overlapping generations' models where various generations are alive in the same time and partially overlap. This kind of model has been used recently in the establishing of a "generational accounting" framework (Auerbach, Kotlikoff, and Leibfritz 1999) used to analyze intergenerational transfers among generations.

Lerner's view on internal debt and on its burden had been already severely criticized by Buchanan (1958) without using the overlapping generation concept. While Lerner's position was based on an organic conception of society as a group (macro-economic definition of the "burden" concept), Buchanan relies on the individual perceptions (micro-economic burden concept) to show that :"the taxpayer in future time periods, that is the future generation, bears the full primary real burden of the public debt" (Buchanan 1958, 32). Moreover, Buchanan shows that the debt's burden is by definition shifted to future taxpayers and that the distinction between internal and external debt is not relevant. Using an overlapping generation model also allows to demonstrate that a debt (internal or external) creates a burden for the future generations (Rosen and Gayer 2010, 468).

For the purpose of our research, macro-economics reasoning does not makes great sense and Buchanan's micro-economics burden concept is more appropriate. Furthermore, Lerner's distinction between internal and external debt is not very relevant to us since we mainly deal with local authorities or sub-national production units. Local public finance by definition relies exclusively on external debt (Musgrave 1959, 575). We used the concept of overlapping generations to explore intergenerational transfers implied by water infrastructure in our paper on the financing history of Milan's water and sanitation service (§6.5 in Crespi Reghizzi forthcoming b in Part II; §4.5.3 in Crespi Reghizzi forthcoming d in Part III).

3.2 Pay-as-you-use finance Vs run-of-river-finance

Infrastructure expenditures and investments usually have a long life time even if they are realized and paid upfront during the construction phase. Infrastructure (and in general all investment decisions) implies a temporal mismatch between those who make the decision and pay for it and those that will receive the benefit from it.

According to the benefit and fiscal equivalence principles (§2.2.1 and §2.10 respectively) one wishes that those who receive some benefits cover also the costs

implied. "If the period-one investments of a government level were entirely paid for by the current generation of taxpayers, the following generations would benefit from the ensuing goods without paying a penny for them. This is unfair" (Rossi and Dafflon 2002, 19).

Such a point of view is the one of *pay-as-you-use* finance which recommends to loan-finance the initial expenditures so that "future fiscal generations are made to pay for the benefits they obtain from these investments as far as their tax-burden covers the corresponding debt service inclusive of debt amortization"(Rossi and Dafflon 2002, 20). Next paragraph (§ 3.3) shall go in more detail on pay-as-you-use finance.

Pay-as-you-use finance (and the implied loan-finance) is criticized by those economists who think that investments are recurrent and continuous. This is what we call the *run-of-river-finance*[40] view (tax-finance in Musgrave's terms). According to that view each generation pays for some investments through tax-finance. The assumption of continuous investment implies that there is roughly a match between the benefits obtained by the current generation from the investments undertaken by the previous generations and the investments costs which shall yield benefits to future generations. According to this view there is no need for loan-finance as intergenerational equity is already obtained through continuous investments (Buchanan 1997, 133). Such a point had been also made by Musgrave: "Matters are simple enough if we assume that there is a continuous stream of capital outlays. In such a case tax-finance [run-of-river finance] of new projects becomes equivalent to pay as you use finance of old projects"(Musgrave 1959, 558).

However, Rossi and Dafflon point out that "this line of reasoning applies only to relatively large sub-national jurisdictions. For smaller local authorities [or smaller production units], as those of several European countries, the constant investment hypothesis seems far less realistic."(Rossi and Dafflon 2002, 20). Our research concerns mainly local authorities and sub-national production units. To this purpose the concept of pay-as-you-use finance fits well as we shall see in the next paragraphs.

[40]The term is chosen in analogy with hydropower where one distinguishes run-of-river production which does not require to stock water and production based on water storage.

3.3 Pay-as-you-use finance

To start with, we refer to the allocation branch within Musgrave's trilogy (§2.1).

> "The budget of the allocation branch should be balanced since the opportunity cost of resource withdrawal must be allocated to the individuals whose wants are satisfied; [however] annual balance is not necessary, since the cost of durable goods or of lasting services should be allocated over their useful life"(Musgrave 1959, 16).

Following Musgrave's line of thought, suppose a production unit requiring some initial investments[41]to deliver a good or a service through the time.

> "In these cases present expenditures will provide for future benefits. Where the initial outlay is large, taxpayers may not wish [or may not be able] to assume the entire cost at once and may prefer to pay over the years as the services of the new facility are enjoyed. This reflects the same motivation underlying the purchase of a house on a mortgage […]. The option of pay-as-you-use finance increases the flexibility of consumer budgeting and adds to the efficiency of private finance. Precisely the same results occur in public finance. The question is how the principle can be implemented at the public level"(Musgrave 1959, 558).

From a macroeconomic perspective the classic Ricardian[42] model assumes that in a perfect system with rationale taxpayer behavior and a pure credit market, tax-finance and loan-finance are equivalent. Indeed if a one-shot tax-finance solution is chosen the rational tax-payers may subscribe a loan to pay the tax. Thus "the outcome will be similar to that of public loan finance, the only difference being that private rather than public debt is issued"(Musgrave 1959, 559).

The assumptions of the Ricardian model are far from being met in reality since the individual taxpayer is much less rational and is not farsighted as supposed in the model. Moreover, "credit facilities are not available in equal terms to all taxpayers. Public loan

[41]In Musgrave's perception investments may include not only infrastructure but also "productivity-increasing services such as investment in education" (Musgrave 1959, 558).

[42] Buchanan (1958, xviii) reminds us that the Ricardian point of view had been deeply studied and defended by Italian public finance scholars such as Pantaleoni, de Viti de Marco and Einaudi.

finance may then be thought as a means of enabling tax-payers to secure tax-credit at equal terms"(Musgrave 1959, 559).

To understand Musgrave's argument, let us imagine a club requiring some significant investment. Either the club shares the investment cost as a *una tantum* fee to be charged to the members (which can eventually subscribe individual loans) or it subscribes a loan and shares year by year the annuities among the members. Loan-finance is a way of making only one collective loan in place of various individual loans.

Relying on pay-as-you-use finance (repayable finance) to fund capital expenditures is a way of implementing the benefit approach (§2.2.1) and the fiscal equivalence principle (§2.10) in a intergenerational framework. To respect the pay-as-you-use principle, public debt should be entirely paid back when "the benefits from the initial expenditure are being exhausted" (Musgrave 1959, 559).

We think that pay-as-you-use finance as discussed by Musgrave is a useful concept for our research. *Ex-post*, it is interesting to observe that on one hand Musgrave's discussion was still based on the macroeconomic distinction between internal and external debt (which we shall not retain) while on the other hand it was already based on a overlapping generation model (Musgrave 1959, 563–564). Moreover the whole "pay-as-you-use" concept considers that loan-finance allows to shift the investment cost (burden) on the future generations to solve the mismatch between costs and benefits.

From a practical point of view relying on pay-as-you-use finance justifies to "draw up a budget statement that divides the budget accounts into a current and capital part"(Musgrave 1959, 559). And indeed this kind of distinct accounting rule was made increasingly compulsory in public accounting.

Pay-as-you-use finance (repayable-finance) can also be justified on the grounds that it allows to minimize fluctuations "in the level of tax rates due to fluctuations in the level of public expenditures"(Musgrave 1959, 567). The argument was initially developed in the general case of public debt serviced by tax-revenues : debt was thought as a way of reducing "tax friction". The same argument however applies to the case of repayable finance serviced by endogenous revenues (club-finance § 2.6) since repayable-finance may allow to smooth club-fees fluctuations.

3.4 Repayable finance serviced by endogenous revenues

A particular case is the one of collective consumption units where all costs including debt-service are covered by endogenous revenues (also defined as “club-finance”§ 2.6). This case is defined by Musgrave as the case of “self-liquidating” projects”.

> “Self-liquidating projects may be defined narrowly as investments in public enterprises that provide a fee or sales income sufficient to service the debt incurred in their financing ; or they may defined broadly as expenditure projects that increase future income and the tax base. Such projects permit servicing (interest and amortization) of the debt incurred in their financing without requiring an increase in the future level of tax rates”(Musgrave 1959, 569).

In this case, public finance works in a very similar to market finance. The initial investment cannot be financed by the collection in advance of club fees. As in private investment, the required capital is obtained through debt which must be serviced by future revenues of the collective consumption units

There is nearly no-debate on the use of repayable finance for “self-liquidating” projects. Buchanan agrees too:

> “If a project is self-liquidating, then sufficient revenues are automatically earmarked for debt service from the start. For public projects of this sort, which must be of a quasi-private nature such that services may be marketed to individuals directly, debt financing is certainly appropriate. Many examples come to mind here. Perhaps the most familiar are municipal electric power facilities, municipal water and sewage systems, toll highways, and other projects of like nature”(Buchanan 1958, 128).

3.5 Repayable finance serviced by exogenous revenues

Let us consider the broader case of a collective consumption unit where endogenous revenues (club-finance revenues§ 2.6) are not high enough to fully cover operational costs or where they cover operational costs only at break even. In this general case club-revenues are not high enough to finance investments.

In this case it is very common that the investments might be undertaken by a governmental entity external to the collective consumption unit or by an upper level of government. This can be done in various ways :

- Investments are undertaken by the external entity and transferred as a in-kind grant to the collective consumption unit. In this case investments might be financed by the external entity through repayable finance or through tax-finance.
- Investments are undertaken by the collective consumption unit through repayable finance serviced by exogenous revenues (general taxation money coming from the external entity or by an upper level of government)

We shall discuss further this issue in §4.7.2 since it is very linked to the issue of Intergovernmental Relations and local public finance (Section 4).

3.6 Off-balance repayable finance

Until now we have always made reference to repayable finance which is accounted for on-balance : loans and bonds issued by a municipality or by the central government for example.

A local government unit or the central government may choose to externalize out to a private partner both the construction of an infrastructure and the production of the associated public service. This is the concession model also referred-to in terms of Public Private Partnerships (PPP).

“Through conventional public procurement, the public sector accounts infrastructure investments as capital expenditures. Alternatively, the public sector can contract out the infrastructure provision to a private contractor and is committed to remunerate the private partner for such a provision.

> Public-Private Partnerships (PPPs) exemplify the latter case since they are a model for procuring infrastructures and related services through a long-term regulated contract between the public sector (i.e. buyer) and private sector (i.e. seller). The contract bundles the infrastructure building and subsequent service provision so as to secure the private sector’s return on investment.” (Santandrea, Bailey, and Giorgino forthcoming, § 1)

PPPs and concessions are frequently used by the central government or by a LGU as a way of not increasing its debt level. Various authors argue however that most of the time a PPP agreement is not a way of avoiding debt but a only an artificial way of replacing on-balance-debt by less politically visible off-balance debt:

> "As such, PPPs allow the public sector to avoid the on-balance sheet treatment of borrowing and debt (Quiggin 2004). In so doing, the public sector substitutes today's capital expenditures by tomorrow's current spending which does not show up in the public sector's balance sheet."(Santandrea, Bailey, and Giorgino forthcoming, § 1)

An example of a PPP scheme is given by the case of Paris canals (Crespi Reghizzi forthcoming a, § 2). Indeed in that case the concession scheme implied an implicit off-balance debt as a yearly grant was guaranteed to the private partner by the local authorities as a compensation for the upfront capital expenditures he had covered.

In the present European context, national governments and local government units are subjected to borrowing constraints. In such a context privatization policies and PPP's are often seen as the *panacea.* We agree with Santandrea et al. and argue that from a public finance perspective the implicit off-balance debt associated to the PPP needs to be cautiously considered when evaluating the pros and cons of externalizing out an infrastructure. Such a position has been also underlined by Dafflon et al.

> "[…] public private partnerships, and even purely and simply renouncing local public responsibility through privatization are idealized – often mistakenly – as much better alternatives. Dafflon and Beer-Toth (2009), however defend the thesis that these arguments are excuses and that the countries concerned should (and could) take on real responsibility in the investment=loan duo"(Dafflon and Madiès 2011, 57)

3.7 Inflation

Inflation is another key factor when dealing with long term repayable finance. Indeed "when the government is a debtor and the price level changes, changes in the real value of the debt may be an important source of revenues" (Rosen and Gayer 2010, 463).

In presence of borrowings with fixed interest rate, changes in the price level may affect significantly the borrower-lender relationship. That was the case for example with the great inflation rate of the 1910-1930 years in France and Italy which had the effect of

absorbing a significant part of the debt's residual burden, transferring it, from a long run point of view, away from the borrower on the lenders. In the three papers in Part II we shall show the key role played by inflation in absorbing a part of the costs of Milan and Paris water and sanitation capital expenditures.

3.8 Intergenerational clubs

In Section 2 we have referred to club literature with an intra-generational focus. In fact very often collective consumption units deliver a good or service which is shared among overlapping generations of members.

> "For such intergenerational clubs, the life span of the shared goods exceeds the membership span of the founding members, so that the good is shared among generations until the time span of the good is exhausted"(Cornes and Sandler 1996, 461).

Public services based on a long lasting infrastructure (such as the water and sanitation one) may be looked at as intergenerational clubs. In this kind of clubs one of the possible problems is the "myopia" of the members in defining maintenance and investment policies. Indeed, by definition the forthcoming generations are not members of the club. Thus the club manager faces incentives to satisfy only the present generation members and adopt myopic policies consisting in postponing investments or implementing only the minimum level of maintenance.

4 Local Public Finance

The development of water and sanitation systems in Europe (and particularly in France and Italy) has been mainly a municipal one. That's why it is relevant to focus this section on what public finance theory can tell us on intergovernmental relations and fiscal federalism. This is the field of "Local Public Finance" to quote an expression from Bernard Dafflon[43].

Before starting our discussion it is useful to define the concept of Local Government Unit (LGU) to which we shall make frequent references : by "Local Government Unit" we refer to a sub-national level of government. For example it could be a municipality, a county or a region: we shall refer indistinctly to all of them as a LGU[44].

4.1 Federalism, decentralization and subsidiarity

It is worthwhile to remember here the distinction between the concepts of "federalism" and "decentralization". The distinction is based on two different disciplinary point of view of law and economics.

> "From the standpoint of constitutional law there are three possible distributions of state sovereignty […] : unitary, federal and confederate government units."(Dafflon and Madiès 2011, 5)

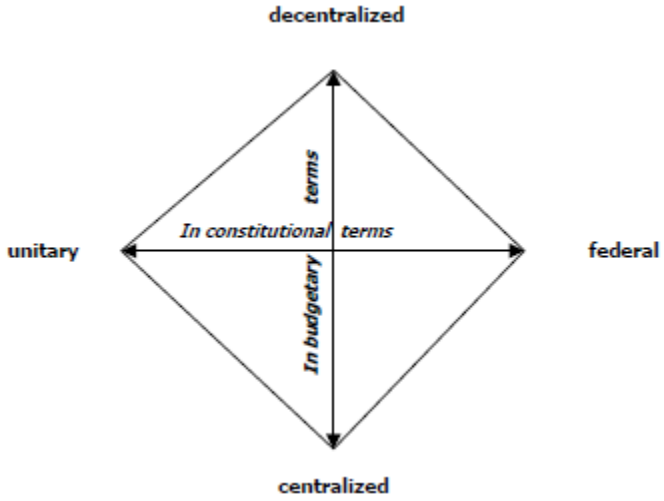
On the contrary from an economics point of view the question is not whether a government system is decentralized or not but to what extent is the system centralised in budgetary terms. As Wallace E. Oates claims : "In economic terms most if not all systems are federal"(Oates 1972, 18; quoted by Dafflon and Madiès 2011, 5)

Dafflon and Madiès (2011, 6) cross the constitutional law and the economics standpoints to obtain a two-dimensional map of systems of Government which might be useful to perform comparative analysis.

[43] The expression is inspired from the title of a book edited by Bernard Dafflon : "Local Public Finance in Europe"(Dafflon 2002)

[44] However implicitly we shall often have in mind the municipal level which has been the most relevant for the development of water and sanitation infrastructure in France and Italy.

Figure 3: Two-dimensional Map of Systems of Government



Source : Dafflon(2011, 6)

The concept of subsidiarity guides us into a third way of considering intergovernmental relations based on the idea that a specific public policy must be adressed at the most local level as long as local authorities are able to cope with it (Barraqué forthcoming, 2; Barraqué 1997, 3).

The principle of subsidiarity takes its origin as far as in the 16th and 17th century[45]. The concept of subsidiarity was also used at the end of the 19th century by the bishop von Ketteler in Germany (Barraqué forthcoming, 2). It was also inserted in the Catholic social doctrine in the 1931 "*Enciclica Quadragesimo anno*" by Pope Pius XI (Breton, Cassone, and Fraschini 1998). The subsidiarity principle found a new success in European institutions, first in the single European act of 1986 and later in the article 3 of the Maastricht Treaty of 1993 :

> In areas which do not fall within its exclusive competence, the Community shall take action, in accordance with the principle of subsidiarity, only if and in so far as the objectives of the proposed action cannot be sufficiently achieved by the Member States and can therefore, by reason of the scale or effects of the proposed action,be better achieved by the Community.

[45]Eberlin in 1521 and Althusius in 1603 (Breton, Cassone, and Fraschini 1998, n. 2)

As stated in the Maastricht treaty, the principle of subsidiarity "relates to the question of the assignment of powers to governing bodies located at different jurisdictional tiers in governmental systems though the Treaty itself does not assign any powers" (Breton, Cassone, and Fraschini 1998, 2). In other term the subsidiarity principle raises the question of where to assign powers without giving a sharp answer. Some clues might be found in the theory of decentralization which was developed by public finance scholars.

4.2 What should be decentralized?

We might refer once again to Musgrave's trilogy of government functions (§2.1). There is quite a large consensus on the fact that the stabilization branch should be under the central government responsibility. Interpersonal redistribution policies should also be centralized to avoid people "voting with their feet" (Tiebout 1956).

To the purpose of our research the most relevant issue is the question of assigning the Allocation Branch to the proper level of government. Two different principles may guide the policy-maker in such a choice:

- on one hand, the various local government units "differ greatly in their ability to render public services". According to a vision somewhat derived from the ability-to-pay approach (§2.2.2) the central government may wish to deliver a uniform level of service among communities and to "equalize fiscal positions"(Musgrave 1973, 612). We shall refer to this vision as the "**unitary principle**". That principle suggests to adopt some kind of territorial equalization mechanism on which we shall give some more detail in §4.4.
- On the other hand a vision based on the benefit approach (§2.2.1) suggests that "the policies of the allocation branch should be permitted to differ between states [Local Government Unit] depending on the preferences of their citizens"(Musgrave 1959, 181). We shall refer to this vision as the "**decentralization principle**". Indeed, "devolution best makes it possible to match local public services to citizens' preferences […if it is] accompanied by a solid democratic process with a solid institutional foundation." (Dafflon and Madiès 2011, 13). This paragraph shall focus on the content and implementation of such principle.

Fiscal federalism theory tells us that decentralized provision of public services which satisfies a 3-P trilogy (preference, participation and proximity) allows to improve the allocative and productive efficiency of Local Public Goods (LPGs) (Dafflon and Madiès 2011, 13). Exceptions to this principle are the case of economies of scale in production and the case of spillover.

In absence of economies of scale and of spillover, **Oates decentralization theorem** states that "each public service should be provided by the jurisdiction having control over the minimum geographic area that would internalize benefits and costs of such provision"(Oates 1972 quoted by; Dafflon and Madiès 2011, 13). Oates' theorem is another way of expressing the benefit approach (§2.2.1) and has very common views with Olson's fiscal equivalence principle (§2.10)(Olson 1969).

In presence of technical **economies of scale** for producing a particular good or service, these are *ipso facto* a justification for moving to a new functional scale (Dafflon and Madiès 2011, 19). For example in the case of a municipal collective consumption unit, this can imply relying on an inter-municipal production unit. Taking into account economies of scale gives an additional decentralization criterion suggesting "to assign the allocation function to the government tier which can provide a particular level of a public good or service at the lowest unit cost" (Rossi and Dafflon 2002, 25)

When **spillover** occurs it raises another issue to be adressed. The literature distinguishes production and consumption spillover.

> "**Production spillover** happens when the LPG produced in a local government unit (LGU) has effects in other adjacent LGUs without the latter taking part in the decision or sharing the cost of the LPG.
>
> **Consumption Spillover** happens when the LPG produced by a LGU A can be consumed by residents of adjacent LGUs who move to A to take advantage of the service without paying when it is not possible to exclude them (Dafflon and Madiès 2011, 19)".

Policy response to spillover might be to enlarge the collective consumption units scale in order to make the circles of payers, beneficiaries and decision-makers coincide.

Although the already mentioned Tiebout hypothesis is more relevant for redistribution policies it may also be extended to allocation policies since "agents are mobile and can vote to choose the jurisdiction offering the combination of local public goods and tax system closer to their preference"(Rossi and Dafflon 2002, 25).

4.3 Autonomy of Local Government Units

The autonomy of Local Government Units is twofold: "financial autonomy" which concerns LGUs revenues and "budget autonomy" which concerns their spending. Obviously the two autonomies[46] are not independent: the accountability principle suggests that LGUs should bear the financial cost of their spending decision; *vice versa* they might be able to make expenditures only if they have the corresponding financial resources available. In presence of an imbalance between the local revenues and expenditures, transfers from an upper level of government might take place (Dafflon and Madiès 2011, 40).

4.3.1 Financial autonomy

The "financial autonomy" of a local government unit might be defined as the ratio of autonomous revenues over its total revenues or as the ratio of autonomous revenues over its total spending. "Fiscal autonomy" of a local government is defined instead as the ratio between LGU own tax revenues to their total revenues. Fiscal autonomy is then a "sub-set of financial autonomy." (Dafflon and Madiès 2011, 42) "Fiscal sovereignty" is a more restrictive concept : a government has fiscal sovereignty if it can define all the tax criteria (tax base, tax rate , exemptions…). Very often a local government unit has only a "partial tax sovereignty" limited to a part of the taxation criteria. A local government unit has "tax flexibility" only if his autonomy of choice is limited to the tax rate (Dafflon and Madiès 2011, 28).

Local Government Unit Revenues include a variety of sources:

a) user charges and other endogenous revenues (club-finance) related to a particular local public good or service (§2.6),

[46] Another important concept is the one of "borrowing autonomy". It shall be treated separately in §4.5

b) exclusive taxes :“a tax for which only one level of government can exploit the tax base and collect all of the revenue from the tax” (Dafflon and Madiès 2011, 28),

c) shared tax : several levels of government have access to the same tax base but each level of government may apply a specific tax rate (Dafflon and Madiès 2011, 28). Included in this category are the piggyback taxes or *centimes additionnels*.

d) revenue sharing : here the tax revenues are collected by the central government who defines all technical aspects too (tax base, tax rate…) but a set rate of the tax revenues collected in a LGU is allocated to the LGU(Dafflon and Madiès 2011, 28; Giarda 2004, § 4.2).

There is no doubt that the first two categories should be considered as autonomous revenues. It is trickier to determine whether the categories (c) and (d) should be considered as autonomous revenues at least partly. This depends on the implemented set of rules and institutional setting. “The degree of autonomy depends, in this case, on how much latitude local governments have to negotiate when defining the formula that shall be used to distribute tax revenues between levels of government.”(Dafflon and Madiès 2011, 43)

In fact the distinction between autonomous and non autonomous revenues is not a black or white one. On the contrary a LGU might be classified according to a deacreasing sovereignty spectrum which goes from full local sovereignty in setting the tax rate and/or the tax base, to full central sovereignty. An intermediate category is the shared tax revenues one where the distribution key might be under the control of the central government or of the LGU[47].

4.3.2 Budget autonomy

Budget autonomy is defined as “the capacity of a local government unit to decide alone, fully independently, the categories, quantity and quality of services that it intends to offer to its residents”(Dafflon and Madiès 2011, 45).

[47] The classification of Tax Sharing suggested by the OECD is summarized by Dafflon and Madiès (Dafflon and Madiès 2011, 44)

In fact, the activities of a local government unit might be classified in three categories (Dafflon and Madiès 2011, 45):

- *Deconcentrated functions* where LGUs provide public services on behalf of central government with no or little freedom. "Central government dictates supply, and the local governments manage production according to criteria determined by the central ministries concerned"
- *Delegated functions* where LGUs have only a part of the responsibility. The central government keeps a relevant control on these functions through setting standards or other supervisory norms. A typical example in many countries is primary education.
- *Devolved functions* where LGUs "have strong controlling powers and full responsibility for services and their quality".

4.3.3 Decentralized taxation in practice

The principle of horizontal equity (equal fiscal treatment of citizen) is in contrast with a full local fiscal sovereignty where LGUs are free to determine the tax base and the tax rate. Dafflon and Giarda agree that in practice the sovereignty and management of the major modern fiscal sources (income tax, value added tax, business tax…) should be at least partially kept under the central government responsibility (tax base definition, control and arbitration). Some degree of autonomy could be left to the LGU concerning the tax rate of the income and value added tax. The degree of fiscal sovereignty left to LGUs is however highly dependent on the eventual presence and characteristics of the transfers and equalization mechanisms (Giarda 2004, § 4) (§4.4).

A part from user charges and other endogenous revenues related to a particular public good or service, exclusive local taxation is generally composed of the property tax which is local by definition. "Land value capture" tools (§ 2.11) are another possible fiscal source of income for the LGUs.

Depending on the entity of the LGUs functions and expenses, user-charges and exclusive taxes are eventually not sufficient to cover costs. That's where shared taxes, revenue sharing, transfers or equalization mechanisms intervene. We shall refer to them globally speaking as "transfers"

For sure if all the revenues of a LGU come from transfers, its autonomy is very limited (Giarda 2004, § 4.2). Shared tax and revenue sharing should be considered as a supplement to exclusive taxes of the LGU when these do not produce enough revenues to cover the functions to be fulfilled. On the contrary shared tax and revenue sharing should not be the only revenue of LGUs if one wishes the LGUs to be able to adapt both the fiscal pressure and the provison of goods and services to their citizen preferences (Giarda 2004, § 4.3)

4.4 Equalization and transfers

We mentioned in §4.2 the trade off between the two principles of decentralisation and the unitary principle suggesting the uniformity of treatment of citizens in different LGUs. This paragraph focuses on the latter principle.

Musgrave's redistribution branch should be kept at central government level. A redistribution policy in favour of inequality reduction is generally implemented using two policy tools : i) progressive taxation (including negative income tax) and ii) expenditures and provision of public services in favour of low-income people (Giarda 2004, § 5).

In many countries there are significant differences in the average income between the various geographical areas. In presence of full fiscal sovereignty and autonomy, LGUs would be able to cover very different levels of public expenditures and to provide very different levels of public goods and services. On one hand this might be considered as an expression of local preferences according to the decentralization theorem. On the other hand if a great lot of the Allocation Branch has been decentralised, significant differences in the level of public services provision could be judged unacceptable (Giarda 2004, § 5).

A great spatial variability of income within a country might have consequences in terms of ability of LGU's to provide public services. Policy-makers might judge such a situation unacceptable and wish to mitigate spatial inequalities through some kind of transfer and equalization mechanism.

From the institutional point of view the literature distinguishes two families of equalization mechanisms : vertical equalization where the transfers flow from the

central government to the poorer LGUs and horizontal equalization where the transfer flow straight from the richer LGUs to the poorer LGUs (Giarda 2004, § 5).

Equalization mechanisms might also be distinguished according to their target. On one hand there are *fiscal equalization mechanisms* where the central government transfers money from its budget to LGUs with low tax base. On the other hand there are *transfer mechanisms based on the satisfaction of public needs* where the central government "may wish to assure a minimum level of state services independent of self-finance by the states"(Musgrave 1961, 97; Giarda 2004, § 5.1).

When a policy of fiscal equalization is adopted one has to set the maximum level of the tax base below which a LGU is qualified for receiving a transfer. Do all LGU's below the LGU with the higher tax base receive a transfer ? or only those below the average ? Moreover the transfers should be done in the form of *general* and *non-matching* grants. This means respectively that the LGU has no constraints on the use of the grant amount and that the LGU receives a set amount to spend irrespective of its own contribution (Dafflon and Madiès 2011, 51; Giarda 2004, § 5)

On the contrary when an equalization mechanism is based on the provision of a minimum level of public services the policymakers have to set : i) what are the public needs indicators to adopt and ii) shall the transfer cover only a minimal level of public service provision or a merit level to be defined by the central government ? In this case the transfers should be done in the form of specific grants where the funds are allocated to a specific function (Dafflon and Madiès 2011, 51; Giarda 2004, § 5).

Another key choice to be made is the one between open-ended or close-ended transfers. "Grants are closed-ended if the total budgetary means made available by the government issuing the grant for a subsidizing function are limited" and their awarding based on selection criteria. Open-ended grants are just the opposite (Dafflon and Madiès 2011, 52).

Central governments may adopt a tailor-made equalization policy according to their normative judgment. In general such a policy is in contrast with the autonomy principle as expressed through the decentralization's theorem. The more the equalization transfer mechanism is constraining (sector-specific, close-ended, matching) the more it is an expression of the central power interference on the local autonomy (Giarda 2004, § 5).

The trade-off between the unitary and the decentralization principle is more a political and normative one rather than an economic one and local public finance theory leaves it with no clear answer.

4.5 Borrowing autonomy

Local Governing Units (LGU) might also borrow to finance their expenditures. We already discussed the use of repayable finance for infrastructure (§3.4 and §3.5). This paragraph focuses on local debt finance in the context of intergovernmental relations.

4.5.1 Constraints on local borrowing and the bailout issue

The first issue to consider is whether LGU should be totally free to borrow or not. According to the "financial market discipline" no legal borrowing constraints on LGUs are required since the "modern financial market would suffice to exert effective discipline on LGUs […] in particular higher interest rates" which "would impose effective sanctions and penalties on those jurisdictions living beyond their means"(Rossi and Dafflon 2002, 33 quoting other authors' positions).

Another key issue is whether the central government will grant financial support in case of financial distress of LGUs. Although LGUs are autonomous legal entities, in general it is not credible that the central government will not bail them out in case of risk of failure. Since the central government commitment not to bail out is not credible, financial markets will *de facto* not play their regulatory role as they might assimilate sub-sovereign borrowing by a LGU to sovereign borrowing. This is the classical moral hazard problem in presence of *soft budget constraint* (no or weak budget rules).

That is why some central government control on LGUs borrowing is required and performed in most countries.

4.5.2 For what purpose should LGUs borrow ?

The question here is for which purpose LGUs should rely on repayable finance? We already discussed that only the Allocation Branch should be decentralized while the Distribution and Stabilization branch should be kept under the central government responsibility (§4.2). The question is less general and should then be restated as : for which purpose LGUs should rely on debt-finance *within the Allocation Branch* ? From a

normative point of view, public finance theory answers that the pay-as-you-use principle justifies the use of debt-finance for capital spending only (Section 3).

In practice, if they have total borrowing autonomy, LGU might not limit the use of debt-finance to capital spending only. That is why in many countries there are constraints on the borrowing autonomy of LGUs based on the accounting separation between current and capital spending. On such a setting, the so called "golden rule" imposes:

> "a balanced current account combined with a capital account in which government borrowing for investment expenditures is tolerated or even promoted for inter-generational equity reasons. This distinction has been pushed ahead by arguing that a balanced current account must include debt service, which is defined as interest payment, and debt amortization according to a pay-as-you-use rule"(Rossi and Dafflon 2002, 28)

Not only the golden rule is the expression of the pay-as-you-use principle but it is also a way to impose a *hard budget constraint,* enhance the LGU *budget accountability* and limit the risk of financial distress of LGUs and need of bailout from the central government (Dafflon and Madiès 2011, 59).

4.5.3 Borrowing autonomy Vs Borrowing constraints

Once the golden rule is adopted, should the LGUs have an extended borrowing autonomy or should they be submitted to some borrowing constraints ? From a normative point of view there is no sharp answer to such a question. In practice, there is a great variety of institutional solutions and rules which might be characterized by the following questions[48].

- Does the LGU need to ask for a *a priori* authorization before borrowing or is the LGU only submitted to *a posteriori* control and sanctions ?Which level of government and which institution is in charge of the authorization process
- Is there a borrowing cap to be respected by a LGU ? How is it defined ?
- Can the LGU freely choose the lender or not ? Is market-borrowing authorized or not ?are there some special state-owned lending institutions having the exclusive right of lending to LGUs ?

[48]These questions are partly inspired from the list of questions made by Dafflon (2002, 12)

- What are the sort of loans authorized ? Which interest rate?

Depending on the country and possibly on the specific sector, each of these questions has multiple answers. That leaves us with a great number of combinations which call for useful comparative analysis (Dafflon 2002; Brugnoli 2009)

One should take note that the tighter the constraint set on LGUs' borrowing, the more LGUs are incentivized to avoid borrowing and to adopt eventually other solutions where debt is more implicit and externalized out (Dafflon and Beer-Tóth 2009) (§3.6).

4.5.4 Borrowing cap in EU countries

According to the Maastricht treaty Member states have committed to respect two ratios : i) a ratio of government deficit to GDP below 3% and a ratio of government debt to GDP below 60%. In EU definition the "government" label includes all levels of government from the central to the LGUs with exclusion of commercial activities[49] (where Tariffs cover at least 50% of the total costs) (Dafflon 2002, 2).

The subsequent question is then how this commitment should be shared among the various levels of government. In some European countries (such as in Italy) an internal stability pact has been approved to make the LGUs to contribute to the goals of the European Stability and Growth pact (SGP) in terms of percentage of consolidated sovereign debt / GDP (Fraschini 2002, 177). Other countries (such as France) chose to rely only on a strict application of the golden rule to discourage LGUs from excessive borrowing. A very deep comparative analysis on the implementation of EU constraints on subnational units of government is made in the collective book edited by Dafflon (2002).

4.5.5 Liquidity management

One should also consider that the borrowing issue is not independent from the rules applying to liquidity and savings of LGUs (Adam, Ferrand, and Rioux 2010). In some countries (such as in France) LGUs' liquidity is managed by the central Treasury. From

[49]The European legislation (Council Regulation n°2223/96 – SEC95) established that "market" public enterprises with Tariff covering at least 50% of the total costs should not be included in national public accounting" used for yearly reports to EU institutions in the framework of the European growth and stability pact (SGP).

the national government perspective such a policy has the great advantage of reducing short term liquidity needs of the central government.

On the contrary, from the local perspective, the LGU is not free to manage its cash and is not encouraged to accrue funds for future investment spending. The constraints on the liquidity management are an implicit incentive to LGUs for loan-financing investments having future revenues as collateral rather than financing them through savings from past revenues. This was particularly attractive in the historical phases of high inflation.

4.6 Autonomous and external collective consumption units

In §2.5, we used the concepts of collective consumption unit (CCU) and production unit to understand the twofold nature of public services. In some cases the collective consumption unit and the production unit may coincide while in others the production unit might be operated by a private entity (§2.8) or by another level of government. The degree of private sector participation is not our issue. In this paragraph we focus instead on the institutional nature of the collective consumption unit.

Indeed, when a LGU is responsible for the provision of a public good or service various choices are possible in terms of institutional nature of the related "collective consumption unit". The CCU can be fully part of the LGU, it can be a public law entity autonomous from the LGU or it can even be a company fully or partially owned by the LGU (cat. A, cat.B or cat.C in Table 2 below). What we label "LGU" could be indifferently a municipality, a county or a region. In the case of a municipality:

-In the first category (Cat A) the CCU is a municipal department with no legal autonomy, ruled by administrative law and public accounting rules

-In the second category (Cat B) the CCU is an autonomous legal entity ruled by public law and public accounting)

-In the third category (Cat C) the CCU is a company ruled by private law and private accounting rules, fully or partially owned by the municipality

Table 2 : institutional status of collective consumption units

	Cat. A	**Cat. B**	**Cat. C**
	Provision fully internal to the LGU	**Provision autonomous from the LGU**	**Corporatized provison**
Comment	The CCU is fully part of the LGU.	The CCU is an external entity	The CCU is a corporate entity (joint stock company or plc…) owned by the LGU
Law	Administrative law	Administrative law	Private law
Borrowing autonomy	Integrated in the LGU	Yes	Yes
Accounting rules	Public accounting rules	Public accounting rules	Private accounting rules

Source : author's elaboration

The CCU in the first category (Cat. A) are part of the LGU and in general the rules on intergovernmental relations (budget and financial autonomy, public accounting rules, borrowing rules) apply to them. On the contrary these rules do not apply to Corporatized CCU (cat. C) since they are external to the LGU. Autonomous CCUs (Cat. B) are somewhere in-between the two other categories.

4.7 Decentralization and infrastructure

We already discussed in Section 3 the peculiarity of infrastructure provision within the Allocation Branch. Additionally, in the previous paragraphs we analyzed the theories of fiscal federalism. In this paragraph we shall discuss how the public finance decentralization theory interacts with the infrastructure issue.

We showed that a public service function might be provided by a LGU according to three different decentralization paradigms: de-concentration, delegation or devolution (§4.3.2). As discussed by Frank and Martinez-Vazquez (2014, 5) these labels do not fit easily to infrastructure provision. Indeed one needs to consider both the specific public service function and the underlying infrastructure required to provide it and distinguish the *service provider* ("who is responsible for the end-service to citizens") and the *infrastructure planner* (who is "responsible over the project and investment cycle"). Indeed, the two concepts are necessary because even when a public-service is fully devolved to a LGU, the infrastructure investment cycle might be more or less under the central government authority in the various phases: planning, defining the technical standards, procurement, and financing.

Some literature classifies the infrastructure both according to its technical nature and to its business model. On the technical side the distinction is made between *point-*

infrastructure (hospital, school…) and *network-infrastructure* (roads, bridges, water, sanitation). The latter category (on which we focus) often delivers a public service mission *per se* (e.g. a bridge or a road) without requiring as many operational expenditures as in the point-infrastructure (e.g. teacher in a school)(Frank and Martinez-Vazquez 2014, 3). Indeed, public services based on network infrastructure (such as water and sanitation services) have a high ratio of fixed capital costs over total costs compared to other kinds of public services.

Concerning the business model, some literature (Martinez-Vazquez and Timofeev 2013, 47) classifies the infrastructure in three categories : i) *fee-recoverable* infrastructure where the user charges cover the full cost including the investment amortization, ii) *non-fee-recoverable* infrastructure with sizeable operations and maintenance costs (public parks, non toll roads) and iii) *non-fee-recoverable* infrastructure with very large operations and maintenance costs (mainly point-infrastructure). Martinez-Vazquez and Timofeev include water and sanitation in the fee-recoverable infrastructure. This might be true in many country specific cases but we already discussed that choosing the share of costs covered by revenues to the service is a normative trade-off which is the expression of the wished level of exclusion (case of CCUs with voluntary membership) or of the wished level of compulsory membership to the CCU (§2.9.2and §2.10).

For sure the provision of infrastructure in a decentralized context is a complex issue which raises many questions. From a normative perspective the first question is whether the central government should intervene in the provision and financing of decentralized infrastructure (§4.7.1). A second question concerns the technicalities of such a central government intervention (§4.7.2).

4.7.1 Should the central government intervene?

Assume a multi-level state where LGUs are responsible for the provision of some public services which requires some capital investments in infrastructure. Should the central government (or an upper level of government in the general case) intervene in the infrastructure provision and financing or should it let the issue to the LGUs alone ?

On one hand, applying the decentralization theorem (§4.2) to infrastructure would recommend to leave its provision to the local level in order to increase the allocative

efficiency and the satisfaction of citizen's preferences. On the other hand, the unitary principle (§4.4) would suggest to equalize infrastructure provision over the country.

The pros

At least three arguments are given in the literature to justify some level of central government intervention in subnational infrastructure : *coordination, efficiency*, and *equity* (Frank and Martinez-Vazquez 2014, 2).

The coordination argument makes reference to the need of coordinated capital spending in a multilevel government to achieve the goal of regional and national growth in the context of a Keynesian stimulus through public investment policy. The efficiency argument opens the door to central government intervention to solve the cases where full decentralization is inefficient (spillover effects, economies of scale).

We focus on the latter argument. The equity argument consists in pointing out that "disparities in the availability of and need for capital infrastructure matters very significantly for fiscal equity"(Martinez-Vazquez and Timofeev 2013, 46). This is a straight-forward extension of the unitary principle previously discussed (§4.4). One underlying question is "whether intergovernmental policies should address disparities in the accumulated stock of physical capital (sometimes referred to as "capital backlog" or "capital infrastructure gap") relative to some target level" or not (Martinez-Vazquez and Timofeev 2013, 19).

Assume that there are large inequalities between the various LGUs in the infrastructure endowment, policy-makers might judge such a situation unacceptable and wish to mitigate spatial inequalities in infrastructure. In that case the infrastructure gaps issue is very much interrelated with the whole intergovernmental relations framework (§4.4).

Another argument in favour of central government intervention frequently mentioned in the literature[50] is the fact that when they are under tight financial constraints LGUs may prefer to allocate the scarce financial resources available to operational expenditures rather than to investments. In other terms in presence of scarce financial resources LGUs tend to cut capital expenditures in favour of operational ones. This may call for some kind of ear-marked infrastructure equalization fund as we shall see next (§4.7.2).

[50]Ahmad and Brosio (2006), Moak and Hillhouse 1975 quoted by Martinez-Vazquez and Timofeev (2013, 6)

The cons

On the other hand, in a decentralized setting, the stock of infrastructure of each LGU (the infrastructure endowment) could be considered as the expression of the local preferences. Such a line of thought would suggest avoiding any central government intervention in equalizing disparities among LGUs in infrastructure stock (Martinez-Vazquez and Timofeev 2013, 19).

Another argument against government intervention in interfering in decentralized infrastructure provision derives from the fact that investments in infrastructure can be considered as a way of saving and that infrastructure stock equalization grants could encourage moral hazard phenomena. Following this line of thought, government intervention in favour of LGUs with smaller infrastructure stock "could be interpreted to represent essentially a bailout to a municipality that has failed to save in the past"(Martinez-Vazquez and Timofeev 2013, 5)

4.7.2 How should the central government intervene?

In general terms, the action of the central government concerning subnational infrastructure provision can take one of the following forms: a) planning and management of the investment cycle directly under the central government responsibility, b) definition of a general equalization mechanism which includes infrastructure needs too, c) ear-marked transfer specifically focused on capital spending and d) no infrastructure equalization policy.

a) Central planning and management of the investment cycle. In this case the central government is the *investment planner* (full responsibility over planning, management, procurement and financing of the investment cycle) and the LGU has only the role of *service provider*. In this model the LGU receives infrastructure from the central government as an in-kind grant. On the one hand, such a centralized model has the advantage of having a coherent and well technically optimized infrastructure (assuming that in general the central government has stronger technical capabilities than the LGUs).

   On the other hand, such a model creates a strong and risky dichotomy between the investment and the operations and maintenance phases. Indeed, the LGUs might perceive infrastructure as a free gift on which they have no

responsibilities. The LGUs might tend to free ride and spend as little as possible in maintenance of the local assets waiting for central government *ex post* intervention. Furthermore, the central government might under estimate the burden of operational expenditures associated to the infrastructure project. Sadly there are many cases of infrastructure implemented or financed by a central government (or even by external development aid in developing countries) turning to be a "white elephant" where the LGU is unable to afford operations and maintenance in a sustainable way. This sometimes leads even to the infrastructure being abandoned (Martinez-Vazquez and Timofeev 2013, 5).

In Italy after WWII local authorities had the formal responsibility of water and sanitation services. However the investments were mostly managed, planned and financed by the central government (Crespi Reghizzi forthcoming d, § 3.3). In France too, until the 1980's, central government influence on LGUs investments was quite tight as we shall discuss in § 6.3.5.

b) Integrated equalization mechanism which includes infrastructure needs. The infrastructure needs can be integrated either in the estimation of the fiscal capacity (in the case of a *fiscal equalization mechanism*) or as an input for the indicators related to public service provision (*equalization based on public needs satisfaction)*(Prud'homme 2007, 456) (§4.4).

In countries where subnational infrastructure is debt-financed against future revenues "this equalization should allow local governments to generate the necessary surpluses to cover amortization and interest on their debt in addition to maintenance of the associated capital assets"(Martinez-Vazquez and Timofeev 2013, 16). In this case a credible commitment of the central government to the stability of the equalization mechanism is essential to ensure the creditworthiness of the LGU.

In countries (such as Denmark[51]) where it is compulsory to finance subnational infrastructure through past savings the equalization model should generate enough surplus to allow savings for infrastructure spending in the future.

[51](Martinez-Vazquez and Timofeev 2013, 5)

In presence of significant inequalities among the various LGUs in the infrastructure stock at the time when the equalization mechanism is designed, the mechanism should take into account the disparities in the infrastructure stock and whether these are generating profit or deficit (Martinez-Vazquez and Timofeev 2013, 20).

c) Ear-marked transfer. In this model the infrastructure equalization issue is distinct from the general equalization mechanism. Ear-marked grants are allocated to the LGUs depending on the infrastructure needs. The grants could be more or less ear-marked, meaning that their use could be allowed for all capital expenditures, or restricted to a specific sector or even restricted to a specific project. The more the conditionalities are tight the less the LGU's autonomy is respected and the more such a model gets similar to the first model (a – central planning and management of the project cycle).

In most sectors there is a clear dependence between maintenance and investments in new assets. In general, a higher level of maintenance extends the infrastructure life time and makes possible to postpone new investments. Therefore in presence of an ear-marked mechanism, this should include both investments and maintenance expenditures in order not to bias the LGU's behaviour[52]. This argument suggests to adopt sector-broad ear-marked grants rather project-specific ear-marking (Martinez-Vazquez and Timofeev 2013, 19).

Another solution to make the LGU more aware of its responsibilities on the infrastructure assets could consist in shaping the ear-marked transfer mechanism as an intergovernmental loan system.

A intergovernmental loan system could also be appropriately designed by the central government to keep an eye and be able interfere on the management and service provision based on the financed infrastructure : the loan non-reimbursement could be conditional on the LGU respecting various

[52]This point of view is in contrast with the most common paradigm according to which even when the initial endowment in infrastructure is financed by an upper level of government(or by an external donor in developing countries), the maintenance and renewal cost in the future should be covered by the LGU. Depending on the accounting system future renewal costs are accounted for through different depreciation systems.

conditionalities imposed by the central government(Martinez-Vazquez and Timofeev 2013, 25).

d) No infrastructure equalization policy. This model is based on the idea that no specific equalization mechanism is needed for infrastructure. Independently from this choice the central government might have implemented a general equalization mechanism or not. Infrastructure provision is fully seen as an expression of local citizen preferences. If a general equalization mechanism exists, it is judged powerful enough to equalize LGU's with no need to address in a specific way the infrastructure issue.

   In this model, infrastructure is debt-financed by CCUs within the LGUs with the debt service and amortization flows being covered by endogenous revenues (§3.4) or by exogenous revenues (§3.5) depending on the specific infrastructure being -fee-recoverable or not fee-recoverable (in the classification by Martinez-Vazquez and Timosheev(2013)).

   One of the caveats of such a model is that relying only on market-based repayable finance "is likely to benefit primarily the richer sub-national government – those that are already better endowed than the average and that at the same time can more easily obtain the trust of lenders. An improved borrowing system (the well functioning bond market dreamt by many) can therefore increase, rather than reduce, existing disparities."(Prud'homme 2007, 456).

In practice, the four policy solutions detailed above are not exclusive or rival. There are many possible in-betweens among them. For example a central government could adopt central planning (model a) for a specific infrastructure sector only and on the contrary not adopt an infrastructure equalization policy (model b) in all the other sectors. Or alternatively a central government could rely on ear-marked transfers for a specific sector where infrastructure gaps are particularly big and adopt an integrated equalization mechanism for all other sectors. The combination of policy options is vast. No matter which combination is chosen, it will be heavily dependent on the general framework of intergovernmental relations in place in that specific country with respect to its federalist

or unitary nature, its degree of decentralization (§4.1) and to the choices made in the full autonomy Vs full equalization trade-off (§4.4).

Infrastructure should be considered as part of the broader governmental policy and "infrastructure projects alone should not be assigned any type of priority that is independent of the programs and public services that utilize these capital assets as inputs"(Martinez-Vazquez and Timofeev 2013, 47). All the same, the reverse is also true and the intergovernmental relations should not be designed without taking into account somehow the infrastructure issue and particularly the disparities in infrastructure endowments (Martinez-Vazquez and Timofeev 2013, 56)

The issue is complex and the literature suggests the policy-solution to be both sector and country-specific (Frank and Martinez-Vazquez 2014). Nevertheless, the same literature gives some policies suggestion depending on the infrastructure classification in § 4.7 : i) fee-recoverable, ii) non fee-recoverable with sizeable O&M costs and iii) non fee recoverable with very large infrastructure costs.

- Equalization for the latter category should take place through general purpose equalization grant which integrates the infrastructure issue to avoid the dichotomy between investment and O&M costs..
- The second category should be equalized instead through sector specific ear-marked conditional grant for investments and maintenance. (Martinez-Vazquez and Timofeev 2013, 47; Frank and Martinez-Vazquez 2014, 24).
- According to the same literature no equalization policy should be implemented for fee-recoverable infrastructure (infrastructure covered by endogenous revenues in our own terminology §2.6) which "would call for using credit markets and borrowing to facilitate those investments and fully abstain from any form of transfers. This is because the stream of future use fee receipts can be more easily pledged as a collateral for debt financing than general tax revenues vulnerable to the uncertainties of the political climate"(Martinez-Vazquez and Timofeev 2013, 48).

We do not fully agree with the authors on the latter recommendation at least for the three following reasons.

- Our first argument is that fee-level is at least as much vulnerable to the policy climate as general tax revenues. Moreover, there could be some kind of institutional commitment to the stability of the equalization transfers which would guarantee creditworthiness[53].
- As we have discussed in Section 2 (§ 2.9 and § 2.9.2), the choice of the share of the costs covered by endogenous revenues and those covered by exogenous revenues is a key normative trade off to be made by policy-makers and not an intrinsic value of a kind of infrastructure.
- When the choice is made to have a collective consumption unit with all costs covered by fees (club-finance), by definition its perimeter is financially isolated from the general budget of the LGU. In network infrastructure sectors where the capital expenditures costs are very relevant some specific kinds of financing equalization mechanisms needs to be designed to smooth, through time and space the infrastructure burden. We shall see that this kind of mechanism is largely present in the water sector through various institutional solutions (§5.2).

In practice, infrastructure grants are more common than what public finance theory would suggest.

> "The normative base […] would seem to justify a rather sparse use of capital transfers within the desired architecture of intergovernmental fiscal relations. […]However, in reality many countries regularly implement capital transfer programs, in many cases quite considerable in size by comparison to other transfers, which do not always conform to the normative prescriptions"(Martinez-Vazquez and Timofeev 2013, 53)

For example such a mismatch between theory and practice is confirmed by the kind of intergovernmental relations between the European Union and the member countries : one observes that "grants from the (small) EU budget to countries and regions most frequently take the form of infrastructure grants" (Prud'homme 2007, 456).

[53] Curious enough this had been argued by the same authors (Martinez-Vazquez and Timofeev 2013, 16)

5 Public finance & water and sanitation services

In the previous sections we have presented a discussion on public finance theory which is not sector-specific. In this section we take a dip instead into the water sector.

We start by giving some recalls on the European legal framework and on full cost recovery (§5.1) and the reasons behind it (§5.1.2). We review literature that shows that FCR is not necessary to achieve sustainability (§5.1.3). Indeed, gradually international institutions made a shift from full cost recovery to sustainable cost recovery and the 3 T's paradigm (§5.1.4). In § 5.2 we analyze some institutional choices which allow equalization and financial economies of scale in the water sector.

The last paragraph (§ 5.3) proposes an original matrix which summarizes all the trade-offs on which water and sanitation services policy-makers needs to take position. Such a trade-off matrix might also be used by researchers to perform comparative or historical analysis (as we shall do in Part IV).

5.1 From full cost recovery to endogenous / exogenous revenues

5.1.1 European water framework directive and full cost recovery

The full cost recovery (FCR) principle became increasingly popular through the 1990's and was *in fine* adopted by EU legislation within the Water Framework Directive (WFD) – 2000/60/DCE which is the key water policy act in Europe (UE 2000).

Specifically, article 9, "Recovery of costs for water services", states that "Member States shall take account of the principle of recovery of the costs of water services including environmental and resource costs […] and in accordance with the polluter pays principle"..

According to the WFD by 2010 « Member States shall ensure by 2010 :

> -that water-pricing policies provide adequate incentives for users to use water resources efficiently and thereby contribute to the environmental objectives of this Directive,
>
> -an adequate contribution of the different water uses, disaggregated into at least industry, households and agriculture, to the recovery of the costs of water services, […] according to the polluter pays principle.

Member States may in so doing have regard to the social, environmental and economic effects of the recovery as well as the geographic and climatic conditions of the region or regions affected."(UE 2000)

5.1.2 The reasons in favor of full cost recovery

De facto through the full cost recovery concept the European legislation takes position, in the normative trade off between cost recovery based on exogenous revenues or endogenous ones (§2.6) in favour of endogenous revenues cost recovery.

What were the reasons behind the adoption of the full cost recovery principle within European legislation? According to Massarutto (2002; 2004; 2007) the European legislation adopted the full cost recovery principle for four major reasons :

a) The implementation of a more equitable cost allocation based both on the polluter pays principle and on the internalization of externalities.

b) The adoption of tariff formulas which would encourage a more sustainable use of water resources. On these grounds, subsidies and rebates were forbidden and it was established that the total costs of services was to be covered by the users.

c) To guarantee the financial equilibrium of water and sanitation utilities through autonomous and stable endogenous revenues. Endogenous revenues were seen as more stable and predictable than exogenous ones. Through this vision endogenous revenues were to be preferred as collateral for repayable finance.

d) To make compulsory for the water and sanitation services to adopt accounting rules based on a correct depreciation and provision for long life time infrastructure assets.

Officially full cost recovery was mainly justified at the European level on the environmental grounds (reasons (a) and (b)) rather than on the financial sustainability ones. Massarutto argues that in reality the latter objectives are very relevant arguments too (Massarutto 2002; 2004; 2007).

5.1.3 From full cost recovery to sustainability

In reality, applying the full cost recovery is not an easy task : on the one hand, identifying the costs (and particularly the environmental costs) is not trivial (Massarutto

2004); on the other hand, applying Long Run Marginal Cost Pricing is not appropriate for natural monopolies (§2.9.1). Massarutto points out that "once the pricing rule deviates from the orthodox LRMC, the choice of the pricing structure is by far a political decision whose pros and contras originate from other reasons than allocative efficiency"(Massarutto 2002, 3). As we already argued (Section 2) the trade-off between cost recovery based on endogenous and exogenous revenues is a normative one.

FCR might be a too rigid and ambiguous concept since by definition costs are recovered. Massarutto suggests "that instead of asking for FCR, the legislation should require that externalities should be avoided" (Massarutto 2002, 3). These could be both intra-generational[54] and inter-generational[55] externalities. In other terms, sustainability might be achieved as long as the natural and infrastructure capital are not damaged from a single generation at the expenses of the forthcoming ones. Such a vision does not require to impose full cost recovery and to ban *a priory* any exogenous revenue. (Massarutto 2004; 2007).

In fact even within the European institutions the report of the WATECO working group[56] (UE 2003) clarifies that full cost recovery is not an objective *per se* to be achieved everywhere. Member States should take action in order to obtain a situation where the polluter pays principle is sufficiently implemented and perceived. That leaves to the Member states the latitude of taking into account in their decision the social, environmental and economic impacts of full cost recovery (UE 2003, 130).

Indeed, through the 2000 decade imposing the full cost recovery and forbidding all sorts of contribution from endogenous revenues (tax-finance) on environmental grounds appeared excessive and too rigid to many international institutions which progressively softened their position as we shall see next.

[54] Think of the classic example of an untreated waste water discharge into an un-spoilt River system which generates an externality on the downstream water users.
[55] Think of a water utility which does not invest in network renewal and transfer the renewal burden on the next generations.
[56]Such a report clarifies what is the correct interpretation of the WFD

5.1.4 Sustainable cost recovery and the 3T's

In the last ten years great attention has been given by international institutions and donors to the issue of sustainable financing for the water sector through various working panels[57] which progressively softened their position from *full cost recovery* to the more realistic and pragmatic concept of *sustainable cost recovery* (OECD 2009a).

This process led around the Istanbul 2009 World Water forum to the OECD publications (OECD 2009b; OECD 2009a; OECD 2010) clarifying concepts and defining a harmonized terminology on costs and financing sources well known as the "3T's" (Tariffs, Taxes and Transfers). The issue was also picked up again in 2012 at the World Water Forum in Marseille where the whole "Condition for Success 2 -Financing water for all*"* was focused on the concepts of the 3T'sand of "Sustainable Cost Recovery*"* (Tremolet 2012a; Tremolet 2012b).

According to the OECD 3T's paradigm (Figure 4), the costs of a water and sanitation service may be covered *in fine* by three source of revenues : Tariffs (direct charges paid by the user), Taxes (general taxation paid by taxpayers) and Transfers (subsidies from an upper level of government or from foreign donors). Repayable finance tools might be used to finance in the short terms some investment and paid back on future revenues from the 3T's.

The trade off between the 3Ts is still a source of debate. According to the OECD the Tax source of revenue is more appropriate for sanitation rather than for water (OECD 2009b, 56). Also, the OECD suggests that urban services should be able to apply FCR (rely on Tariff revenues only) while rural ones may have more need to rely also on Tax revenues in particular for investment and renewal of infrastructure.

According to the Camdessus panel and to the 3Ts paradigm a sustainable cost recovery includes three aspects:

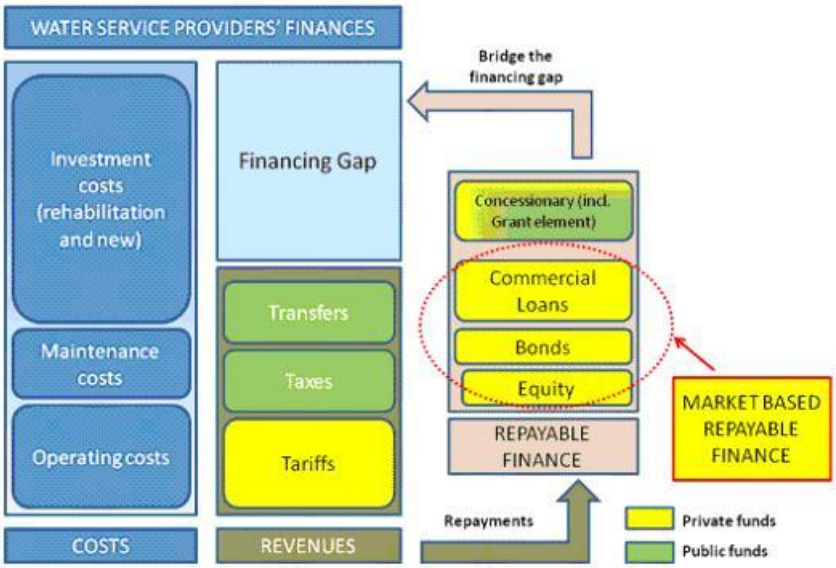
- An appropriate mix of the 3Ts which allows both to cover recurrent costs including investments costs and debt amortization

[57]Such as the ones chaired by Mr Camdessus and Mr Gurria which produced various reports (Van Hofwegen 2006; Winpenny 2003).

- When the system relies also on Tax revenues these should be previsible and secured well in advance

The water tariff should be designed in order to be affordable for all on one hand and to ensure the financial sustainability of the operator on the other hand.

Figure 4 : the 3T's paradigm



Source : OECD

5.1.5 Endogenous & exogenous revenues

According to the OECD 3T's paradigm (OECD 2009) the costs of a water and sanitation service may be covered *in fine* by three source of revenues : Tariffs (direct charges paid by the user), Taxes (general taxation paid by taxpayers) and Transfers (subsidies from an upper level of government or from foreign donors).

In fact the 3T's paradigm is another way of expressing the normative trade off to be made between club-finance and tax-finance or between endogenous and exogenous revenues (§2.6)

The terms endogenous and exogenous revenues have been proposed by Massarutto(2002; 2004; 2007) who points out that "it becomes very difficult to distinguish prices from taxes"(Massarutto 2002, 13) and that "it is often a pure terminological convention that of considering revenues either as direct charges or

taxation. What really matters is who pays, for what purpose and how much"(Massarutto 2002, 25).

We follow Massarutto and we distinguish revenues endogenous to the WSS (Tariff according to the OECD) and ordinary fiscal revenues exogenous to the service (Taxes). According to this line of thought, sanitation levies which have a fiscal nature are considered revenues endogenous to the service contributing to the "Tariff" element of the 3T's. By definition costs left uncovered by endogenous revenues are covered by exogenous revenues (general taxation at the local or national level). Local Exogenous revenues may be labelled as "Taxes" in the OECD 3T's while National exogenous revenues should be considered as "Transfers".

Apart from the endogenous and exogenous source of revenues, land value capture tools can play a financing role too in the infrastructure expansion phase. The idea is to make the property-holders to contribute too to the infrastructure development costs (see also §2.11). In Part II we discuss the role of land-value capture tools in the financing of Paris and Milan water infrastructure.

Box 2 : Water and sanitation cost recovery in Fribourg canton, Switzerland

Switzerland is not submitted to the full cost recovery principle as set by EU Water Framework Directive. In a recent paper Bernard Dafflon (Dafflon 2013) discusses how cost recovery for water and sanitation is organized in the Fribourg canton in Switzerland.

Water supply costs are accounted for in distinct accounting chapters :

- [II]Initial investment (*Premier investissment*)
- [IR]Investment for Renewal (*Investissement de renouvellement*)
- [PI] Investments for fire protection and other public functions
- [F_Opex] Fixed Operational Expenditures (*coûts fixes d'exploitation*)
- [V_Opex] Variable Operational Expenditures (*coûts variables d'exploitation*). This is roughly the marginal production cost

Three categories of payers are distinguished in Fribourg canton :

- [A] Owners of building connected to the water supply system

- [B] Owners of properties (buildings and buildable lands) unconnected to the water supply system but located in areas served by the water supply system
- -[C] Users of the water service (connected to the water supply service)
- -[D] Tax Payers

The cost sharing solutions are the following ones :

-Initial investments costs [II] are covered both by categories [A] and [B]. Owners of properties unconnected to the water supply system but located in areas served by the water supply system are asked to contribute too as the undertaken initial investment increase their properties values: they will be free to connect to the service it they wish to do so. Costs are shared among economic agents according to the maximum potential demand of each economic agent. Category A pays a *una tantum* connection levy (*taxe de raccordement*). Unconnected properties owners [category B] pay only a fraction of the contribution of category A (roughly 60-70 %) through a preference levy (*charge de preference*). When a property owner wishes to connect, it will have to pay the difference between the connection levy and the preference levy he already paid.

- Investment for Renewal costs [IR] are covered by an yearly infrastructure renewal charge which is paid both by category A and B.

-Fixed Operational Expenditures [F_Opex] are shared among the users of the water service independently of their consumption

- Investments for fire protection and other public functions [PI] are covered by the general municipal budget paid by tax payers

-Variable Operational Expenditures [V_Opex] are shared among the users of the water service according to their water consumption.

Bernard Dafflon also gives a full description of how sanitation costs are shared in Fribourg canton. The cost sharing scheme follows the same principles. One of the specific aspect is that rain water collection and drainage costs have are covered by the general municipal budget and not by water users.

It seems to us that one of the caveat of the cost recovery approach implemented in Fribourg canton is its accounting complexity. On the other hand it is a very interesting way to capture land value gains and make property owners to contribute to the investment costs.

5.2 Equalization and financial economies of scale

Water and sanitation are local public services. Very often their provision is under the responsibility of the local governing unit. Moreover the water and sanitation sector is highly capital intensive. Some system of equalization between the CCU are required to smooth through time and space inequalities and infrastructure financing needs.

According to Barraqué (2011a) there are four kinds of equalization : a - spatial equalization, b- temporal equalization, c-inter-sector equalization[58] and d- social equalization. We already talked of temporal equalization when we discussed of infrastructure and repayable finance (Section 3). We shall focus here on spatial equalization mechanisms in the water sector.

We distinguish two categories of spatial equalization mechanisms :

- Implicit equalization, i.e. the equalization is only based on the collective consumption unit size.
- Explicit equalization, i.e. there is a *ad hoc* institution or mechanism to smooth inequalities among collective consumption units.

Examples of implicit equalization are UK water services which are run on a large geographical basis (there are only 30 water services utilities in England). In Italy the attempt was made to follow the English example: the 1994 reform asked to provide WSSs at the Optimal Provision Area (*Ambiti Territoriali Ottimali – ATO*) scale. However the reform had to face a strong resistance and was implemented with great inertia. Implicit equalization was not really obtained since many ATOs are much too small (little area and/or population deserved) (Linares, Massarutto, and Anwandter 2012, 7–8).

[58] The inter-sector equalization approach is typical of the German model where a single municipally owned company provides various public services (water, gas, urban transport). Inter-sector cross subsidies may take place.

In some countries there are explicit equalization funds which help local water and sanitation services to finance their infrastructure. Various choices have to be made in designing this kind of fund:

a) Geographical size of the fund : river basin scale, state / regional scale or federal scale

b) Source of the revenues of the fund : is the fund fuelled by water user levies or is it composed of subsidies coming from the government budget (general taxation) ?

c) Kind of financing tools allowed : grants and/or loans ?

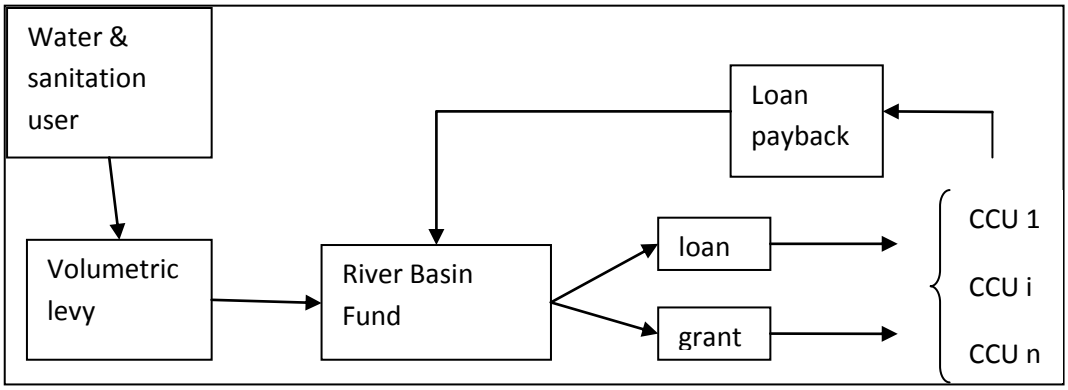
d) An additional issue which goes beyond the equalization purpose is whether the fund is designed also to obtain financial economies of scale. Does the fund also borrows on the financial market on behalf of the collective consumption units ?

Two examples of water sector equalization fund are the River basin agencies[59] in France (*Agences de l'eau)* and the USA revolving funds system (Figure 5 and Figure 6 respectively). One of the key differences between the two systems is the fact that funds of the French River Basin agencies are fuelled by the water and sanitation levies paid by the users through their water bills while the money of the US revolving funds comes from the federal government subsidies. This implies that in France users pay a total water price which includes water and sanitation levies set by the River Basin agencies and thus feel the "real cost" of water and sanitation services. On the contrary, in the US system the users are kept in the low water tariff illusion since a part of the cost are subsidized by federal Transfers.

In fact, it has often been argued that the French River basin agencies are essentially a temporal equalization tool rather than a spatial one since the amounts received by each CCU are roughly equal to the amounts paid by the CCU users through levies.

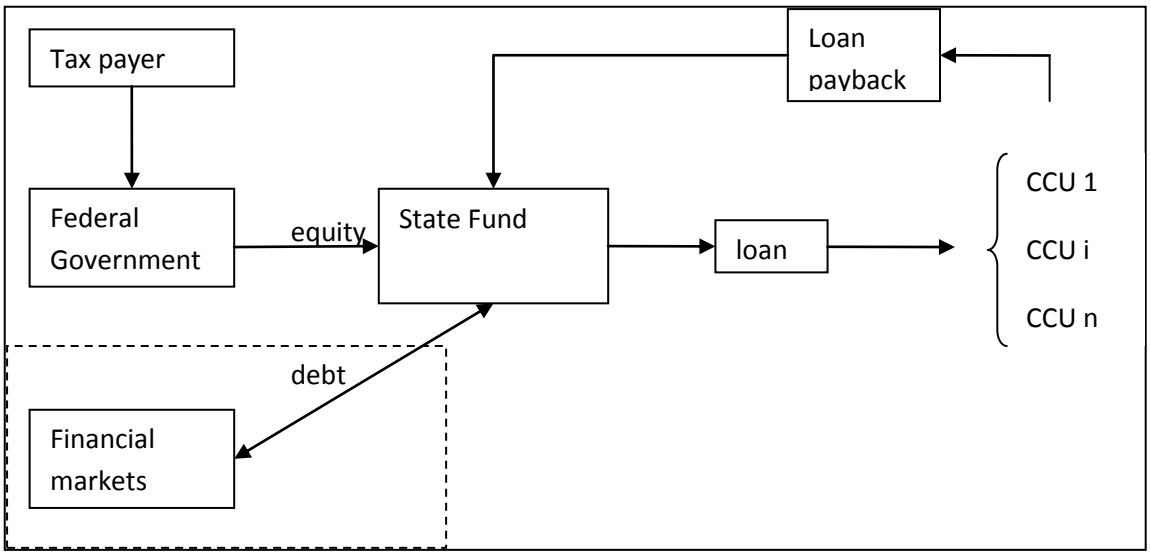
[59] See also Barraqué (Barraqué forthcoming; Barraqué 1997)

Figure 5 : The French river basin equalization scheme



Source : author's elaboration

Figure 6 : The USA revolving fund system



Source : author's elaboration

An additional feature of the US revolving fund system is the fact that the State Fund can also borrow on the financial markets through bonds or loans in order to leverage more funds (dotted box in Figure 6). In such a way the fund not only has an equalization function but also helps the collective consumption units to pool together to get an easier and cheaper access to debt financing (Linares, Massarutto, and Anwandter 2012; Bougelot and Loury 2003). This is what Linares et al. define as "financial economies of scale i.e. benefits from centralizing and standardizing the financing functions and financial documentation through a dedicated institution" (Linares, Massarutto, and

Anwandter 2012, 5) . The same authors also show that institutional mechanisms allowing financial economies of scale are essential to lower the costs of water and sanitation services which are both local and highly capital intensive.

Linares et al. make a comprehensive comparative analysis of various institutional agreements which allow a financial economy of scale mission to be fulfilled in various countries. Among the various cases at least two cases are worth mentioning here :

- The Netherlands water institutions & the NWB Bank (Nederlandse Waterschapsbank N.V.)
- The *Aguas de Portugal* (AdP) holding system

In the Netherlands the water sector is characterized by a multi-level governance which is composed of many institutions among which there are 24 regional water boards in charge of water quantity and quality management (including sewage treatment) and 10 drinking water limited liability companies owned by municipalities and provincial governments (OECD 2014; Linares, Massarutto, and Anwandter 2012, 70). In 1954 the NWB was created originally with the purpose of financing investments in the sea defences. It plays the role of the "house banker and treasurer for the water boards". NWB also "finances municipal and provincial authorities, drinking water supply companies, environmental organizations and housing, healthcare and educational institutions" (Linares, Massarutto, and Anwandter 2012, 70).

In Portugal, since the reform of the 1990's, there are many multi-municipal companies responsible for the planning, financing and management of bulk water supply and waste water treatment plants. Each multi-municipal company is partially owned by the served municipalities and by *Aguas de Portugal*. AdP is a private law company owned and controlled by the central government (also through state owned financial institutions). The AdP holding plays a major role in the Portuguese water sector since it "provides funding, project consultancy, technical personnel and advisory services to its subsidiaries". The holding AdP is the unique borrower for the Portuguese water sector. Often the Portuguese government gives a sovereign guarantee for the borrowings (Linares, Massarutto, and Anwandter 2012, 58). Through such an institutional design loans awarded by lenders such as the European Investment Bank are obtained at better financial conditions.

5.3 Key trade-offs for Water and Sanitation Services

In the previous paragraphs we discussed the concepts how the concept of full cost recovery, sustainable cost recovery and the 3T's can be expressed in terms of endogenous Vs exogenous revenues (§5.1). We also analyzed the institutional tools available to allow equalization and financial economies of scale in the water sector (§ 5.2).

Water and sanitation services are natural monopolies and club goods as Elinor and Vincent Ostrom show:

> "Once appropriated from a natural supply, water can be dealt with as a toll good to be supplied to those who have access to a distribution system; similarly, once taken from the ocean, fish can be dealt with as a private good. Water management problems, typifying common pool resources, are likely to be subject to market failure while water distribution problems typifying toll goods are likely to manifest market weaknesses associated with monopoly supply"(Ostrom and Ostrom 1999, 78)

Such a point of view is shared by Bernard Barraqué (2009, 4): "Water services, as a set of infrastructures, are club goods, even though the club ideally encompasses the full territory of a city and its suburbia (there are economies of scale and of scope, up to a certain point, and frequent club effects)".

In the earlier sections we have discussed many aspects of public finance without focusing specifically on water and sanitation services. Choosing to cover costs through endogenous or exogenous revenues is one of the various trade-offs which have to be made by policy makers but we pointed out in the previous sections a great lot more of issues which have to be set and which have an impact in terms of water and sanitation infrastructure financing.Table 3 below summarizes some of the key trade offs to be made by policy makers. The last column gives the references of the paragraph in which the issue has been discussed.

Table 3 : Key trade-off for WSSs

Trade off		**Options**		**Paragraph**
1	**CCU-Membership**	1a	Voluntary	§2.6
		1b	Compulsory	
2	**Revenues**	2a	Endogenous	§2.6, §2.9.2, §2.10 and § 5.1
		2b	Exogenous	
		2c	Both	
3	**Institutional nature of the CCU**	3a	Internal to the LGU	§4.6
		3b	Autonomous from the LGU	
		3c	Corporatized	
4	**Legal nature of the endogenous revenues**	4a	Tariff	
		4b	Fiscal	
5	**Technical nature of the endogenous revenues**	5a	Volume	
		5b	Flat	
		5c	Two part	
6	**Source of the exogenous revenues**	6a	Local	Section 4 and §4.7
		6b	National	
		6c	Both	
7	**Infrastructure project planning & management**	7a	By the central gvt	Section 4 and §4.7
		7b	By the LGU	
		7c	By the CCU	
8	**Who borrows ?**	8a	The central Gvt	Section 4 and Section 3
		8b	The LGU	
		8c	The CCU	
8	**Infrastructure end-payer**	9a	By the central government	Section 4 and Section 3
		9b	By the LGU	
		9c	By the CCU	
10	**Spatial equalization & financial economies of scale**	10a	Implicit (Based on the CCU size)	§ 4.4 and § 5.2
		10b	Explicit (revolving funds, financial mutualization)	

Source : author's elaboration

In fact not only the policy-makers should consider and take position on the trade-offs listed in the above table but the same list of issues might be used by the researcher to analyze past and present policies. Indeed this is the approach we undertook. In Part IV (Section 6) we shall analyze the long run path of the French and Italian water sector using such a matrix.

1) Is the membership to the water and sanitation CCU voluntary (presence of exclusion) or compulsory (§2.6)?
2) What is the level of exclusion signal / compulsory membership fee implemented? Is cost recovery based on endogenous or exogenous revenues (§2.6, §2.9.2, §2.10 and § 5.1) ?
3) What is the legal and institutional nature of the collective consumption unit (CCU) (§4.6) ?
4) What is the legal nature of the endogenous revenues? Do they have a tariff or a fiscal nature? Are they based on a tariff or on a tax system ?
5) What is the technical design of the endogenous revenues, are they metered and billed according to volume? Or is it a flat fee rate? or a two part tariff based both on a flat rate and a volumetric part ?
6) Where do the exogenous revenues come from? Do they come from the Local Governing Unit (LGU) or from the Central Government? Through this question it is all the topic of Local Public Finance which is concerned (Section 4)
7) What entity and level of government is in charge of the planning and management of investments (Section 4 and §4.7)?
8) Who borrows to finance investments in the short run (Section 3, Section 4 and §4.7) ?
9) What entity and level of government is the end-payer of the investments costs (Section 4 and §4.7)?
10) Is there a spatial equalization mechanism in place? What kind is it? (§ 4.4 and § 5.2)

Part II. Network expansion phase within urban development : two case studies

a) The Finance of Paris Water: Local Public Goods at the Onset of Industrialization, in Infrastructure Finance in Europe. Insights into the History of Water, Transport and Telecommunication, edited by Massimo Florio, Giuseppe de Luca and Youssef Cassis [submitted to **Oxford University Press**]

b) Providing and financing a municipal infrastructure : a long run analysis of water and sanitation investments in Milan (1888-1924), in The Economics of Infrastructure Provisioning - The (Changing) Role of the State, edited by Arnold Picot, Massimo Florio, Nico Grove and Johann Krantz [submitted to **MIT Press**]

c) Providing a municipal infrastructure: how did Paris and Milan finance their water and sanitation infrastructure (1853-1925) ?[to be published in FLUX - Cahiers scientifiques internationaux Réseaux et territoires]

The publication rights for the three papers in Part II have been ceded to the publishers. Thus, only the abstract are available in this thesis.

A "working paper" version of the two first papers is available online on http://ideas.repec.org/p/mil/wpdepa/2012-22.html and

http://www.certet.unibocconi.it/wps/wcm/connect/cdr/centro_certet/home/working+papers/providing+and+financing+a+municipal+infrastructure

The Finance of Paris Water: Local Public Goods at the Onset of Industrialization (1807-1925)[60]

Olivier Crespi Reghizzi[61,62]

Abstract

Sustainable financing is a major challenge for the water sector both in many developing countries where water and sanitation services are still in the expansion phase and in Europe where the water industry also faces major investments needs too. To give more depth to the present policy debate a historical perspective on water services financing is needed. This paper focuses on how the completion of the Paris water system (Ourcq canal, water supply network and sewers, long distance aqueducts) was financed during the 1807-1925 time frame. The Paris municipal finance framework is analyzed. A variety of financing schemes and institutional solutions (municipal budget - fiscal resources, concession, municipal bond and land added value capture schemes) are identified and described. The financial flows of Paris' water, sanitation and canals service over the 1865-1930 time frame are analyzed in depth. The OECD 3T's framework is adopted to analyze the long run cost allocation. Tariff" revenues were insufficient to cover full costs which were partially covered by Tax sources too. Long term debt, inflation and land added value capture mechanisms played key roles in absorbing part of the investments' costs.

Keywords:

Financing history, Infrastructure, Water supply and sewerage, Paris, Municipalization, 3T's, cost sharing, bonds, inflation, land value capture

JEL: H54 - H72 - H74 - L95 - N73 - N74 - N83 - N84 - N93 - N94

Acknowledgments

I wish to thank the Paris water operator *Eau de Paris* and the *Agence Nationale de la Recherche* (ANR) through the EAU&3E research project (http://eau3e.hypotheses.org) for their financial support. I am also grateful to all those who read and made comments on the earlier version of this paper.

[60] An earlier version of this paper was presented at the XI Milan European Economy Workshop, June 22 - 23 2012.The MEEW was supported by the Jean Monnet Chair of EU Industrial Policy and the EIBURS program. The usual disclaimer applies.

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Providing and financing a municipal infrastructure: water and sanitation investments in Milan (1888-1924)

Olivier Crespi Reghizzi[63,64]

Abstract

Sustainable financing is a major challenge for the water sector both in many developing countries where water and sanitation services are still in the expansion phase and in Europe where the water industry is facing major investments needs too. To give more depth to the present policy debate a historical perspective on water services financing is needed.

Water and sanitation services (WSS) have been mostly provided in Italy (and in Europe) at the municipal level. WSS are highly capital intensive. How water and sanitation infrastructure has been financed by Italian municipalities? What were the financing tools implemented to cover the huge investments' costs in the short run? Who were the final end-payers in the long run?

In Italy intergovernmental financial relations between municipalities and the central state changed significantly from 1861 till now : fiscal autonomy or dependence from central state transfers, balanced budget obligation or not, degree of borrowing autonomy. This is a useful background element to our work.

Our paper focuses on a detailed analysis of the rolling-up phase of Milan modern water and sanitation service (1888-1924). A variety of implemented financing schemes and institutional solutions (municipal budget - fiscal resources, municipal bond and land added value capture schemes) are identified and described.

More over the financial equilibrium of Milan's WSS is analysed. A discussion on on the long run cost allocation of the chosen financing schemes is made using the OECD 3T's scheme. Furthermore a basic overlapping generation model is used to explore how the infrastructure costs have been allocated between the various generations. It appears that long term debt and inflation played key roles in absorbing part of the investments' costs.

Keywords:

Financing history, Municipal Infrastructures, Water supply and sewerage, Milan, intergovernmental relations, 3T's, cost sharing, deficit financing, Italy

JEL: H54 – H71 - H72 - H74 - L95 - N73 - N74 - N83 - N84 - N93 - N94

Acknowledgments

We wish to thank the Paris water operator *Eau de Paris* and the *Agence Nationale de la Recherche* (ANR) through the EAU&3E research project (http://eau3e.hypotheses.org) for their financial support. We also aknowledge CESIFO sponsorship.

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Providing a municipal infrastructure: how did Paris and Milan finance their water and sanitation infrastructure (1853-1925) ?[65]

Olivier Crespi Reghizzi[66,67]

Abstract

Water and sanitation services (WSS) are highly capital intensive, particularly in the networks' expansion phase. How was water and sanitation infrastructure financed in European cities in the early phase of 'modern' WSS' creation? What were the financing tools implemented to cover the huge investment costs in the short run? Who were the final end-payers in the long run? This paper analyzes the financing history of WSS in Paris and Milan from their creation as 'modern' services (mid-19th century in Paris, 1888 in Milan) until 1925. A comparative approach is adopted. The analysis is based both on existing literature and on primary sources (particularly the municipalities' annual financial report).

In both cities WSS were developed by the municipality. In Paris clean water was not easily available on site and complex infrastructure was built: canals, long-distance aqueducts, water supply network and sewers, water treatment plants, sewage farms. Conversely Milan lies on an abundant alluvial aquifer and only basic water infrastructure was built.

A variety of implemented financing schemes and institutional solutions (fiscal resources from the municipal budget, municipal bonds and land added value capture schemes) are identified and described. The financial equilibrium of the WSS is analyzed. A discussion on the long run cost allocation is made. It appears that long-term debt, inflation and land added value capture mechanisms played key roles in absorbing part of the investment costs.

Keywords:

Financing history, Infrastructure, Water supply and sanitation, Paris, Milan, Municipalization, 3T's, cost sharing, bonds, inflation

Acknowledgments

We wish to thank the Paris water operator *Eau de Paris* and the *Agence Nationale de la Recherche* (ANR) through the EAU&3E research project (http://eau3e.hypotheses.org) for their financial support. We also thank the anonymous referees which made useful comments on an earlier version of this paper.

[65] An earlier version of this paper was presented at the 8th Water History Conference – Montpellier – June 2013

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Part III. Water and sanitation services from WWII up to the present

d) Water, sanitation and intergovernmental relations in Italy after WWII : a case study on Milan's water and sanitation service– [accepted with minor revisions by the Journal of Competition and Regulation in Network Industries]

e) ***Institutions, comptabilité et financement des services d'eau et d'assainissement en Italie et en France*** **– [**revised version of a paper published in « Le service public d'eau potable et la fabrique des territoires », L'Harmattan 2013]

f) Milan's water and sanitation service after corporatization: Metropolitana Milanese SpA in "Case histories of Public Enterprises: learning from success and failure"edited by Luc Bernier – [to be published by Peter Lang International]

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A "working paper" version of paper (d) and paper (f) is available online on

http://www.certet.unibocconi.it/wps/wcm/connect/cdr/centro_certet/home/working+papers/providing+and+financing+a+municipal+infrastructure

and http://ideas.repec.org/p/crc/wpaper/1308.html

A shorter version of paper (e) is available in « Le service public d'eau potable et la fabrique des territoires », L'Harmattan 2013.

Water, sanitation and intergovernmental relations in Italy after WWII : a case study on Milan's water and sanitation service

Olivier Crespi Reghizzi[68,69]

Abstract

This paper focuses on the case of Milan's water and sanitation service in the second half of the 20th century in the wider legislative and regulatory context of Italian Water and Sanitation Services (WWS). We discuss the evolution of intergovernmental financial relations in Italy. We also analyze the water and sanitation regulatory context, the financing tools available and the constraint on water price due to national regulation driven by anti-inflation policies. We look into Milan's water sanitation service focusing on three key issues: a) how were public service mission goals implemented ? b) were the costs covered by revenues endogenous or exogenous to the water and sanitation service ? and c) what is the long run cost allocation ? who did pay *in fine* for the infrastructure ? Our analysis is based on an original dataset collected from the yearly financial report of Milan's municipality.

Keywords:

Water supply and sewerage, Milan, investments, public service mission,

JEL: L95 - H54 - H71 - H72 - H76 - H77

Acknowledgments

We wish to thank the Paris water operator *Eau de Paris* and the French *Agence Nationale de la Recherche* (ANR) through the EAU&3E research project (http://eau3e.hypotheses.org) for their financial support. We also thank *Metropolitana Milanese SpA* and the *Comune di Milano* for all the data and all the interviewees for their availability and kindness.

This paper is based on a largely revised version of parts of two earlier papers presented at the XII Milan's European Economy Worshop (June 2013) , at the CESIFO Venice Summer Institute (July 2013) and at the Sixth Annual CRNI conference. The MEEW was supported by the Jean Monnet Chair of EU Industrial Policy. The usual disclaimer applies. We acknowledge CESIFO and CRNI support. We thank all workshops attendants for the fruitful comments.

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Institutions, comptabilité et financement des services d'eau et d'assainissement en Italie et en France[70,71]

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MOTS-CLES : eau, assainissement, emprunt, investissement, financement, Italie, France

Introduction

La disponibilité de financements suffisants et soutenables pour les infrastructures des services publics d'eau et d'assainissement (SPEA) est une question clé non seulement dans les pays du Sud où dans de nombreux cas les services d'eau sont encore dans une phase d'expansion mais aussi en Europe où ils ont atteint « un âge mur avec un besoin croissant de remettre à niveau le capital infrastructurel conséquent qui a été constitué dans les décennies passées » (Barraqué 2009). Actuellement en France cet enjeu fait tout particulièrement l'objet d'études et de débats tels ceux qui sont contenus au sein de l'ouvrage collectif qui vient d'être publié dans le cadre des travaux du Comité consultatif sur le prix et la qualité des services publics d'eau et d'assainissement du Comité National de l'Eau (CNE 2013).

De plus la question du financement des investissements publics est encore plus critique dans le contexte économique actuel. En effet l'accès à des financements de long terme est particulièrement difficile pour les collectivités locales du fait de la crise économique que traverse l'Europe et de la mise en œuvre progressive des règles prudentielles de Bâle 3 en matière de réglementation bancaire. Par ailleurs il apparait que les ratios d'endettement public par rapport au PIB, tels qu'ils sont fixés par le pacte européen de stabilité et de croissance (PESC), déclinés en Italie en un pacte interne de stabilité (PIS) avec les administrations locales, pourraient contraindre la capacité d'emprunt des SPEA italiens (cf. §**Erreur ! Source du renvoi introuvable.**).

[70]La recherche a été menée dans le cadre de ma convention CIFRE à Eau de Paris qui s'inscrit dans le projet de recherche « EAU & 3E » sur la durabilité des services d'eau dans les grandes villes. Le projet EAU & 3E est financé par l'Agence Nationale de la Recherche.
[71] L'auteur remercie tous les participants au groupe de réflexion IMMO au sein du groupe de travail ASTEE - AITF sur la gestion patrimoniale pour la richesse des échanges.
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Quel est le régime juridique, institutionnel et régulatoire des SPEA ? Comment celui-ci conditionne-t-il le financement des investissements ? Dans notre travail une classification des statuts des SPEA dans quelques pays européens est dressée (paragraphe **Erreur ! Source du renvoi introuvable.**). Une analyse comparative plus poussée est faite pour la France (paragraphe**Erreur ! Source du renvoi introuvable.**) et l'Italie (paragraphe3) en s'intéressant en particulier à la régulation et aux contraintes en matière d'emprunt et de placement des fonds. Un aperçu historique sur la trajectoire institutionnelle qui a été empruntée pour arriver à la situation actuelle est fourni pour la France (§**Erreur ! Source du renvoi introuvable.**) et l'Italie (§**Erreur ! Source du renvoi introuvable.**). La comparaison des deux cas d'étude questionne certains choix de politiques publiques.

Milan's water and sanitation service after corporatization: Metropolitana Milanese SpA

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Abstract

This paper presents a case study on Milan's water and sanitation service (MI-WSS) between 2003 and 2013. Historically Milan's water and sanitation service (WSS) was under direct municipal provision since its inception in 1888. After 2003, MI-WSS has been provided by *Metropolitana Milanese* SpA (MM) which is a joint stock company fully owned by Milan's municipality. MM not only operates the water services but also civil engineering services mainly in public transportation. Commitment to public service mission and general interests' goals are discussed adopting a historical approach too to appreciate the switch from full direct provision to corporatized provision. Limiting the analysis to MM only would be too restrictive and we propose instead to adopt a wider perimeter which includes all the stake-holders of Milan's WSS. Such an enlarged perimeter of analysis is particularly relevant to discuss regulation and governance issues. In the water sector public service mission includes many goals which should be appreciated adopting a long run and intergenerational perspective and expressed in terms of sustainability. Applying sustainability criteria to Milan's WSS raises more than one question.

Keywords:
Water supply and sewerage, Milan, corporatization, regulation, public service
JEL: L95 – H41 - H54 - H72

* An earlier version of this paper has been presented in June 2013 at the Milan European Economic Workshop in the framework of the CIRIEC research project « The Future of Public Enterprise ». We wish to thank the Paris water operator Eau de Paris and the French Agence Nationale de la Recherche (ANR) through the EAU&3E research project (http://eau3e.hypotheses.org) for their financial support. We also thank Metropolitana Milanese SpA for all the data and all the interviewees for their availability and kindness.

Part IV. Conclusion

This last part is composed of three sections. In Section 6 we analyze Italian and French Water and Sanitation Services thanks to the trade-offs matrix detailed in Part I (Table 3 in § 5.3). In that same section we also add a few case stories of development of Water and Sanitation Services in other cities in France and in Italy.

Section 7 focuses on the financing history of water infrastructure in other countries (UK, USA and Germany).

Section 8 is the general conclusion of this thesis.

6 Answers to key trade-off in France and in Italy

This Section summarizes the cases of Paris and Milan water services which have been analyzed in the various papers in part II and III. We look at the two case studies using the public finance theory we presented in the beginning (Part I) and the trade-offs matrix we sketched (Table 3 in § 5.3). We analyze what were the choices made by policy makers in these two cities. The first paragraph (§6.1) gives a necessary historical analysis on trade-off n°6 : what were the intergovernmental financial relations and the source of exogenous revenues in both countries?

The second paragraph focuses on the choices made in terms of trade-offs in the early expansion phase until 1925 while the third one concerns the 20th century after 1925.

As much as possible we try not to limit our analysis to the two case studies and expand it to the national trends in the two countries also using a few more case studies from the existing literature (§6.4 and §6.5).

6.1 Source of the exogenous revenues in France and in Italy

In our model, costs uncovered by endogenous revenues (club-finance) are covered by exogenous ones (tax-finance). What is the source of these revenues? Are they covered by the Local Government Unit (LGU) or by the central government? Local exogenous revenues may be labeled as “Taxes” in the OECD 3T’s paradigm while National exogenous revenues may be considered as “Transfers”.

This paragraph starts with a snapshot on France and Italy before 1925. It then focuses on local public finance reforms in France after the 1920's. The Italian case has been already discussed in our paper (Crespi Reghizzi forthcoming d) in Part III.

6.1.1 France and Italy before the 1920's

This sub-paragraph gives a summary of what has been written on these issues in Crespi Reghizzi (forthcoming c, § 2.1)

At first, through the 19th century, both in France and in Italy, there were no recurrent financial transfers from the central government to the municipalities. Thus, the fiscal autonomy of municipal budgets was very high even though municipalities only had partial tax sovereignty on most fiscal sources which were shared with the central government.

Municipal revenues of urban municipalities were coming mainly from indirect taxes and in particular from excise duties (the *droit d'octroi* in France and the *dazio di consumo* in Italy*)* on goods entering the city. At that time excise duties were shared taxes between the central government and the municipalities. There were various attempts to abolish excise duties but the difficulty to find other fiscal revenues to replace them, postponed their definitive abolition at national scale in France until the 1940's by the *Vichy* regime (Brunet 1981, 118–136). However the percentage share of excise duties over total municipal revenues kept decreasing: 73 % in 1910, 19 % in 1930 and 11 % in 1936. In 1934 excise duties were collected in 278 French municipalities of more than 10 000 inhabitants (Pinol 1999, 71).

Other fiscal sources consisted in piggyback taxes. In France the *centimes additionnels* on the 4 national taxes (*les quatres vieilles*) established after the Revolution were kept as municipal taxes for a significant part of the 20th century. In Italy too, municipalities could ask to be authorized by the central government to impose additional levies on national taxes (income tax, land property tax and building property tax)(Cassar and Creaco 2007, 716).

These direct taxes played a minor role both in Paris and Milan as the excise duties represented respectively more than two thirds and more than half of the total municipal revenues of the two cities (Volpi 1959, 25; Cadoux 1900).

6.1.2 Italy after WWII

We already showed in one of our papers (Crespi Reghizzi forthcoming d) that after WWII, Italian municipalities' financial autonomy was heavily reduced and own tax revenues to total spending ratio got very low meaning that exogenous revenues came mainly from the central government. It was only in the 1990's that some local fiscal autonomy was given back to Local Government Units.

6.1.3 France between 1917 and the 1980's

Between 1917 and 1940's

In 1917[73] the French national tax system was heavily reformed. It was not anymore based on the 4 national taxes (*les quatres vieilles : contribution foncière sur le bâti et le non bâti, contribution personnelle mobilière, contribution sur la patente, contribution sur les portes et fenetres*) but on national income tax (*impot national sur le revenu).* However the *centimes additionnels* were kept as sources of municipal fiscal revenues. The amount of these local taxes was still computed as piggyback taxes even though they were based on a "principal" which was not anymore collected by the central government (Lainville 1928, 26; Lainville 1930, 82; Brunet 1981, 136). The rates of the piggyback taxes were set by the municipalities which however had to respect some constraints. A part of the *centimes* were compulsory while other were freely set. Moreover, when the piggyback tax rate exceeded a specific cap, the prefects authorization was required (Lainville 1930, 13–16). Such an authorization was generally obtained (Lainville 1928, 42).

In 1925, a major cadastral revision was made. However the revised cadastral values had an impact only on the national income tax base while the local piggyback taxes were still based on the previous non revised cadastral values (Lainville 1928, 20–21)

Transfers from the central government were another source of municipal revenues. These transfers were composed of two major categories :

a) *Fonds communs* (revenue sharing) (e.g. *fonds commun sur les boissons et sur les contributions indirectes*, *fonds commun sur le chiffre d'affaires*). The central

[73]Loi 31 juillet 1917

government collected a tax and shared it among the municipalities according to specific criteria (e.g. number of inhabitants)

b) *Subvention* (transfer grant): most of the time the grant was proportional to the relevance of the level of the piggyback tax rate. Incredibly, the higher was the tax rate (*centimes*), the higher was the grant (Lainville 1928, 66) meaning that the wealthier was the municipality, the higher the grant it would receive. These grants were mostly ear-marked for specific lump-sum capital expenditures such as streets, schools, health centers and water supply networks but there were also some grants for recurrent expenditures such as the fire brigade[74](Lainville 1930, 12).

Tranfer grants were awarded to municipalities both by central government and by the counties. Jean-Luc Pinol underlines that there were huge disparities among municipalities in the level of transfer grants received. In 1934, an average municipality of the Seine county received 169 francs *per capita* from the central government and 68 francs *per capita* from the county. Outside the Seine county these figures were respectively of 36 and 7 francs *per capita* (Pinol 1999, 76).

After 1919, municipal expenses increased suddenly due to both the economic context (inflation) and to the national legislation (in particular the reduction of the daily labour duration to height hours)(Brunet 1981, 117).

The 1941 reform in France

The fiscal reform of 1917, the difficult economic context, the increased municipal expenses and the wish to abolish the excise-duties without giving up their revenues made a new reform of local public finance necessary. It was launched in France in the 1941/1942[75] during the *Vichy* regime, which increased centralisation.

[74]ex : *subvention du département pour assistance aux familles nombreuses et aux femmes en couche, subvention de l'état pour construction scolaires, subvention de l'état sur les fonds du pari mutuel pour l'adduction d'eau* (Lainville 1928, 66)

[75]Various acts were passed : Loi 14 sept 1941 portant révision des rapports financiers de l'Etat, des départements et des communes & Loi 31 octobre 1941 modifiant le régime des licences des débits de boissons & Loi 6 novembre 1941 sur les taxes additionnelles au droit enregistrement & Loi 6 novembre 1941 autorisant les communes à instituer une taxe locales sur les ventes au détail et prestations de service – Journal Officiel *JO 7 novembre 1941* and *JO 1er janvier 1942*

The excise duty was abolished and replaced by a local sales tax (*une taxe locale sur les ventes au détail et prestations de service)*(Vatus 1982). The various revenue sharing mechanisms (*fonds communs*) and transfer grants (*subventions*) were abolished and merged in a single yearly transfer grant. The grant was designed to take into account various factors among which the size of the municipality, the level of its piggyback taxes and the number of children going to school (Lainville 1942).

One of the aims of the reform was to simplify the local public finance system and to partially untighten the interlink between central government and local authorities finance deriving from the revenue sharing mechanisms (*fonds communs*) which were previously in place (Lainville 1942, 23–27).

The 1959 reform in France

The 1941 reform left untouched the piggyback taxes (*centimes additionels*) which kept being collected despite the abolition of central government taxes on which they were supposed to be added in 1917. The mechanism of the *centimes* implied a stable and never changing share of the tax burden between land-owners, tenants and industrial/commercial activities. It was also criticized for being complex, opaque and based on articificial tax bases poorly connected with reality since the cadastral values had not been updated for a long time (Chaix 1986, 15).

In 1959[76], an administrative act established the principle of replacing the *centimes* with four exclusive local taxes computed on real tax bases and on tax rates quite freely set by local authorities (Chaix 1986, 15) : a)tax on built-up land (*taxe sur le foncier bati*), b) tax on land*(taxe sur le foncier non bati),* c) housing tax (*taxe d'habitation*) and d) business tax (*taxe professionnelle*[77]). In fact the implementation of the reform was long and complex and ended only in 1980[78].

Before the decentralization reforms which were implemented in the 1980's, autonomous fiscal revenues of local authorities averaged only at 25% of total local revenues. 40.5 % and 20.4 % of the revenues came from transfers from an upper level of government, ear-

[76]Ordonnance 7 janvier 1959

[77] What would become the *taxe professionnelle* in *1975* was still labeled as the *taxe sur les patentes* 1989, 152–153)

[78]Loi du 3 janvier 1979 on the« *dotation globale de fonctionnement* ». Loi 10 janvier 1980 on the new local taxes.For more details the reader shall refer to Chaix (1986) and to http://www.assemblee-nationale.fr/histoire/decentralisation.asp

marked respectively for capital expenditures and operational expenditures. 13% of the revenues came from loans. Additionally, most of local authorities investments were financed by non autonomous financial resources. As a matter of facts, the fiscal and financial autonomy of local authorities was very low and obliged them to rely heavily on external resources for investments and new public services (Chaix 1986, 18).

6.1.4 France after the 1980's

The decentralization reforms

Between 1981 and 1983 various legislative acts increased the decentralization of French multi-level state. An additional level of government had been created in 1963 : the region. The *a priori* control exerted by the central government on local authorities' decisions was replaced by the *a posteriori* control exerted by the *Cour des Comptes*. New responsibilities were given to the communes together with new financial resources[79].

Between the late 1970's and today the attempt to increase the decentralization of the French multi-level state has been a steady trend implemented through various reforms (on which we do not focus). Indeed "it took France 30 years to move from a highly centralized system to a fairly decentralized one"(Prud'homme 2006, 113).

Rémy Prud'homme also points out that what had characterized the centralized multi-level French state was not only the relatively low local fiscal autonomy but also and mainly the many controls and constraints that central government imposed on local government units: a) prefect's approval of public services fees level, b) imposed minimum and maximum level of local tax rates, c) approval of municipal budgets[80], d) constrained borrowing and e) constrained investment policy (Prud'homme 2006, 88)

> "For a long time, *communes* and *départements* were treated like children who required supervision and guidance. In a *département*, the prefect had more power than the elected council chair; the *département* budget was actually prepared by the prefect staff, and in many cases, the prefect chaired council meetings, even in the presence of the elected council chair.

[79] http://www.assemblee-nationale.fr/histoire/decentralisation.asp, retrieved online on April the 2nd 2014

[80] For example in 1934 a decree (Décret Loi 25 juin 1934) reinforced the control of the national administration on the municipal budget (Pinol 1999, 70).

> This multifaceted control or tutelage of subnational governments defined centralization in France as much as or more than the relatively large ratios of central-to-local taxes and responsibilities. The history of decentralization in France, which occurred over the 1970–1990 period, is largely the history of the gradual relaxation and abandonment of these controls much more than the history of the shift of central-to-local taxes and responsibilities. Now, French subnational governments enjoy an extremely high degree of autonomy. They do pretty much what they want with their taxes, their expenditures, their debt, their regulations, and their employees. Constraints and mandates are minimal. In that sense, today's France can be considered a relatively decentralized country" (Prud'homme 2006, 88).

Intergovernmental relations after the decentralization process

In the early 21st century, resources of local authorities in France still come mainly from three major sources : a) local service fees and non-fiscal resources, b) local taxes and c) transfers from central government and from the upper levels of government.

The main local taxes are still somehow the heirs[81] of the four *vieilles*: business tax[82] (*taxe professionnelle*), property tax (*taxe foncière)* plus the garbage tax and housing tax (*taxe d'habitation*). For many taxes the tax bases are shared among different subnational levels of government (*région, département, commune)* but not with the central government. However each level has a relative freedom in setting the tax rate level as long as it respects the maximum level of tax rate imposed by the central government (Prud'homme 2006, 94–95).

Transfers from the central government and from others upper levels of government are still very significant. In 2004 "such transfers represented about half of local government income and about 16 percent of central government expenditures" (Prud'homme 2006, 100). These transfers[83] are "formula driven" and "not discretionary". They are not ear-

[81] 1989, 140–141)

[82] The business tax is paid by all enterprises. "The tax base used to be a mix of capital and wages. In 1999, wages were eliminated from the calculation of the tax base" (Prud'homme 2006, 96)

[83] These transfers are composed of general subsidies (mainly the *Dotation Globale de Fonctionnement - DGF* and the Fond Compensation TVA – FCTVA), of decentralization subsidies (which were approved when additional responsibilities were given to the LGU) and of compensation subsidies (which are funds paid in order to compensate for some lost local tax revenue when the central government abolishes a local tax or approves a local-tax reduction or exemption)(Prud'homme 2006)

marked. Some of these transfers such as the *Dotation Globale de Fonctionnement*[84] are "a replacement for particular local taxes that were eliminated in a distant past (1969)"(Prud'homme 2006, 103).

> Local governments can do what they want with the subsidies they receive, even if and when those grants are calculated in reference to well-defined uses. […] This arrangement is a great change from the situation that prevailed 30 years ago, when most subsidies were earmarked for a specific use or project. Official documents (followed by many analysts) continue to distinguish between operating subsidies and investment subsidies. This distinction is a mere accounting curiosity with no practical meaning. For a given local government, subsidies are as good as own source taxes (Prud'homme 2006, 100).

6.2 The early expansion phase till 1925

6.2.1 The initial picture

Here we analyze the early 19th century picture prior to the beginning of our time frame with the trade-off matrix we sketched (Table 3 in §5.3 in Part I).

Before the creation of a modern water supply service, water in the urban environment had both a fully public good and a private good nature. In Paris, Seine water and water delivered for free at public fountains was a fully public good. In Milan too water drawn from the canals (*I navigli)* for non drinking purposes was a public good[85] while water drawn from private wells had a private nature[86] (Crespi Reghizzi forthcoming b, § 3.1). In both cities water-carriers (*porteurs d'eau)* offered at a given price home-delivery of water (*l'eau à l'étage*). Once delivered at home, water was fully a private good (market good).

In Paris, some years before, at the end of the 18th century, the experience of the *Compagnie des Eaux de Paris* founded by the *Frères Périer* (Box 1 in Crespi Reghizzi forthcoming a) had been an attempt to home-deliver water as a club-good with voluntary membership (and thus with exclusion). However the *Périer* club was obliged

[84] The History of the creation of the DGF is given in Brémond (1989, 118).
[85] Public fountains and wells had a public good nature, at least in theory, because in practice there could be rivalries to access to the well or to the fountain, possibly regulated by clientelism or by mafia-like systems of power.
[86] Except that groundwater pollution or overdraft could make it a common pool resource.

to set a quite high level of exclusion (relatively high water tariff) since it could rely only on endogenous revenues. Additionally, the Périer club was in competition with public good water delivered for free at public fountains. People did not rush to become members and the *Compagnie des Eaux de Paris* failed.

Waste water disposal also had a dual nature. At that time the sewer system was embryonic and mainly designed for drainage. Waste water collection through the sewers (*tout à l'égout)* was forbidden. The first solution consisted in discharging waste water for free in the urban environment – in the streets or under the ground with significant negative externalities both in terms of public health and environmental pollution.

At some point the public authorities became aware of the negative impact of water pollution in terms of health conditions. Thus, they imposed to stop discharging freely feces and waste water in the environment. When this happened, wastewater and feces were collected through cesspools (*fosses d'aisance*) and sanitary tubes (*tinettes filtrantes*). In Paris, water could be discharged freely but feces were to be collected in cesspools or barrels which needed to be emptied once full (Dupuy and Knaebel 1982, 5). Landlords would need to contract with cesspools emptiers and pay them for the service (waste water disposal with private good nature).

Thus, the prohibition to discharge feces and water for free in the environment created the need for a waste water disposal service to comply with the law.

6.2.2 Water as a club good with voluntary membership

Through the 19th century in Paris and after 1888 in Milan, the development of a municipal water service took place. At first water was delivered both through domestic water connections (*"service privé"– eau à l'étage* in Paris*)* and through public fountains (*"service public"* in Paris) having respectively club good and public good nature.

In both cities domestic water delivery was developed by the municipality as a service provided by Collective Consumption Unit (CCU) with voluntary membership and exclusion. However, the exclusion level was not set too high as total costs were at first covered by a mix of endogenous and exogenous revenues. The endogenous revenues had a tariff nature (non fiscal). The exogenous revenues came mostlyfrom local taxation

since there were no recurrent transfers from the central government to the municipalities at that time (§6.1).

In Paris at first, endogenous revenues were not metered and collected through flat payments. After 1876, in Paris, collective meters were installed and the water service was paid through a volume based tariff. In Milan, water was collectively metered from the start of the service and billed through a two part tariff (Crespi Reghizzi forthcoming a, § 4.4; Crespi Reghizzi forthcoming b, Section 5).

Membership to the water service CCU was voluntary and despite the not-so-high exclusion (tariff) level, the subscription rhythm to the water service was not so fast. With the development of the hygienic theories and the discoveries of Koch and Pasteur, policymakers and public opinion became aware of the positive health externalities of improved water supply and sanitation. The water service started being considered as a merit good and the municipal authorities decided to incentivate the subscriptions to the service either through lump-sum connection subsidies or through setting low level of CCU membership (low percentage of total costs covered by endogenous revenues) (Crespi Reghizzi forthcoming a, § 4.4; Crespi Reghizzi forthcoming b, Section 5).

6.2.3 Institutional nature of the Collective Consumption Unit (CCU)

In both cities the water service was provided by a municipal department : according to our matrix this is a collective consumption unit (CCU) internal to the Local Government Unit (Cat A in Table 2 in § 4.6).

The production unit was also municipal as the attempt to award a concession to a private partner failed (Crespi Reghizzi forthcoming a, §2.4; Crespi Reghizzi forthcoming b, §3.1). In Paris however an innovative public-private partnership was made with the *Compagnie Générale des Eaux* which was responsible for metering, billing and collecting the endogenous revenues (Crespi Reghizzi forthcoming a, § 4.1).

6.2.4 The intertwined development of water and sanitation services as CCUs with coerced membership and no exclusion

At a certain point, the path followed by the water service started being tightly intertwined with sanitation. At first sewers were aimed at urban drainage which had a public good nature. Both in Paris and in Milan with the *tout à l'égout* revolution (feces and wastewater collection through the sewer system) sanitation was made compulsory

(This was not the case all over France as we will show in § 6.4.2). The sanitation service was provided as a CCU with compulsory membership and no exclusion. All landlords with a sewer nearby had to become members of the CCU and to pay the service received through an ear-marked sanitation levy (endogenous revenues) which had a fiscal nature. Developing a sewer system required huge investment costs which were covered only to a very small extent by endogenous revenues. Exogenous revenues (tax-finance) played a major role in obtaining a financially balanced budget. In Paris, the sanitation endogenous revenues were collected through a fiscal sanitation levy based on the property value of the buildings (*Taxe municipale sur les tuyaux de raccordement à l'égout*) while in Milan the sanitation levy was proportional to the surface of the house (Crespi Reghizzi forthcoming a, § 4.4; Crespi Reghizzi forthcoming b, Section 5).

In Paris, thanks to the 1894 *tout à l'égout* law (through the decree of August 8th 1894), not only sanitation but also the water service became a CCU with compulsory membership (and no exclusion). Officially the subscription to the water service was made compulsory to ensure sufficient fluidity into the sewer system but an implicit objective was also to improve the financial equilibrium of the water service
1905; quoted by Bellanger, Pineau, and SIAAP 2010, 84; Crespi Reghizzi forthcoming a, § 4.4). In Montreal too an obligation to connect to the water service was enforced (see also the Box 3 here below). In France, it seems that such an explicit obligation to connect to the water service is a striking peculiarity of the Paris case which was not generalized to the rest of the country.

In Milan we did not found explicit reference to the obligation to connect to the water service but just before WWI 81 % of the houses were connected to the water service (Crespi Reghizzi forthcoming b, § 5.3). Furthermore, in 1896 in Italy, a ministerial legislative act not only required the installment of latrines in flats in urban areas but also made it compulsory to have a domestic water connection in the urban areas where water is present in sufficient quantities[87].

[87]"*Nelle città ed aggregati, dove vi sia una sufficiente distribuzione di acqua nelle case, sarà obbligatorio per le latrine, l'uso di apparecchi a chiusura idraulica, con a disposizione almeno dieci litri di acqua di lavaggio al giorno per persona*." Art. 70-72, Istruzioni Ministeriali 20 Giugno 1896 *Compilazione dei regolamenti locali sull'igiene del suolo e dell'abitato*. Source : http://architettura.it/notes/ns_nazionale/anno_96/ISTR.MIN.20-6-96.html retrieved online on March 28th 2014

In Milan and in Paris, the sanitation service developed from the beginning as a CCU with compulsory membership while the water service started first as a CCU with voluntary membership. That explains why, at first, endogenous revenues had a fiscal nature for the sanitation service while they had a non fiscal nature for the water service. When the water service became a CCU with compulsory membership in Paris, it kept collecting endogenous revenues through meters on a non-fiscal basis.

We do not know whether these mandates to connect to the water service were enforced tightly or not. Nevertheless, we assume that they played a significant role in the expansion phase since they spread the idea that the water service was an essential CCU to be member of. Furthermore, we argue that the action of getting connected to the water service is almost an irreversible one. Indeed private connection to the water service is such a positive change for people lives that once having experienced it, people would hardly go back to the previous situation. Thus, once people have installed and experienced private water connection, the obligation to connect is not needed anymore as most people would anyway probably choose to stay member of the water service CCU on a voluntarily basis.

Box 3 : Water provided through a CCU with compulsory membership in Montreal

In **Montreal** the water service was municipalized in 1843-1845 when the municipality bought the former private operator *Compagnie des proprietaires des eaux de Montreal*. The private operator had run the water service as a CCU with voluntary membership and financed through endogenous revenues.

Once municipalized, the water service kept being operated by a corporation with an accounting system distinct from the municipal one. At first the water service kept being operated as a CCU with voluntary membership and financed through endogenous revenues. In reality the municipality wished to make subscription and payment of the water service compulsory in order to obtain a fast rhythm of subscription to the service and thus reach the necessary economies of scale. However at first the municipality was not authorized to do so. In those years the water service was trapped in an under-investment circle : a slow rhythm of subscription implied little endogenous revenues which did not make possible to expand the network.

A few years later, in the 1850s, having a water supply network in all streets started being considered as increasingly strategic for fire protection. An ambitious investment policy was undertaken to expand the network in every street. According to Fougères, the municipality had to choose among three financing options : i) to subsidize the water service using money from general taxation, ii) to make the municipal fire protection department pay for the investment costs or iii) to make the water users pay the full costs. In fact options i) and ii) implied the same financing choice as the fire protection department was financed through general taxation: it would have meant to cover costs through exogenous revenues. On the contrary municipality chose and obtained to make the water service compulsory. Everyone having a water main nearby had to connect and was charged a compulsory water levy which had a fiscal nature. A similar way of collecting endogenous revenues was also adopted in the UK (see section 7).

Source : Fougères (2004)

6.2.5 Investments, repayable finance and end-payer

In the previous pages we looked how Paris and Milan answered the trade-offs 1 to 6 at the top of the matrix (Table 3 in §5.3). We now look at the bottom of the matrix (trade-offs 7 to 10).

In both cities, water and sanitation infrastructure planning and management was officially municipally driven. Infrastructure projects were planned and managed by the municipality (the LGU in the matrix). However in practice the municipal autonomy of Paris was not so high as the City was administered by a prefect appointed by the central government (eg. Haussmann nominated by the Emperor Napoleon III). Moreover, the high ranking civil engineers managing the water and sanitation service in Paris were members of the national *Corps des Ponts et Chaussées* and thus were both part of the local and national public administration.

In both cities investments were paid by the municipality through ordinary funds and through repayable finance. The municipality was the borrower. Debt was centrally managed by the municipality to fund municipal needs as a whole. Only in a few cases was debt contracted to cover sector-specific needs. The city's fiscal revenues (exogenous revenues) were given as collateral in most of the loans. Only in a few occasions, endogenous revenues were used as collaterals. Borrowing was submitted to

approval by an upper level of government. No spatial equalization mechanism was in place at that time.

Loans and bonds had a long term maturity and a fixed interest rate. The high inflation of the early decades of the 20th century played a major role in lowering the debt service in real terms. *De facto* a part of the investment costs were absorbed and transferred to the lenders.

Furthermore in Paris during the Second Empire, Land Value Capture tools also played a significant role in financing urban infrastructure including the water network and the sewer system. This financing tool made possible to lower the costs to be covered by the water and sanitation service.

We showed (Crespi Reghizzi forthcoming a; Crespi Reghizzi forthcoming b) that by the early decades of the 20th century nearly all total costs of the water and sanitation service considered as a whole were covered by endogenous revenues. This was possible thanks to the effect of long run fixed interest debt combined with high inflation (and in Paris also thanks to the implementation of land value captures tools) which lowered the WSS total costs.

6.3 The evolution beyond 1925

This section extends beyond 1925 the analysis of the choices made by the two cities regarding the trade-offs matrix. To some extent it is a summary of what has been discussed in the three papers in Part III (Crespi Reghizzi forthcoming d; Crespi Reghizzi forthcoming e; Crespi Reghizzi forthcoming f). However, the analysis through the trade-off matrix is original and includes additional evidence on the French case.

6.3.1 Institutional nature of the Collective Consumption Unit (CCU)

In **Italy** an autonomous legal form for local public services (Cat. B in §4.6) was created in 1903 (*Azienda Municipalizzata).* However full municipal provision of the service (as in Milan) was still possible (Cat A in §4.6). The institutional nature for the Collective Consumption Unit did not change until the reforms of the 1990's (Legge Galli in 1994 and decree 448/2001) which made compulsory for water and sanitation services to be provided by joint stock companies (Cat C in §4.6) with public, private or mixed ownership.

Milan's municipality kept the water and sanitation services as municipal departments (Cat. A in §4.6) from its inception in 1888 till 2003 when a concession for the WSS was awarded to *Metropolitana Milanese SpA* (Crespi Reghizzi forthcoming f).

We already reminded that in **France** the *régie à autonomie financière* legal status was created in 1926 (larger financial autonomy from the LGU but still within Cat A in §4.6) and that the *régie à personnalité morale* et *autonomie financière* (Cat B in §4.6) was introduced in 1962 (Crespi Reghizzi forthcoming e, § 2.5.1). This new legal status for water and sanitation services was created by the central government in order to incentivize the WSS services to be budget-balanced, i.e. to cover their costs with endogenous revenues rather than with exogenous ones. However, water and sanitation services created before 1926 were authorized to keep their non autonomous legal status (*régie directe / régie simple* - Cat A in §4.6).

After 1926[88] and 1930[89] local authorities were also authorized to take shares and eventually create joint stock companies with mixed ownership (*Société d'Economie Mixte* – SEM) to provide municipal public services with an industrial and commercial nature (Mourareau and MAT 2007, 7). The SEM legal status was better defined by a 1955 decree[90]. SEM were not very common in the water sector while they very largely used after WWII in urban development and renovation operations. In 1983[91] a reform of the SEM legal status was made. The 1983 reform established that a SEM was to be fully ruled under private law and private accounting principles (Cat C in §4.6). It also made compulsory for local authorities to control the majority of the shares of the company even if they had to stay below 75 % of the shares (and later 85 %). In 2010[92] a new legal status was introduced : the *Société Publique Locale* (SPL). A SPL is a joint stock company fully owned by at least two different local authorities or governmental institutions.

Paris water service kept being provided by a municipal department together with a *régie interessée* contract with CGE until the 1980's when major institutional reforms were made by mayor Chirac (see also Appendix 1). In 1984 the water supply

[88] Decrees *Poincaré* of the 5th November and 26th November 1926
[89] Judgement of the *Conseil d'État, 30 mai 1930, chambre syndicale du commerce de détail de Nevers*
[90] Decret n° 55-579 du 20 mai 1955,
[91] Loi n° 83-597 du 7 juillet 1983
[92] Loi n° 2010-559 du 28 mai 2010

distribution was delegated through an *affermage* contract to the CGE on the right bank of the Seine and to *Lyonnaise des Eaux* (LDE) on the left bank. In 1987 the SEM SAGEP (Société Anonyme de Gestion des Eaux de Paris) was created. SAGEP was owned by Paris municipality (70 %), by CGE and LDE (14% each) and by other public institutions for a small share. SAGEP was in charge of water production through a concession contract.

When the two *affermage* contracts expired in 2009, the water service was municipalized once again and the full responsibility of the service (production, distribution, metering and billing) was given to the new autonomous entity *Eau de Paris*[93].

What about sanitation in Paris? The local waste water collection part of the sanitation service never stopped being under the responsibility of a municipal department from its creation till now. However the large interceptors system outside the city and the waste water treatment plants were developed and operated on a a regional scale by *Seine* county (*Département de la Seine*) also on behalf of the *Seine et Oise* county through a cooperation agreement made in 1933 (Bellanger, Pineau, and SIAAP 2010, 213 & 217). When in 1964 the *Seine* county was dismantled to create 4 counties in Paris and 1st ring, the responsibilities on the main sewer system and waste water treatment plan were transferred to an *ad hoc* inter-county entity : the SIAAP – *Syndicat Interdepartemental d'Assainissement de l'Agglomération Parisienne* (Bellanger, Pineau, and SIAAP 2010, 277).

6.3.2 Endogenous or exogenous revenues

We showed that after WWII in **Milan (and in Italy)** water tariffs were heavily regulated to pursue general interest goals (anti-inflation policies). Endogenous revenues were capped and in Milan they were even below operational expenditures (OPEX) in the 1970's (Crespi Reghizzi forthcoming d, § 4.3). By definition costs uncovered by Endogenous revenues are covered by exogenous revenues. It was only with the reforms of the 1990's that price control policies were softened according to the principle of full industrial cost recovery.

[93] *Eau de Paris* is an *Etablissement Public Industriel et Commercial* (*EPIC*) which is classified in cat C in §4.6. See also Barraqué (2012).

In France, the central government started adopting legal measures to encourage cost-recovery of water services through endogenous revenues back in the 1920's and 1930's with the creation of more distinct and autonomous forms of collective consumption units (*régie à autonomie financière)* in 1926 and with a 1937 decree asking autonomous water services to have balanced budgets. However local authorities were reluctant and kept as much as possible their water and sanitation services under the previous non autonomous regime (*régie directe*)(Crespi Reghizzi forthcoming e, § 2.5.1).

In France during the 1960's it was made compulsory for the water and sanitation services to have balanced budgets including investments and debt amortization[94]. Despite the anti-inflation tariff limitations[95], step by step the water pays for water principle (*l'eau paie l'eau*) was enforced through the implementation of distinct accounts for water and sanitation services and became effectively applied in the 1980's (Crespi Reghizzi forthcoming e, § 2.5.1–2.5.3).

6.3.3 CCU Membership & technical nature of the endogenous revenues

Water and sanitation services in both cities can be considered as CCUs of which *de facto* everybody is member all along the 20th century after the end of the expansion phase. We make the assumption that this may be due to one or more of the following reasons : i) explicit obligation to connect, ii) enforcement of sanitary rules on buildings and houses or iii) private water connections being considered as an essential living standard.

At first sanitation was paid through a flat levy. In Paris the sanitation levy was introduced in 1894 while in the rest of France it was authorized only in 1926[96].

Bernard Barraqué (2011a) underlines that as the need to treat wastewater emerged, it implied higher operational costs for the sanitation service and induced policy-makers to adopt a volume-indexed sanitation levy instead of a flat one. The next step was to

[94] Décret 29 Décembre 1962, Décret 67-945 du 24 Octobre 1967 et Instructions Comptables n°67-113 du 12/12/1967 et n°69/69 du 12 juin 1969

[95] Between 1952 and 1970 and between 1978 and 1987 water tariffs are regulated and submitted to the prefect's approval in application of anti-inflation policies.

[96] The *taxe municipale de déversement à l'égout* was authorized by the *Loi du 23 Aout 1926* (Scherrer 1992, 156)

include the volumetric levy in the water bill as it was the easiest way to collect it[97]. This was imposed by the national regulations both in France and in Italy respectively in 1967[98] and in 1976[99].

6.3.4 Legal nature of the sanitation levy

An open question is whether the sanitation levy has a fiscal nature or not. Is it a payment in front of a service rendered (non-fiscal) or is it a fiscal payment *tout court* that everyone has to pay whether being connected to the wastewater network or not ?

In principle, when one thinks in terms of service rendered, the sanitation service can be considered as being composed by two CCUs with different beneficiaries (members). On the one hand collecting waste water and channeling it away from the city is clearly a service rendered to the water users which are members of the CCU. On the other hand treating wastewater before discharging it into the river is a service rendered to all the people living further downstream. *Stricto sensu* it is not a service rendered to the upstream water users.

In presence of a legislative obligation on the quality of waste water discharged in rivers, waste water treatment might enventually be considered as a collective service rendered to the upstream water users through a collective consumption unit in order to respect the law. This view could be considered as a way of making the *polluter-pays principle* intellectually compatible with the *fiscal equivalence principle* and with the *benefit approach*.

In practice, French jurisprudence considers that in urban areas, once everybody is connected, the sanitation levy becomes a non fiscal payment in front of a service rendered (*paiement pour service rendu*). However all those that can be technically connected have to pay for sanitation even if they are not connected. On the contrary the

[97] In France it was also the best way to bypass local authorities' reluctance to pay the pollution discharge levy when the French River Basin Agencies were created : thus both the levy and sewer charge were transferred on the water bills (Bernard Barraqué, private conversation).
[98]Décret n°67-945 du 24-10-67 relatif à l'institution, au recouvrement et à l'affectation des redevances dues par les usagers des réseaux d'assainissement et des stations d'épurations.
[99]Legge n. 319 del 10 maggio 1976 Legge Merli

Conseil d'Etat ruled against the payment of the levy by inhabitants of rural areas where a sewer system is not present (Barraqué 2011a, 6)[100].

In Italy the volumetric sanitation levy introduced in 1976 was composed of a waste water collection levy and a water treatment levy. The first one was to be paid by all connected and technically connectable users. The latter was due only if a waste water treatment plant was in operations in the area. In cities, such as Milan, where a wastewater treatment plant was not in operations, this implied lower endogenous revenues collected after the *Legge Merli* than previously (Crespi Reghizzi forthcoming d, § 4.3).

According to the 1994 Galli act all users, even those unconnected to the sanitation service, were obliged to pay the volumetric sanitation levy[101]. In application of the polluter-pays principle, the sanitation levy was considered as an environmental tax with a fiscal nature rather than a payment for service rendered. There were however various legal actions against such a vision and in 2008 the Constitutional court[102] ruled against the Galli act and established that the sanitation levy is a payment for service rendered which does not have a fiscal nature and must not be paid when the service is not provided[103].

6.3.5 Infrastructure planning, management & borrowing

In both countries municipalities (or inter-municipal entities) were formally responsible for planning and managing the water and sanitation infrastructure. However in practice central government had a heavy influence on the municipal infrastructure investment policy.

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[100] « *En fait en France comme en Allemagne, on considère désormais que lorsque tous les habitants d'une ville sont raccordés, l'assainissement devient ipso facto un service rendu; donc il peut être financé à son tour par la facture d'eau […]Et ceux qui sont raccordables mais pas raccordés payent la taxe d'assainissement comme une pénalité. En revanche, le Conseil d'Etat s'est opposé à la couverture des coûts de l'assainissement autonome par la redevance d'assainissement assise sur la consommation d'eau* : CE, Avis de la section de l'intérieur du 10 avril 1996, n° 358783, Rapport annuel 1997, p. 295 ; et art 2224-12 du CGCT. » (Barraqué 2011a, 6)

[101] *La quota di tariffa riferita al servizio di pubblica fognatura e di depurazione è dovuta dagli utenti anche nel caso in cui la fognatura sia sprovvista di impianti centralizzati di depurazione o questi siano temporaneamente inattivi. I relativi proventi affluiscono in un fondo vincolato e sono destinati esclusivamente alla realizzazione e alla gestione delle opere e degli impianti centralizzati di depurazione.* Art 14 legge 36/1994

[102] Corte Costituzionale, sentenza 335/2008, 8 ottobre 2008

[103] This implied also the obligation for the water and sanitation utilities to refund users for the sanitation levies unduly collected, http://www.altalex.com/index.php?idnot=11347 retrieved online on March 26th 2014.

In Italy, since 1934, if a municipality was not able to finance by itself the investments, it could submit an investment plan to the central government which could eventually approve and finance them[104]. This was the "dualistic model where the investments are financed by the central government while the municipality provides the service"(Ermano 2012). Central government influence on investments was increased further after WWII with the 1949 *Tupini Act* and with the 1963 National water supply master plan (*Piano regolatore generale degli acquedotti)*. Concessional loans were available at the *Cassa Depositi e Prestiti* but municipalities were free to borrow on the market too. Furthermore, after WWII (and particularly after the 1970's) the financial revenues of Italian municipalities were so tightly dependent on centralized transfers that little could be autonomously planned and implemented by local authorities without the central government approval and financial contribution (Crespi Reghizzi forthcoming d, § 3.2) .

In France until the decentralization reforms of the 1980's local authorities had to obtain an approval from the prefect in order to borrow. If the total borrowed amounts exceeded a specific amount, an authorization from the *Conseil d'Etat* was also required[105]. Generally speaking, the loans collaterals consisted in municipal revenues as a whole[106] and not in service-fees specifically linked to the loan-financed infrastructure.

Municipalities were obliged to borrow from the *Caisse des Dépots et Consignations*[107] at concessional interest rate and could not borrow freely on the market.

> "Central government ministries granted subsidies on a project-by project basis, which made it practically impossible for a mayor to develop a particular infrastructure investment without the agreement and support of the central government." (Prud'homme 2006, 88).

[104]The reader may refer also to the paper in Part III (Crespi Reghizzi forthcoming d, § 3.3) where these aspects have been analyzed.

[105] « *En principe les emprunts sont approuvés par le prefet .Cependant lorsque la durée d'amortissement doi dépasser 30 années ou que l'emprunt seul ou ajouté aux autres emprunts non encore remboursés excède un certain chiffre, l'autorisation doit être donné par decret en conseil d'Etat* » (Lainville 1930, 19)

[106]« *Le conseil municipal doit indiquer sur quelles ressources il compte rembourser l'emprunt (imposition extraordinaire, fonds commun ou autre recette ordinaire* »[Loi du 18 avril 1922 relative au crédit foncier] (Lainville 1930, 19).

[107] Or from other specific institutions such as the *Crédit Agricole*, the *Crédit Immobilier* or the *Caisse d'Aide à l'Equipement des Collectivités Locales* after 1966

Indeed the *Caisse des Dépots et Consignations* would hardly accept to finance a municipal infrastructure if it had not been approved for a grant subsidy by the appropriate central government ministry[108].

Box 4 : National subsidies for water and sanitation infrastructure in France

Water

After 1903[109] water supply infrastructure was partially subsidized by the central government using funds from the *Pari mutual*, PMU, (bets on horse races) at first and after 1920 funds from lottery and other gambling games ("*le produit des jeux*") (Goubert 2008, 185). Subsidies could cover between 50 and 80 % of the investments costs and were awarded to poorer municipalities especially in rural areas. Between 1903 and 1928, 400 millions francs have been paid by the central government on *Pari mutuel* funds. The investment grant could not be higher than 40% of the investment amount and was capped to a maximum amount of 400 000 francs per each project (Frioux 2009).

Funds from the PMU and from gambling were not sufficient. After 1925, additional financial resources coming from the central government budget[110] were allocated to water supply subsidies in rural areas (Goubert 2008, 185).

The Ministry of Agriculture was responsible for the decisions on how to award the subsidies. Until 1930's only a small part of the eligible projects were subsidized. In 1934[111] the subsidy system was reformed and given more funds (Pezon 2000, 112–113). The same mechanism was in place until 1953 with some light modifications (Canneva à paraître). According to Frioux, after WWII, in the 1950's, the French central government chose to intervene massively in the design and financing of water and sanitation networks : "in may 1953 the total promised grant add up to a total amount of more than 3.6 billions francs to be compared with only 1 billion francs allocated to

[108] « *Les caisses publiques consentent aux communes des emprunts à taux bonifiés à condition que l'Etat ait accepté de doter les équipements d'une subvention spécifique* » (Pezon 2000, 148).
[109] Loi relative à la protection de la santé publique du 15 février 1902and Loi des Finances 31 mars 1903 (art 102).
[110] *Plans d'Outillage National* and *Plans de Grand Travaux*
[111] Circulaire 29 octobre 1934

urban housing and 1 billion francs allocated to public constructions[112]"(Frioux 2009, 445).

Between 1954 and 2005 water supply infrastructure was partially subsidized by an ear-marked national fund: the *Fonds National de Développement des Adductions d'Eau* (FNDAE). The FNDAE was a mutual fund fuelled by an additional levy on all volumes of water sold everywhere in France. The FNDAE could finance projects through concessional loans and after 1960 through investment grants. Some *Conseils Généraux* also created some funds at county level or mobilized their general budget which played a significant role in addition to FNDAE (Canneva à paraître).

Sanitation

In 1919 and 1924 two laws on urban development mandated municipalities to draw urban development masterplans which had to include a sanitation annex masterplan. But this obligation was not respected as most municipalities did not have enough money to finance such a costly infrastructure. "A logical consequence of such a lack of money was that the central government should finance by itself the costs of designing and eventually building the sanitation infrastructure"(Dupuy and Knaebel 1982, 28).

During WWII, a national committee for buildings reconstruction (CRI)[113] was created. In 1943 thanks to the National Delegation for public infrastructure (DGEN)[114] the June 15th 1943 act established that the costs of the design of urban development masterplans including sanitation annex masterplans (*avant projet sanitaires)* were to be covered by the central government (Dupuy and Knaebel 1982, 28). After WWII, the ministry for Reconstruction and Urbanism[115] was created from CRI and DGEN. It produced in 1949 an administrative act which states technical standards for sewer systems to be built all over France (Circulaire Caquot, CG1333, 22 février 1949) (Scherrer 1992, 316; Dupuy and Knaebel 1982, 28; Chatzis 1993).

Generally speaking, urban sewer system extensions were subsidized up to 50 % by the ministry of Interior after WWII until 1974 when the national planification was

[112] « Ainsi en mai 1953 le montant total des promesses de subventions pour les réseaux urbains s'élève à 3 milliards 620 millions de francs, contre à peine un milliard pour l'habitat et un milliard également pour le chapitre « constructions publiques » (Frioux 2009, 445), author's translation
[113] *Commissariat à la reconstruction immobilière*
[114] *Délégation Générale à l'Equipement National* (DGEN)
[115] *Ministère de la Reconstruction et de l'Urbanisme*

abandoned under liberal presidency of V. Giscard D'Estaing (Barraqué, private conversation)

With the creation of the *Agences de l'eau* in the 1960's waste water treatment plants and sewer systems were heavily financed through grants and concessional loans coming from mutual revolving funds fuelled by the additional levies on billed water (see also §5.2).

After the decentralization reforms of the 1980's in France, municipalities are now free to borrow on the market[116]without requiring an approval from an upper level of government. The only two conditions are that "the borrowings must be exclusively earmarked to capital expenditures" and that municipal accounts have to be balanced.

> "The banks receive aggregate demands for borrowings from the local entities, all investment projects are taken together instead of separate demands for each project. Thus the borrowings are considered by the local authorities as a global (i.e. non ear-marked) revenue source for the investments projects"(Gilbert and Guengant 2002, 115).

Water and sanitation services are provided in France by more or less autonomous municipal or inter-municipal collective consumption units (§4.6). Our paper in part III clarifies the borrowing policies in the various cases (Crespi Reghizzi forthcoming e, § 2.2).

In Italy, after the Galli reform, water and sanitation services are run by corporatized entities which are in principle free to borrow on the capital markets. Formally, investment plans (*Piano d'ambito)* are set by local regulatory authorities and are part of the concession agreement with the company in charge of the service (Crespi Reghizzi forthcoming f, § 6.2 & 6.3)

6.4 Additional cases from France

6.4.1 The water service in the Paris suburbs

This paragraph summarizes shortly some aspects of the history of the water service in Paris suburbs. Most information comes from a research report made by Christophe Defeuilley (Defeuilley 2004; Defeuilley 2013a).

[116]Loi 2 mars 1982 (Bourdin 2001, 257)

Piece meal private concessions

In 1860 an agreement was signed between the Paris municipality and the *Compagnie Générale des Eaux* (CGE) : within the Paris administrative area CGE was awarded a *régie interessée* contract according to which the company was responsible for selling water, handling relations with clients and billing and collecting payments on behalf of the municipality. The CGE kept also the full management of various water services in the suburbian municipalities (Crespi Reghizzi forthcoming a, § 4.1).

Indeed in the suburbs, outside the administrative boundaries of Paris, various concessions had been awarded since the 1820's to various private companies. By 1859, the CGE had bought all the previous existing companies and was responsible for the water service in 26 nearby municipalities through concession contracts (Defeuilley 2013a). The CGE activities in the suburbs expanded even more after the 1867 amendment to the 1860 contract. Under this amendment, the City of Paris withdrew from all the water supply contracts with neighbouring suburbs and left CGE totally free to expand its activity as a *concessionaire* in these neighbourhoods (Bocquet, Chatzis, and Sander 2008). By 1900 CGE was managing the water service in 60 Paris suburban municipalities (over a total of 75 Paris suburbian municipalities) trough 60 different bilateral contracts (Defeuilley 2013a, 11).

Intermunicipal cooperation and the *Syndicat*

After 1890, French municipalities were authorized to create *Syndicats* : inter-municipal entities through which various municipalities can cooperate to provide a specific public service. Since then, the municipalities in the Paris suburbs started to discuss the idea of more intermunicipal cooperation in the water sector. The idea was to create a unified *syndicat* in order to have more bargaining power with CGE (Defeuilley 2013a, 11).

It was only in 1922 that the *Syndicat des Eaux d'Ile de France (SEDIF)* was created. All the pre-existing concession contracts between the municipalities and the CGE were resigned and a single 39 years long contract was signed between SEDIF and CGE. The new contract was not a concession but only a *régie interessée* one (as in inner Paris). SEDIF had full responsibility over the investments cycle (planning and financing) while CGE was responsible for metering, billing and handling relations with users. Revenues from the sold water were shared between SEDIF and CGE according to an incentive-

based price formula. Additionally an annual fee was paid by the SEDIF to the CGE as an indemnity for all the assets previously built and financed by CGE under the various concession contracts (Defeuilley 2013a, 12). In 1962, at the expiration of the 1923 contract, a new 23 years contract was signed. This contract was extended several times until 2010. In 2011 a new contract was signed with *Veolia* (former CGE) after a competitive tendering.

Christophe Defeuilley (2013a) underlines that step by step the CGE increased its role going beyond its *régisseur* role and taking more responsibilities over the daily operations and maintenance. The CGE also acted as an industrial partner able to provide the required technological solutions and to build the planned infrastructure extension. Indeed works and infrastructure projects planned by the SEDIF were frequently assigned to CGE and its subsidiaries by mutual agreement (no tendering) (Defeuilley 2013a, 15–16).

The 1923 contract left all responsibilities on investments to SEDIF. All along the 20th century the population of the Paris suburbs kept increasing steadily (2.5 million people in 1950 vs 4 million people in 1975). In those decades the SEDIF kept investing in water supply infrastructure (Defeuilley 2013a, 14). A detailed analysis on how these investments were financed is not available but it seems likely that most investments costs were covered by a mix of endogenous revenues (Tariff) and exogenous revenues from the national government (Transfers). These transfers were given through the form of either grants or concessional loans. On the contrary we assume that the SEDIF did not receive any contribution from local general taxation.

6.4.2 The case of Lyon

In the second half of the 19th century Lyon was the French city having the third highest population (more than 300 000 inhabitants). As in Paris, under the second empire, the municipal autonomy of Lyon was removed and the authority on the city was transferred to the prefect until 1880 (Scherrer 1992, 140 & 230).

Water service in the city of Lyon

In 1853, the prefect Vaisse awarded a 99 years concession for the water service to the *Compagnie Générale des Eaux* (CGE) on the basis of a project already drafted by a

Ponts et Chaussées engineer. Water was to be drawn from the Rhone alluvial aquifer through a drift and a pumping station (completed in 1859). (Scherrer 1995, 47).

Water was not metered. It was billed by CGE according to a flat rate which was indexed on the number of inhabitants in the flat (Scherrer 1995, 47–48). In fact the service was produced according to a full concession agreement only between 1853 and 1862. Between 1862 and 1874 the new investments required to increase the volumes of water produced were directly financed by the municipality. After 1862, *de facto* the CGE was operating more under an *affermage* régime rather than a concession one (Scherrer 1995, 47 & 54). In 1874 the municipality imposed a lower tariff.

The agreement allowed the city to buy the assets back from the company after 30 years. In 1885 the municipal council voted in favour of a municipalization of the service but the issue was not settled straight away because the city struggled to find the funds to pay the indemnity to the CGE. In 1900 the service was fully municipalized (*régie directe*) as an application of the "municipal socialism" ideas defended by the mayor Edouard Herriot. The *régie directe* applied a very low level of exclusion. It billed water according to a flat rate which was indexed on the rental value of houses rather than on the number of inhabitants as previously done by CGE. The minimum rate for low rental values decreased significantly from 36 F/year to 12 F/year. In this phase, the water service costs were covered by a mix of endogenous and exogenous revenues from local general taxation. A huge investment plan was undertaken in the 1920's totalizing more than 22 Million Francs.

Between 1931 and 1934, meters were installed and water started being metered and billed according to a volumetric tariff. Water consumptions decreased significantly (Scherrer 1995, 47–48). After the investment plan of the 1920's, Lyon stopped investing for many decades. It was only in the 1960's that it was forced to undertake a major upgrade. In the 1960's the mayor, Louis Pradel, borrowed massively to finance a new ambitious investment plan. The debt's amount was so huge that it was still under amortization in the late 1980's (Scherrer 1995, 50).

Water service in the Lyon suburbs and intermunicipality

As in Paris, in response to the end of the concession contract with the municipality of Lyon, the CGE strategically chose to focus on the suburbs of Lyon where it signed

many concessions agreement with various municipalities. In 1928, the CGE was running the water service in 26 municipalities in the suburbs. In that same year the municipalities decided to create a joint entity, the *Syndicat Intercommunal des Eaux de la Banlieue* in order to better negotiate in front of the CGE. It was only in 1949 that they managed to merge all the municipal distinct agreements in a single contract between the *Syndicat* and the *CGE*. The new agreement was more an *affermage* than a *concession* one, as all the investments were to be implemented and financed by the municipalities (Scherrer 1995, 48–49).

In 1969, a larger intermunicipal multipurpose administrative entity (*Communauté Urbaine* - COURLY) was created and given the responsibility of the water and sanitation service. At first the COURLY kept direct municipal provision in the inner city (*régie directe*) and affermage with CGE in the suburbs. Later, in 1986, an affermage contract was made between the COURLY and CGE both for the inner municipality and for the suburbs (Scherrer 1995, 51).

Sanitation service

The first sewer system was developed in Lyon between 1854 and 1870 for a total length of 80 km (roughly 5 km per year). The sanitation service was part of the municipal department in charge of Streets (*la voirie)*. The operational expenses were mainly due to the salary of more than 50 sewage workers who were in charge of the maintenance. Both operational and capital expenditures were fully part of the municipal budget (Scherrer 1992, 122–124).

After 1870, the sewer system was extended in Lyon with a slower but very regular rhythm with an average increase of roughly 2.2 km per year between 1867 and 1909 and 2.7 km per year between 1909 and 1948. The slow and regular extension rhythm was also due to the fact that until the 1920's the sewer system was entirely financed by the municipality on the ordinary municipal budget (local exogenous revenues). Each year the municipality spent roughly 100 000[117] francs without any repayable finance tool being implemented. The fact that the municipality did not borrow implied also that its investment decisions were fully autonomous as no approval of the national parliament

[117] The sum of 100 000 francs is quite small if compared to the annual budget of the municipality of Lyon which totalized 16.8 million francs in 1903. In that same year the operational expenses of the *Voirie* department totalized 2 million francs (Scherrer 1992, 236).

was required. Only a few main sewers next to the river were built and financed by central government in order to protect the city from flooding (Scherrer 1992, 231–233).

Franck Scherrer points out a key difference between the Paris and Lyon cases. In Paris the *tout-à-l'égout*[118] was made compulsory in 1894 together with the setting of a sanitation levy. This was the usual "Paris exception" as the same legislation did not apply to the rest of France. The 1902 act[119] on public health authorized the *tout à l'égout* in France but did not make it compulsory. It was only in 1958[120] that the *tout à l'égout* (with a separate sewer system) was considered as the standard solution in France with some exceptions being tolerated. At first in Lyon the *tout-à-l'égout* was illegal. Through the 20th century it was increasingly tolerated on an individual case basis. It was only in 1961 that it was made compulsory as recommended by the 1958 national legislation (Scherrer 1992, 155–175).

In 1926 the collection of a sanitation levy was authorized at national level. After 1931 the story of sanitation in Lyon becomes partly an intermunicipal one with the creation of a joint board with the municipalities on the left bank of the Rhone (*Syndicat Intercommunal de la Rive Gauche du Rhone*). The *Syndicat* was financed by endogenous revenues coming from the sanitation levies. However, the investment plan was heavily dependent on the availability of grants and concessional loans from the national government. Although the central government approved some subsidies to the investment plan in 1937, in 1940 and in 1949, in practice grants and concessional loans were delayed or cancelled many times. In Lyon the central government action is more characterized by a non-intervention policy concerning sanitation than by an intervention one. As a result, the *Syndicat* investment plan was constantly postponed and realized only in the 1970's (Scherrer 1992, 126 & 310–316).

In the same decade, the *Syndicat* was dissolved and the sanitation service included in a larger and new intermunicipal entity (*Communauté Urbaine* - COURLY). The new volumetric sanitation levy and the financing policy of the River Basin Agency (*Agence de l'eau Rhone Mediterranée Corse*) allowed the COURLY to undertake and finance a significative investment plan in the 1970's and 1980's (Scherrer 1992, 368).

[118]Meaning the collection of waste water and feces through the sewer system (CrespiReghizzi forthcoming a, § 4.4)
[119]Loi 15 février 1902 relative à la protection de la santé publique
[120]Ordonnance du 23 octobre 1958 sur le branchement obligatoire à l'égout

To conclude

The development of water and sanitation infrastructure in the city of Lyon is truly a municipal one. Indeed, central government did not interfere that much in the urban development except between 1852 and 1870 and between 1950 and 1960 (Scherrer 1995, 45). No or little intervention from central government implies that the municipality was given much autonomy on its decisions but also that it was given little financial help. As a result, due to the tight municipal budget, investments were spread over a great number of years.

Even if the water service was initially created under a 'concession' contract with a private partner, in Lyon the contract very soon turned to be an *affermage* one with the investments being financed by the municipality.

We do not have detailed available data to prove it, but it seems that in Lyon, at least until the late 1960's, the costs of the water and sanitation service were covered only to a small extent by endogenous revenues with a part of the capital expenditures being covered by exogenous revenues.

6.4.3 Infrastructure end-payer in concession and affermage contracts

In the second half of the 19th century various concessions contracts (Regulated Monopoly model in Box 1) were signed between large municipalities (Lyon, Nantes, Toulon and Rouen) and the CGE (see Table 4). In Lyon quite soon such a contract was transformed in an *affermage* one (Delegation Model in Box 1) (§6.4.1).

According to Christelle Pezon, in the beginning, the CGE's "would very carefully review proposals made by the municipalities and only accept those where the annual fee for public service would not only cover its costs but also provide at least 4% profit. Extra profit would come from the private service which would basically be unlimited as costs would remain fixed while profits increased up to the last connection. In Nantes[121] for instance, the volume of water reserved for the private service was only a quarter of

[121] At that time Nantes was a rich trading city and required large amounts of water for its ships (Goubert 2008, 181).

the volume approved for the public service[122] but could provide three times more income" (Pezon 2011, 9).

CGE had a risk-free strategy where all costs (including investment costs) had to be covered and guaranteed by the yearly public-service fee which was to be paid by the municipality using money from general taxation. This means that in many cities the built infrastructure was largely paid by exogenous revenues (Tax and Transfers) and not only by endogenous ones (Tariff) as one could think.

Table 4 : large scale CGE concession contracts

	Lyon	Nantes	Toulon	Rouen
Start of the contract	1853	1854	1882	1883
Length of contract (years)	99	60	62	60
Date of the municipal decision to terminate the contract	1888	1895	1911	1911
Official termination date	1900	1900	1912	1912

Source : Pezon (2011)

The CGE "failed to develop domestic water supply based on concession contracts"(Pezon 2011, 15). By 1912, all CGE concession contracts with big cities had been terminated (see Table 4). After WWI CGE developed its activities in France mostly under *affermage* contracts.

By definition, in *affermage* contracts investments are a municipal or inter-municipal responsibility. In the general case, the infrastructure was financed in the short run by the municipality using concessional repayable finance if necessary (see §6.3.5). High inflation helped to lower the debt service costs (Pezon 2011, 15). In the long run the investments costs were covered by a mix of endogenous revenues (Tariff) and exogenous revenues (local or national general taxation). Depending on each local context and on each specific historical phase the ratio of the costs covered by endogenous revenues over those covered by exogenous ones could vary.

[122] The term « public service » was used at that time to refer to public fountains, fire protection and water for street washing.

6.5 Additional cases from Italy

6.5.1 Rome

The story

In Rome, the first aqueducts had been built in Antiquity. "It was only at the end of the 1960s that the daily quantity of water provided to the city exceeded the level provided during the Roman Empire" (Bocquet 2004, 2). Under papal authority new aqueducts were built through the centuries. In 1865[123], Pope Pio IX awarded a 99 years concession to the *Sociéta dell'Acqua Pia Antica Marcia* (SAPAM) for operating the *acquedotto Marcio* (left bank of the Tiber river). SAPAM had both English and Italian shareholders. The latter mainly came from the ruling aristocratic catholic elite. The other aqueducts (on the right bank of the Tiber river), which were in poorer conditions, were owned and operated by the municipal water service (Bocquet 2004). Such a duopoly continued even once Rome became the Capital of the Italian state as legal acts made by the former Vatican state kept their validity.

Furthermore, in 1885, an additional 25 years agreement between the municipality and SAPAM was signed: "the Acqua Marcia company was granted exclusive rights to any new aqueduct construction. In exchange, it agreed to comply with municipal service demands to implement fixed prices. The municipality agreed to stop any attempt to get new subscriber and to limit expansion of its own network to what was strictly necessary to fulfill municipal and industrial needs. As a compensation, the company agreed to serve eight public water points nearby Rome to satisfy a demand for social equity"(Bocquet 2004, 9). As a matter of fact, the 1885 agreement restrained any municipal attempt to compete with SAPAM until 1910.

In 1937, under the fascist regime, the *Azienda Governatoriale Elettricità ed Acqua* (AGEA) was created[124] and became responsible for the former municipal water service. According to Battilossi, the aim of merging municipal activities in the electric and water sector was mainly a financial one as operating profits of the electric branch could cover operating losses of the municipal water service (Battilossi 2001, 176)

[123] Rome was still within the Vatican state

[124] The AGEA was the transformation of the former Azienda Elettrica Municipale (AEM) which had been operating in the electricity sector since 1912 (Battilossi 2001, 51).

In 1944, the AGEA was transformed in *Azienda Comunale Elettricità ed Acqua* (ACEA). The duopoly of ACEA and SAPAM coexisted until the expiry date of the SAPAM concession. In 1964 the SAPAM assets were merged into ACEA which became the unique provider of the water service in Rome (Battilossi 2001; Bocquet 2004, 12).

After WWII and until the 1960's, the water branch of ACEA kept operating with significant losses since the municipality constrained the water price to a level even lower than what was imposed by national regulation[125]. On the contrary in the same years SAPAM was billing water at higher tariffs (Battilossi 2001, 276).

As Bocquet underlines, "the uniqueness of the case of Rome, from an economic point of view, was that the water supply was in the hands of two companies: one private and one municipal, and that it was the private one that for a century greatly benefited from both legal protection and protection by a dominant political milieu. The municipally owned company was the challenger, fighting against a de facto monopoly"(Bocquet 2004, 13). In Bologna too a municipal water service was created as a challenger to the private company previously in place (*Società Nazionale Gazometri e Acquedotti*)(Bigatti 1997, 121).

SAPAM investments

We do not have an estimation of the investments made by SAPAM. However we know that SAPAM was awarded a concession in the purpose of "modernizing the Acqua Marcia aqueduct and bringing the water provision network up to date"(Bocquet 2004, 4). The new facilities were inaugurated in 1870 but investments in an improved aqueduct from Arsoli to Tivoli and from Tivoli to Rome would last until 1937 (Battilossi 2001, 162)

A part of SAPAM infrastructure was received from the past as an heritage. We assume from the literature that the costs of rehabilitation and new infrastructure made by SAPAM between 1865 and 1930 were covered by endogenous revenues (Tariff) with no or little contribution from exogenous revenues.

[125] See also our paper in Part III (Crespi Reghizzi forthcoming d)

Since the 1930s, SAPAM had kept its investment policy at the minimum. Its "priority was to keep earning profits from its old subscribers" while waiting for the end of the concession (Bocquet 2004, 12).

ACEA investments

Since the 1910's the municipality had been planning to invest in a new acqueduct (*Vergine elevato* and *acquedotto del Peschiera).* It was only in 1937 that AGEA started the first lot of works which was financed by the municipality (local general taxation)[126] (Battilossi 2001, 175).

Under the fascist regime, the whole investment policy of AGEA/ACEA was financed by the governatorate and by the municipality through grants from the municipal budget and through municipal loans ceded to AGEA/ACEA (Battilossi 2001, 187).

After WWII, the municipality of Rome was in heavy financial distress with a municipal budget constantly in deficit. Additional long term debt could not be issued by the municipality because the piggyback taxes (asked by lenders as collaterals) were already set at their maximum level (Battilossi 2001, 305). As a consequence, ACEA investments (especially in the water sector) were delayed many times.

In 1953, the parliament approved a legislative act (Legge Pella) authorizing Rome to subscribe loans with the *Cassa Depositi e Prestiti* for public works expenses up to a maximum amount of 11 billion lira (Battilossi 2001, 312). ACEA recurred significantly to such financing tools.

For many decades after WWII, the water branch of the company kept covering operating losses with the operating profits of the electricity branch meaning that a cross subsidy was taking place. Globally speaking, investments in Rome water infrastructure made by ACEA through the 20th century were mostly financed through municipal loans and other repayable finance solutions coming from public institutions (the governatorate, the municipality, the central government, the *Cassa Depositi e Prestiti*). In the long run, investment costs were covered mostly by exogenous revenues : subsidies from the electric sector, subsidies from the municipal budget (Tax) and from the central state (Transfers).

[126] 11 million Italiana Lira (Battilossi 2001, 185)

6.5.2 Genova

Two private initiatives in competition

The history of water infrastructure in Genova is an original one as Marco Doria tells us (Doria 2008). At the beginning of the 19th century, an ancient medieval municipal aqueduct from the Bisagno valley was still in operation. It delivered water mostly at collective distribution points. Only a few domestic water connections were in place, delivering water to the upper class only. The aqueduct was in very poor conditions and did not allow to satisfy all water needs. Through the 19th century, things got worse due to the high demographic growth of Genova. The municipality started thinking and discussing the idea of building new aqueducts to bring additional water to the city but no decision was taken as all these projects implied very high investment costs.

In 1853, the *Compagnia del nuovo acquedotto* was founded to build a new aqueduct from the Scrivia valley. Later it was renamed as *Compagnia dell'acquedotto Nicolay* from the name of its founder Paolo Antonio Nicolay. Huge investments were made by the company between 1853 and 1860. They were financed through equity at first. Most shareholders were people from the higher gentry of Genova. Once the company ran out of equity it relied heavily on debt to finance its infrastructure. Revenues came from the water sold both to private users and to the municipality. At first the company was not profitable at all and did not pay any dividend until 1864. Often shareholders paid the water they used through a partial decrease in their share in the company.

In 1880, another private company was founded (*Società anonima dell'acquedotto de Ferrari Galliera)* to build a new aqueduct from the Gorzente valley which would also allow hydroelectric production. The investments were very costly and the company had to call for several capital increases which were fulfilled by the main shareholders (mostly from the Genova gentry).

In the last decades of 19th century, the water service in Genova was run as a competitive duopoly between the two private companies (the ancient municipal aqueduct was nearly not used anymore). In many areas of the city a competition by duplication took place as each company developed its own network (Doria 2008, 146–147) : a textbook example of suboptimal solution in terms of social surplus. In 1916 (and later in 1918 and in 1925) the two companies stopped competing fiercely. A cartel was made as the two

companies agreed to have the same tariffs and to run jointly some activities such as the water supply to the harbor (Doria 2008, 213).

Municipal investments to create a third competitor

Meanwhile, the city needed more water. Some projects were made by the municipality for a new dam and aqueduct (including hydropower) from the Noci River. Works were undertaken between 1923 and 1935 for a total cost of 45 million lira covered by the municipal budget. In 1936, under the fascist regime, a municipal company was created to run the gas and water service : the *Azienda Municipalizzata Gas e Acqua* (AMGA)(Doria 2008, 207–212).

Thus, after 1936 the water service in Genova was operated by three different entities : the two private companies Nicolay and De Ferrari e Galliera and AMGA. After WWII, once more, additional water was needed and the municipality chose to take more responsibilities in the water sector. A project for a new aqueduct (*Brugneto*) was approved by the municipality. The project was financed by a governmental grant, by a loan with the Cassa Depositi e Prestiti and by funds from the municipal budget. By 1961, the Brugneto aqueduct had been completed and was run by AMGA.

In the last decades of the 20th century an increasing tension arose between the municipality and AMGA on one side and the two private companies on the other side. Only in 1979 an agreement on exclusive distribution areas was made in order to avoid duplication and make the network system more rational. In the 1990's, to comply with the Galli reform AMGA was transformed in a municipally owned joint stock company : *Mediterranea delle acque SPA.* Various attempts were made by *Mediterranea delle acque* to buy the *De Ferrari Galliera* and *Nicolay* companies (Doria 2008, 316–326). It was only in 2006 that the three companies merged into *Mediteranea delle acque*[127].

Who did pay for the water infrastructure in Genova ?

The history of Genova water infrastructure is rather a complex one and we tried to summarize it shortly. Investments were made by three entities : the *Nicolay* company, the *de Ferrari e Galliera* company and the municipality either directly or through AMGA.

[127] http://www.mediterraneadelleacque.it/chi_siamo.asp , retrieved online on June 3rd 2014

In the short run, **in the late 19th century**, the two **private companies** financed their **investments** costs both through equity and debt. In the long run those investments costs were covered mostly by endogenous revenues (Tariff) with some contributions coming from exogenous revenues. To understand how this was possible various factors have to be taken into account:

- Some water was sold by the companies to the municipality. The municipality paid this water with money from the municipal budget (local general taxation). Thus, these revenues could be labeled as "Taxes".
- At first both private companies struggled to reach financial equilibrium and get some profitability. No dividends were paid in the first years. Additional financial efforts were asked to share-holders through capital increase operations (*De Ferrari Galliera).*
- The two companies (an especially the *Nicolay* company) relied heavily on debt. We do not have detailed evidence on the debt nature but it is realistic to assume that after 1910, high inflation contributed to lower the debt service in real terms. This means that a part of the investments costs were absorbed by the lenders.
- The two companies sold a part of the water to commercial and industrial activities (such as the harbor activity). Additionally the *De Ferrari e Galliera* had an hydropower activity. We assume that some cross-subsidies took place between industrial and domestic water users and between the electricity and water part of the *De Ferrari e Galliera*.

Investments in the water infrastructure **made by the municipality** (after 1920's and especially after WWII) and by **AMGA** were financed in the short run by central government grants[128], by loans from the Cassa Depositi e Prestiti and by funds from the municipal budget. We lack information to define precisely who was the end-payer of those investments. However, in our paper in Part III (Crespi Reghizzi forthcoming d) we have analyzed how, after WWII, municipal finance in Italy relied increasingly on transfers from central government. We assume that in the Genova case too, municipal

[128] In the 1970's a new dam and water intake (*Busalletta*) was built by the Nicolay company. The Nicolay company obtained a small grant from the central government and from the region for this investment (Doria 2008, 327–332).

investments in the water infrastructure were mostly paid by exogenous revenues (Taxes and Transfers) and in particular by Transfers from the national government.

We lack of information on the sanitation part of the story but we assume that the municipality undertook most of the investments which were paid in the long run by a mix of endogenous and exogenous revenues.

6.5.3 Other cases in Italy

Naples

In the 1860's, a tender was made in Naples to award a concession for the realization and operations of a new aqueduct (*acquedotto* del *Serino).* The company *Mamby and Roberti* won the tender and sold just afterwards the concession right to the Naples Water Works Company. The new aqueduct was inaugurated in 1885 for a total cost of nearly 40 million Lira. The concession terms implied that the municipality had to compensate the company in case the revenues from private consumption were below a minimum level. In return, the municipality kept the right to set the tariff rate (Bigatti 1997, 111). Indeed at first the subscriptions to the service were less than expected and the municipality had to compensate the company with subsidies from the municipal budget. One of the reasons for such a slow rate of subscription was the high price of 0.35 lira /m^3 (to be compared to the 0.20 lira/m^3 in Milan in 1894)(Bigatti 1997, 105–106).

Sanitation in Naples was another key issue in the second half of 19th century. In 1883, a project based on the *tout à l'égout* was drafted by the municipal engineers. After the tragic cholera epidemics of 1885, the parliament approved a law on the urban and sanitary renovation of Naples which budgeted some grants from the central government to improve the sanitary conditions of the city. Thanks to these funds, the realization of the sewer infrastructure started in 1888 (Bigatti 1997, 107–108).

Other cases of water services as private concessions in Italy

The Naples Water Works Company was a subsidiary of the *Compagnie Genérale des Eaux* which was already operating the water service in **Bergamo, Venice** and **La Spezia** (Bigatti 1997, 105). The concession model was also implemented in **Verona** and **Bologna** (Bigatti 1997, 120; Calabi 1980, 306).

In **Padova** too a concession had been awarded in the 1880's to the *Società veneta per imprese e costruzioni pubbliche*. The company financed entirely on its own the infrastructure for a total cost of 3 million Lira. However, the tariff of 0.25 lira/m3 was very high and thus, the subcriptions were much less than expected. The profitability of the project was then so low that the private company decided to resign and sell the infrastructure assets to the municipality. After the municipalization, lower tariffs were approved with a positive impact on the number of subscriptions (Bigatti 1997, 118).

As in Padova, the municipalization of many urban public services started in many Italian cities ten years before the 1903 Giolitti act (Calabi 1980). By 1904, water was operated as a municipal service in 26 county towns (*capoluogo di provincia)*(Bigatti 1997, 112).

As a matter of fact, the development of urban water infrastructure in medium and large size Italian cities is mainly a municipal finance story, as in many cities private concessions played a role only in a relatively short historical phase in the second half of the 19th century.

7 A comparative review on the financing history of water infrastructure

In this section we compare the Paris and Milan cases with cases in other countries as analyzed by other authors. In particular Christophe Defeuilley's forthcoming book (Defeuilley forthcoming) has been very useful to get evidence and references from the United Kingdom and from the USA (§7.1 and §7.2) . The last paragraph focuses on a short overview on what happened in Germany in the second half of the 19th century.

7.1 The United Kingdom

Thanks to its early industrial development and urbanization, the United Kingdom was a forerunner among European countries in the development of water supply networks and sewer systems.

The history of water services in the UK may be framed in 5 major phases of development

- **Phase 0** - Water services were developed by **private companies** which soon became "statutory" as their monopoly creation needed to be authorized by the parliament (Kraemer and Barraqué 2013, 243).
- **Phase 1** – **Municipalism:** after 1840 municipalities bought shares of private water companies and created their own water services[129].
- **Phase 2** – **Consolidation of water services :** with the 1945 National Water Act, UK water services were encouraged to consolidate and merge together "for the purpose of increasing efficiency. Under the terms of the Act the number of separate water supply systems in England and Wales was reduced from 1,400 during World War II to 187 in 1974" (Jacobson and Tarr 1995, 25).
- **Phase 3** – **Regionalization of water services :** in 1973 a further consolidation of the UK water sector took place with the creation of 10 Regional Water Authorities.
- **Phase 4 – Privatization of regionalized water services :** with the 1989 Water Act the Water services part of the Regional Water Authorities were privatized in

[129] This was made possible by the 1835 municipal corporation act.

England and Wales. A national economic regulator (OfWat) and an environmental Agency (National River Authority which became the Environment Agency in 1995) were created too.

In the next paragraphs we shall discuss some aspects of the financing history of water services in London and in the UK. We shall focus on Phase 0 and Phase 1 only.

7.1.1 Unregulated private initiatives

In 1581, a private company, the *London Bridge Water Works company*, was authorized to install a hydraulic water plant under London's bridge. However the company was unable to provide water to the whole city due to the high demographic growth[130] (Defeuilley forthcoming).

Hugh Middleton developed a new water supply project from an original idea of Edmund Colthurst. The project consisted in digging a canal to bring additional water to the city of London. The *New River Company* was created for that purpose and given the statutory authorization in 1605-1609. At first, the company was financed through equity coming from 29 shareholders - "adventurers". However the total costs turned up to be more than 3 times higher than the initial capitalization. In 1611, King James 1st agreed to pay half of the investment costs in exchange for half of the expected dividends (Defeuilley forthcoming; Defeuilley 2013b).

Until the 1630 – 1640's the subscription rhythm was very slow and the company was not able to pay any dividends. According to Defeuilley, various reasons can explain such a slow rhythm of new subscription to the service: i) an initial *una tantum* connection fee was charged by the company to new users and was quite high (1 month workman salary), ii) new users were reluctant to pay the connection investment costs and iii) there was a reluctance to switch from an *a la carte* water service (water carrier) to a fixed monthly rate service (Defeuilley forthcoming). In our terms, people were reluctant to switch from water as a market good to a water service with a club good nature.

Between 1630 and 1820 the New River Company very slowly expanded its infrastructure and increased the number of its subscriptions. There were only 50 000

[130] There were 250 000 inhabitants in London in 1605.

new subscriptions over 200 years while London's population increased from 250 000 to 950 000 inhabitants in the same period (Defeuilley forthcoming) : the least we can say is that the water service provided by the New River Company was a very elitist club. Indeed, the company had no obligation to connect everyone and adopted a "Malthusian" attitude consisting in investing as little as possible and adapted the subscription rhythm to the built infrastructure in order to maximize its dividends (Defeuilley forthcoming). This is a textbook example of the typical behavior of an unregulated monopolist.

Between the 17th and 19th centuries new private water companies were created to provide the water service in other areas of London. There was no real competition between the companies as each one was operating the service in a specific area of the city.

In the same centuries, private water companies developed also in other cities in Britain. In 1700, 8 over 13 of the largest English cities had a private water company operating the service (Defeuilley forthcoming).

In the early 19th century the various private water companies operating in London delivered water to 70 000 households over the 110 000 existing ones (Defeuilley forthcoming). In the early decades of the 19th century new private water companies arose in London, seduced by the high dividends of the New River Water company. Some of the incumbents chose to compete with other companies in the same areas and undertook an inefficient and costly network duplication : the "London Water wars" episode had started (Graham-Leigh 2000). Competition on prices was so fierce that it led to the bankruptcy or quasi-bankruptcy of many companies.

In 1815-1817, various territorial sharing agreements were made to stop competition among the companies. In 1821, a parliamentary report justified the territorial monopoly as the companies' financial distress might lead to underinvestment and jeopardize London's water safety (Defeuilley forthcoming). Such a position against competition in water utilities was confirmed by various studies and parliamentary reports in the 1840s (Falkus 1977, 142). Indeed, "by the middle of the century, London was fairly well districted by the gas and water companies, whilst in the provinces it was unusual to have more than one company serving a town" (Millward 2000, 321).

In 1845, the water services in England and Wales were mostly operated by private companies : “it seems that whilst there were only 10 municipal corporations in England and Wales operating their own water service in 1845, there were already 67 joint-stock companies”(Millward 2000, 322).

Who did pay for the infrastructure ?

Until the middle of 19th century most of the water supply infrastructure had developed in the UK under the responsibility of private investors. Who did pay for such an infrastructure ? There is no clear answer to such a question in the existing literature. It seems however that the New River Company (and other private water companies in the UK) could rely on endogenous revenues only as no subsidies were coming from the local or central government. Under this assumption, in the long run, the costs of the infrastructure built in such a historical phase have been paid by water users. Water meters did not exist yet and the water service was most of the time charged to the users through flat rates. In the case of the New River Company these were proportional to the size of the house (Defeuilley forthcoming, 10; Ward 2003, 9).

We do not know however if it was frequent for municipalities to engage in paying a “public service” (for fire protection, street washing or public fountains) fee to the private operator as in France and Italy in the late 19th and early 20th century (see also §6.4.3 and §6.5.3). In that case the public service fee paid by the municipality might be considered as an exogenous revenues coming from general taxation.

7.1.2 Mild regulation after the 1840s

Thanks to the water wars episode, water supply connections increased significantly in London through the first half of the 19th century. By 1828, there were 164 000 subscriptions over 200 000 households : these represented 82% of the London’s population (1.5 M inhabitants). By 1849, 99 % of London’s houses were connected to the water service. However, water was delivered through a “stop and go” service and there were severe problems both concerning water quantity and water quality (Defeuilley forthcoming).

Most waste water was flowing though a drainage network straight to the Thames River. With the demographic growth of London and the spreading of water-closets systems, things got even worse and the Thames became increasingly polluted, looking like a

giant open air sewer (Bigatti 1997, 55). In 1858, there was the famous "Great Stink" episode when even the House of Parliament was temporarily shutdown.

Those were also the decades of recurrent cholera epidemics in London : in 1831-32, in 1848-49, in 1854 and in 1866. In the 1848 cholera episode 14 000 people died. The public opinion and the policy makers became increasingly concerned about the poor sanitary conditions of British cities. On these grounds, in 1842, Edward Chadwick argued in favour of more public intervention in the water sector in his famous "The sanitary condition of the Labouring Population of Britain". One of Chadwick's arguments consisted in considering more cost-effective for the public authorities to invest *a priori* in water and sanitation infrastructure rather than to cope *a posteriori* with the costs of the poor health condition of the working classes. Indeed, under the "Poor Laws" (existing in Britain since the 16th century) the local public authorities were responsible for a minimum level of social and health conditions for the lower income classes. Following this line of thought, the Public Health Act was approved by the parliament in 1848 : municipalities had to create a *Local Board of Health* and were encouraged to make investments in order to improve the sanitary conditions (Defeuilley forthcoming, 38).

Box 5 : Sanitation in London

In 1855, the *Metropolitan Board of Works* (MBW) was created in London. It had two missions : i) to monitor and control the activities of the private companies and to fight against the pollution of the Thames River. To achieve the latter, the MBW built between 1859 and 1865 a sewer network parallel to the Thames in order to discharge waste water further downstream[131]. This modernization of the sewers was entirely financed on public funds.

Source : Christophe Defeuilley (Defeuilley forthcoming, 44)

In addition to the sanitary condition argument, starting in the 1840s, British policy makers started being more aware of the existence of "local natural monopolies" with their inefficient outcomes which could not be satisfactorily remedied by the use of competition.

[131] In 1887 all waste water from the city of London was discharged directly into the sea.

"Two steps followed: [a] The *de facto* private monopolies were increasingly subject to parliamentary regulation and control. [b] Also the feeling grew that municipal ownership of such monopolies was the appropriate form of control" (Falkus 1977, 139). This sub-paragraph focuses on the first step while next sub-paragraph focuses on municipalisation. Millward argues that the two steps were not independent as the regulatory regime put in place in the 1840s

> "was typical of the mid-century in that the combination of a *laissez-faire* parliament and strong local interests, in the form of Highway Surveyors, Sewage Boards and Poor Law Commisioners and the like, were enough to ensure that the regulations were permissive rather than mandatory. The weakness of the regulatory regime was one of the factors behind the drive to municipalisation in the forty years up to the First World War"(Millward 2000, 318).

In London, soon after the water wars episode, concessional rates had been set for charities and schools and water for fire protection purpose was delivered for free. In 1852, the Metropolitan water act set some additional regulation on the London water service : i) to improve water quality, Thames water intake had to be located further apart from the waste water disposal and water filtration became compulsory, ii) a cap on water tariff and a cap on the company's dividends were introduced and iii) the obligation to connect every client within the operating area was set.

The cap on water tariff was not very tight. Indeed water was billed according to a flat fee proportional to the rental value of the house. The cap was set between 4 and 7.5 % of the yearly rent value. However companies were left free to compute the rental value as they wished. The average rental values increased from £37 in 1851 to £73 in 1896 (Defeuilley forthcoming, 42,52). Indeed, water prices in London "rose by about 30 % in the period 1820 to 1900 while all other prices kept falling in Britain"(Millward 2000, 320). The cap on dividends (10% of the invested capital) was not very tight either as most companies managed to artificially increase their accounting capital base in order not to exceed the cap (Millward 2000, 322; Defeuilley forthcoming, 46). Globally speaking, according to Defeuilley, all along the 19th century private water companies in Britain made very large profits and paid very high dividends to their shareholder (Defeuilley forthcoming, 46–51).

7.1.3 Municipalization

In the second half of the 19th century British municipalities grew in importance and responsibilities in various sectors (poor relief, education, police, public health and improved sanitary conditions) we shall refer to them as "social sector's" municipal activities. In the same historical phase, British municipalities also increased their activities in the so called "municipal trading". Through this terms we refer to "all these undertakings carried on by municipalities which if they were carried on by companies or individuals would be carried on for the purpose of making a profit" (Mackenzie 1927, 244). Municipal trading included water supply, electricity, gas and tramways (Falkus 1977, 135).

Between 1845 and 1870 water supply services run by local authorities in Britain had a spectacular growth and reached the number of 250. By 1930, four fifths of British water supply services were municipally run (Millward 2000, 324–328; Falkus 1977, 152). For instance, the municipalization of the water services in Glasgow and in Birmingham are two famous example of such a trend (Kraemer and Barraqué 2013, 249–251). In the same historical phase, British municipalities also increased significantly their activities in the gas and electricity industry and later in tramways and urban transport (Millward 2000, 324–328).

Expanding municipal activities in "social sectors" implied both investments and operational costs. How to finance them was a challenge for municipalities as there were no significant and recurrent financial transfers from the central government. Indeed, in the second half of the 19th century,

> "central government might establish standards for poor relief, education, policing, and public health […] but it was not willing to use general income taxes or indirect taxes to support or equalize the burden on local communities. Here the central government continued to behave in a minimalist fashion and collective action at the local level could be accorded intellectually within the principle of local self-help. This left a severe fiscal problem especially for the rapidly growing urban areas. Pressure for better services came from local citizens and central government. Finance was not forthcoming from the centre at least initially, the tax on local property—rates—as the main source of income

> even though ratepayers were not the sole beneficiaries of the new services" (Millward and Sheard 1995, 501).

Many authors have pointed out that one of the reasons behind the rise of municipal trading in those decades was the business-oriented mentality of the members of the municipal councils. Many of them were entrepreneurs which were in favor of an expansion of municipal trading in order to capture the profits of natural monopolies and increase non-fiscal source of revenues for the municipality (Millward 2000). Such a vision has been labeled as "municipal capitalism" (Waller, quoted by Millward and Sheard 1995). Only much later, in the early 20th century, municipalization of utilities was advocated by the Fabians on ideological grounds (particularly in London) and was referred to as "municipal socialism".

Very often municipal trading in the gas and electricity sectors was a profitable activity even after taking into account the huge capital expenditures and loan charges. As a matter of fact, municipal trading in the gas and electricity sectors was a way to fuel the municipal budget with money coming from gas and electricity users rather than from tax payers[132] (Millward 2000, 333). Such a policy was largely implemented not only in the famous case of Birmingham under Chamberlain's leadership but also in other British cities such as Leeds (Millward and Sheard 1995, 527)

On the contrary in most cities the rationale in favor of municipal water supply was not profit-making as these activities were much closer to break-even once the huge capital expenditures and loan charges would be taken into account (Falkus 1977, 145; Millward 2000, 339).

In London the municipalisation of the water service took place only with the 1902 Metropolitan Water Act and the creation of the Metropolitan Water Board (MWB) in 1904. The assets of the former 8 private companies were transferred to the MWB. In exchange, an indemnity of 30.6 millions £ was paid by the municipality (equal to 15 times the companies' turnover or 38 times the companies' earnings). The municipality issued long run water bonds (100 years payback & 3% interest rate) to pay the indemnity to the companies (Defeuilley forthcoming, 58–59).

[132] Generally speaking the users and tax payers categories did not overlap.

Who did pay for the infrastructure ?

Not only in London, but also in the whole UK, debt played a key role in allowing municipalities to invest in infrastructure and expand their activities. Between 1875 and 1890, debt of British municipalities more than doubled (Defeuilley forthcoming, 60). Between 1884 and 1914, the great majority of the municipal trading debt (water, gas, tramways and electricity) of British municipalities was imputable to the water sector infrastructure (Falkus 1977, 135).

In most cities in the UK, the water service was unmetered and endogenous revenues were paid by users through a flat fee which often had a fiscal nature and was indexed to the size or to the rateable value of the house. **One of the advantages of municipal water supply vs private one was that the municipality could force everybody to be member of the CCU and thus to pay the fee through a compulsory contribution having a fiscal nature.** This is underlined by Millward who argues that "a great attraction of municipal operation was that it involved the finance of water services by rates, the tax on rateable values. By such a uniform levy, councils automatically enrolled all tax-payers on to the water undertakings books"(Millward 2000, 332).

However, in the general case, due to the very high investments costs, endogenous revenues of the water service were not high enough to cover both the operating costs and the debt service : "**water supply emerges as the largest source of gross profits but, net of loan charges, it barely broke even**" (Millward and Sheard 1995, 508). Falkus also confirms that municipal water services were run at loss and subsidized from exogenous revenues (Falkus 1977, 157)

Exogenous revenues could only come from local source of revenues (municipal budget or other municipal trading activities) since at that time there were no recurrent or significant financial transfers from the central government to the municipalities. Indeed, in some cities the water service could be partly subsidized by the profits of other municipal trading sectors: "water supply in Manchester and Leeds was openly cross-subsidized from gas profits" (Millward and Sheard 1995, 508). In other cities income from municipally owned estates (properties) was a source of relief for the municipal budget as a whole and might have been used to subsidize the water service too (Millward and Sheard 1995, 508).

According to Hassan, an original cost recovery solution was adopted in some cities : Manchester, Liverpool and Glasgow. It was based on a dual rating system, introduced after 1851 : "As well as the domestic rate charged to all private customers, a public rate was levied upon all property-owners, whether customers or not, in consideration of the external benefits generated by the municipal supply, particularly reduced fire-losses"(Hassan 1985, 545). Such a dual solution can be considered as a water service split in two CCUs from an accounting point of view. On one hand the water service *stricto sensu* was a CCU with voluntary membership charged through endogenous revenues to the members only. On the other hand the water for fire protection activity was considered a public good and delivered through a CCU with compulsory membership where everybody had to pay the fee.

7.2 The USA

7.2.1 New York

An embryonic municipal initiative

In 1774, New York municipality approved a water supply project based on wells, a reservoir[133] and wooden distribution mains. The project had been proposed by Christopher Colles, an engineer. The municipality financed all the investment costs through an ear-marked municipal bond labelled as "water works money". The service was operated by a municipal company managed by Christopher Colles himself. We assume that operating costs had to be covered by endogenous revenues (Tariffs). It seems that the scarce availability of water discouraged potential users from subscribing to the service. The whole service and infrastructure was abandoned a few years later (Defeuilley forthcoming, 75).

The Manhattan Company experience

In 1799, the Manhattan Company (MC) was authorized to run a water service on the Manhattan island. 5% of the shares were owned by the municipality. MC was awarded a perpetual concession for the water service with the only engagement of satisfying the city water needs before 1809 (Defeuilley forthcoming, 82). MC was created under the initiative of Aaron Burr. Christophe Defeuilley analyzes finely how Aaron Burr

[133] A pond "the collect" is also used as reservoir.

managed to curb down the initial reluctance of the municipality to authorize a private company to operate the water service. The story is quite original as Aaron Burr was not so much interested in the water business but considered it as the best stratagem to have the authorization to create a private bank. Indeed the 1799 act authorized the Manhattan company to freely use the profits from its water activity on other activities including financial services (Defeuilley forthcoming, 83).

The MC invested as little as possible in the water infrastructure while it opened from the beginning a banking subsidiary. The water provided by MC was available in small quantities and had a very poor quality. Thus subscription rhythm was very low. *De facto*, the MC was only an "excuse" for Aaron Burr banking activities.

Municipal initiative and the Croton aqueduct

Things got even worse through the following decades due to high demographic growth of the city. In the first half of the 19th century New York was far behind its rival city Philadelphia in terms of water supply. Indeed, the 1832 cholera epidemics was much more lethal in New York than in Philadelphia and Montreal where better water supply was available. The lack of a good quality water supply and distribution in New York was also a big problem in terms of fire protection. In 1835, a fire caused huge damages to the city (Defeuilley forthcoming, 87–91).

To solve the water issue, the municipality chose an ambitious solution consisting in a water intake on the Croton river and on an long distance aqueduct to channel water to the city. In a 1835 referendum, the New York citizens pronounced themselves in favour of such a project. Works lasted until 1842 when the water service (operated by NY municipality) started. To finance such a costly infrastructure (12 Million Dollars) the municipality largely used municipal bonds.

In 1848, endogenous revenues covered only 36 % of the interest on the issued bonds. The total endogenous revenues between 1842 and 1868 were not high enough to cover the total initial investment costs (Defeuilley forthcoming, 95).

In 1877, the municipality decided to invest in two additional water intakes in the Croton river area. Works were undertaken between 1886 and 1892. Other works in the Catskills system were also made in the early 20th century, until 1928.

Thanks to the 1893 Webster act, the city engaged in an ambitious policy of water resources protection through massive land acquisition in the Catskill area (Defeuilley forthcoming, 96). Such a policy is considered as an early example of the "payment for ecosystem services" approach (Barraqué and Isnard 2012).

Land acquisitions and infrastructure costs were once more financed through debt. In 1886 NY had a total debt amount of 126 million dollars to be compared with the annual municipal budget of 49.1 million dollars. Revenues from municipal commercial services were flowing into a special fund ear-marked for debt servicing. Revenues from the water service were the major contribution to such a special fund. Revenues flowing in such a fund were not high enough to cover fully the debt service which was also covered by the municipal budget (local taxation) (Defeuilley forthcoming, 96).

In 1920, municipal infrastructure assets were estimated at a 341.5 million dollars value. In 1919, endogenous revenues from the water service managed to cover both operational expenditures and debt service on past investment (Defeuilley forthcoming, 116). We assume that in NY too, as in Paris and in Milan, inflation played a role in lowering the debt service in real terms.

7.2.2 From private concessions to municipal water services

In **Boston**, the municipality awarded a concession for the water service to the *Aqueduc Corporation* which had been created in 1794 by local private investors. It seems that the business was not so profitable. Quite soon some tensions arose between the municipality and the company. The municipal authorities were asking the company to invest more in order to connect the whole city to the water service. On the contrary the company was reluctant to invest in a business which did not seem profitable enough. In the 1840's - 1850's, the municipality chose to buy back the private company and to create a municipal water service (Defeuilley forthcoming, 73). Boston issued various municipal bonds to finance its water infrastructure. The municipality considered the water service as an *ante litteram* merit good : it adopted a low water tariff policy to make water affordable for all and to encourage subscriptions to the water service. For many decades endogenous revenues did not cover the costs of the water service. In particular the debt was not serviced by endogenous revenues but by the municipal budget (Bartlett 2003, 26).

The Boston municipality also chose to heavily subsidize the investments to be made within the private buildings to connect to the water service (Bartlett 2003, 24–25).

The Boston story with a first phase under private concession and a municipalisation in a second phase also took place in many other US cities : New York, Cincinnati, Pittsburgh, Saint Louis, Chicago, Baltimore, Rochester and San Francisco (Defeuilley forthcoming, 104).

Montreal followed an original path as we showed in Box 3 (at page 332): on one hand the former private service was municipalized, on the other hand it was not subsidized by exogenous revenues to keep tariff low and encourage subscription. On the contrary the choice was made to make connection to the water service compulsory and collect endogenous revenues through a compulsory ear-marked water levy having a fiscal nature (Fougères 2004).

The first US city to have a modern water service was **Philadelphia**. Its story however does not fit into the two-phases paradigm as from the beginning, in 1801, the municipality developed, financed and managed the water service on its own. The works were financed through a municipal bond subscribed mainly by the city inhabitants. A water tax was set by the municipality to help paying the bond back. The subscription rhythm to the water service was not so fast and in 1814 endogenous revenues were covering less than half of the operational expenditures and could not cover the debt service.

Based on these case studies, Christophe Defeuilley reminds us that the development of urban water services in the USA may be framed in two different phases : a "**phase 0**" where water services were created by **private investors** under concession agreements and a "**phase 1**" where **municipalities** took back full responsibility over their water service (Defeuilley forthcoming) . Jacobson and Tarr confirm such a trend :

> "Overall, the proportion of government owned waterworks in the United States increased from about 6 percent in 1800 to about 53 % in 1896. […]By 1896, only nine of the largest fifty cities in the United States still relied upon privately owned waterworks. By 1900, all but one of the eleven cities in the United States with a population of more than 300,000 had acquired or constructed a municipally owned waterworks"(Jacobson and Tarr 1995, 11).

In many American cities, during "phase 0" the private water company failed to extend to the whole city a good level of water service in terms of quantity and/or quality. This had consequences both in terms of poor sanitary conditions and of ineffective fire protection. Many USA municipalities considered that municipalisation was the best way to solve such a market failure.

From an infrastructure financing perspective, the major switch was not the change from private to publicly run water services. The big change was the shift from an infrastructure financed by private equity (and private debt), serviced mainly by endogenous revenues, to a municipal-debt-financed infrastructure serviced, for a significant part, by exogenous revenues.

In fact, even during "phase 0", often all costs were not fully covered by endogenous revenues. Indeed, in many cases the municipality agreed to pay an annual fee to the private company for each fire plug installed. In general fees were high enough to cover the financial losses of the first years of concession (Defeuilley forthcoming, 101). Obviously the fire protection fees paid by the municipality came from general taxation and can be considered as exogenous revenues.

7.2.3 The role of municipal debt serviced by exogenous revenues

We already discussed how the major development of water infrastructure in Philadelphia, in New York and in Boston was municipally driven and financed through municipal bonds. Similar stories took place in other US cities. Generally speaking, water debt was serviced by exogenous revenues (general taxation) and not by endogenous revenues only. Indeed, most municipalities set a low water tariffs policy, not only to make water affordable for all but also to encourage subscriptions to the water service and thus obtain more endogenous revenues later. Thus, at first, endogenous revenues were not large enough to cover the debt service. Sometimes they did not even fully cover the operational costs.

As Sarah Bartlett writes :

> "In light of low willingness to pay under private sector provision in Boston, the Commissioners generated demand by subsidizing all connections, offering a low tariff and warning citizens that water department deficits would be paid out of general taxation. […]. From the perspective of Boston's water planners, low

> prices meant improved cost recovery because low rates would encourage more people to connect to the system to help pay for the costs" (Bartlett 2003, 54).

Boston municipality wished to encourage everyone to be member of the water service CCU. To do so costs of the water service were to be covered by general taxation by all inhabitants rather than charged to the water service user only.

Boston water service was then a CCU where the implementation of the exclusion principle was technically possible but not desirable (CCU A2 in §2.5). Boston's policy was clearly stated by its 1848 Mayor Josiah Quincy Jr:

> "The water rent is placed at a price that renders it economical for every one to take it. All citizens, whether they take it or not, will, after the expiration of two years from the completion of the work, be obliged to make up the deficiency of the rent in the general tax. All therefore are called upon by the natural desire of enjoying what they are obliged to pay for, from economy and from public spirit, to take the water and receive a blessing which, after enjoying it for one year, neither they nor their families, would abandon for ten times its cost." (quoted by Bartlett 2003, 26)

Jacobson and Tarr indicate that "cities in the United States have typically funded their waterworks through a combination of user fees, assessments on abutting property-holders for water-main extension and general tax-revenues"(1995, 12).

As a matter of fact, US municipalities financed their water infrastructure mainly through municipal debt serviced by exogenous revenues. "Between 1860 and 1922, municipal debt increased from 200 million dollars to more than 3 billion dollars"(Melosi 2008, 84). A very significant portion of such a debt was imputable to water infrastructure (Melosi 2008, 98). "Available statistics suggest that in 1905, waterworks were the largest debt line item of municipal government" (Cutler and Miller 2005, 21 quoted by; Defeuilley forthcoming, 118).

Exogenous revenues used to cover the debt service came both from general taxation and/or from specific land value capture tools. At that time, in the USA, municipal fiscal revenues came mostly from properties taxes linked to the cadastral value of properties. Water and sanitation infrastructure has a positive impact on the values of the properties connected to the service. Such a land value increase may have been partially captured

either through the general ad-valorem property tax[134] or through specific land value capture tools (refer also to § 2.11).

US municipalities massively used debt to finance urban infrastructure also because they were submitted to quite loose borrowing rules. Indeed until the 1840's, US municipalities were not submitted to any borrowing cap. After the 1840's many States set some borrowing rules:

1) the scope and the total debt amount should be clearly identified,

2) local taxes should be set at a sufficient level to payack the loan and

3) subscribing the additional debt and setting the additional tax needs to be approved by referendum (Defeuilley forthcoming, 117).

By 1890, a borrowing cap had been set by most US States. Often the borrowing cap was expressed as a percentage of the total cadastral value of properties. Indeed such a value was the key determining factor of municipal fiscal revenues which were mostly based on the "*ad valorem* property taxes". However, in most States the borrowing caps were set to a quite high level which was not perceived as a constraint by municipalities (Defeuilley forthcoming, 117). Moreover, very often, water loans were even less constrained (Bartlett 2003, 22) as "legislatures were more lenient in allowing cities to float water bonds than incurring other forms of public indebtness, since they were stable and demonstrated a good payment record" (Melosi 2008, 84).

Not only did the municipal borrowing regulation did not slow down municipal investments but according to some authors it also played a stimulating role as municipalities had to carefully study and calibrate the sustainability of the debt-financed infrastructure project (Defeuilley forthcoming, 118).

[134] Such an option would require to keep updated cadastral values which however is not so frequent in practice

Box 6 : Financing sanitation in US cities

What about **sanitation** ? The development of sewer systems in the US was municipally driven too. If possible, private investors played an even smaller role than in water supply development as "the only large city to grant a sewerage franchise was New Orleans, but it was short-lived"(Melosi 2008, 98). US sewer systems in large cities developed heavily between, 1870 to 1920 thanks to municipal bonds serviced mainly by exogenous revenues (both land value capture tools and general taxation)

Source : (Melosi 2008, 98; Jacobson and Tarr 1995, 14)

Box 7 : The New deal and Federal involvement in water infrastructure financing

Until the 1920's, water infrastructure was a municipal issue in which State and Federal governments were not interested. Things changed with the New Deal. The Federal government chose to be involved and finance water infrastructure either through grants or through loans. Projects could entirely be financed by the federal government or eligible only to a partial federal financing. Such a federal financing policy made possible also for smaller municipalities and more rural areas to get a water supply system (Melosi 2008, 137). Later , in 1972, the Clean Water Act set up the Revolving Fund (fuelled initially by a federal grant) to be repaid at low interest rate. See also § 5.2 in Part I.

7.3 Germany

In this paragraph we give a very short summary on how water and sanitation infrastructure developed in Germany in the second half of the nineteenth century.

In the middle of the nineteenth century no modern water and sanitation service was in place in most German cities. Water was available from wells and fountains only. The municipalities were responsible for the maintenance of public wells, public fountains and of the few sewers already in place. The *tout-à-l'égout* was not yet existing and generally speaking, private landowners were responsible for empting cesspools and discharging untreated waste water into rivers, canals or sewers where they existed (Bigatti 1997, 72–73).

Through the second half of 19th century a fast and massive demographic urban growth took place in German cities with frequent epidemics of cholera and typhoid fever. To

face such a health crisis most municipalities got involved in a sanitary revolution which included the provision of modern water and sanitation services.

By the end of 19th century, all cities having more than 25 000 inhabitants had a water supply network in operation (Bigatti 1997, 81). The extension of the sewer system in German cities took place at a slower rhythm and with some decades of delay. However, by the early years of the 20th century all cities having more than 100 000 inhabitants had a sewer system in operation (Bigatti 1997, 83). "From a peak of 30.7 per 1,000 during the cholera epidemic of 1865-1867, urban mortality in Prussia dropped to 19.2 by 1905. Typhoid fever, a commonly used barometer of the state of public health, had all but vanished by the turn of the century"(Brown 1988, 307).

In Prussia, the largest of the independent states which were unified by Bismarck in 1871, municipal authorities had a large autonomy and were authorized to be involved in the economy and to create municipal corporations. Since then, in Germany, municipalities have been considered "the main citizen defence against the arbitrary power of the central government" (Barraqué 1997, 1). This might be one of the reasons which explains the fact that in most cities utilities were operated from their birth as municipal services (Kraemer and Barraqué 2013, 257). People referred to such an involvement of municipalities into the economy as "*Munizipalsozialismus*", a sort of "social municipalism" which had not much in common with the "municipal socialism" coined in Britain by the Fabians (Kraemer and Barraqué 2013, 258).

With the exceptions of Köln and Berlin, water services developed in Prussia under municipal initiatives. At the outburst of WWI more than 90 % of German water services were provided by municipalities (Kraemer and Barraqué 2013, 256)

Indeed, "from 1850 to 1913, real municipal expenditures rose 4 percent per year and debt grew at an annual rate of 6 percent. A significant share of this growth stemmed from expenditures on public health programs and bond-financed investments in new sanitary infra-structure. In 33 of Prussia's largest cities, for example, sanitary infrastructure accounted for one-third of a sevenfold increase in per capita spending on debt retirement from 1869 to 1908"(Brown 1988, 307).

Indeed, repayable finance played a major role in allowing municipalities to finance in the short term their huge investments in water and sanitation infrastructure. In addition

to that, who was the end payer of such an infrastructure in the long run? The literature seems to give a two-fold answer to such a question for the water and sanitation service respectively. Water was metered and billed to the users and the water service was financed at least partially by tariff. In fact, according to Bigatti, municipalities had to make a choice in an essential trade-off : should they bill the service to the user at a price as low as possible or should they on the contrary use the municipal water service as a source of profits for the municipality (Bigatti 1997, 80) ? Sanitation had a different business model : large capital expenses and very little endogenous revenues. As a matter of fact, the huge capital expenditures necessary to develop a sewer system were covered by two financial sources : local general taxation and land value capture mechanisms[135] (Bigatti 1997, 82–83). Indeed in Prussia in 1875 and 1893 two laws[136] made provision for the infrastructure burden to be covered by side-residents (refer also to § 2.11). A hybrid solution consisted, in Berlin, in using the profits of the water service to partially subsidize the sanitation one (see Box 8).

Box 8 : The birth of the water service in Berlin

In Berlin a public-private company owned by English private investors and by the municipality (13% of the shares) was created in 1856. Initially central government imposed the private concession model despite municipal opposition. The company was awarded a 25 years long concession for the water supply service. According to the concession contract the company had to comply with various obligations : i) a fixed minimum amount of extension of the water supply network per each year, ii) free water supply for fire protection, street washing and five public fountains. The company could set the water tariff but there was a rate of return (cost-plus) regulation with a 10% maximal authorized return. All profits exceeding such a cap were to be transferred to a special ear-marked fund for sanitation investments. Quite soon the private investors bought back from the municipality its shares in the company. Tension arose from the beginning between the company and the public authorities since the latter were not satisfied by the company slow rhythm of investment. In 1874 the company was municipalized.

Source : Kraemer and Barraqué (Kraemer and Barraqué 2013, 247–248)

[135] The relevance of land value capture mechanism in financing urban infrastructure in Prussian cities is also confirmed by Kraemer and Barraqué (Kraemer and Barraqué 2013, 261)

[136] Law July 2nd 1875 and Lax July 14th 1893. According to the 1893 law betterment taxes were included among the ordinary municipal fiscal revenues.

8 Conclusion

Through this thesis we have looked into the financing history of water and sanitation infrastructure through the lens of public finance theory. The originality of our research approach consisted in bearing in mind the present challenges of the water sector both in developing countries and in the western world when looking into the past.

Our research was bi-directional: on the one hand we used the terms and paradigms of the present water sector policy debate to analyze the public policies of the past. On the other hand, we are convinced that a long run perspective can be useful to challenge and give more depth to the present policy debate.

Our conclusion is also twofold. In § 8.1 we summarize our main findings and research outcomes while in § 8.2 we attempt to use our long run analysis to draw some policy lessons both for developing countries and for the western world.

8.1 Research outcomes

This paragraph focuses on the main research outcomes from our PhD.

-The first sub-paragraph summarizes the results from our papers in Part I on the 19th and early 20th century phase of Milan's and Paris' WSSs.

-Sub-paragraph 8.1.2 focuses on Milan's WSS from WWII to the present.

-Sub-paragraph 8.1.3 recalls the public-finance matrix of the trade-offs for water and sanitation services.

- Sub-paragraph 8.1.4 suggests to frame the development of French and Italian WSSs in four historical phases.

-Sub-paragraph 8.1.5 sketches a general path that countries in the West followed in developing their water and sanitation infrastructure.

8.1.1 Economic history - the inception phase of water and sanitation services in Paris and Milan

Original financial model of primary data sources

A significant part of our analysis is based on an original use of primary data sources: the yearly financial reports of Milan and Paris municipalities. No previous study had

exploited these data sources to analyze the financial equilibrium of water and sanitation services (WSS) in a specific historical phase.

To perform our analysis, we manually collected three series of financial data from the water and sanitation accounting sections of the yearly municipal financial reports : one series concerns Paris' WSS from 1865 to 1930 (Crespi Reghizzi forthcoming a) and two series concern Milan's WSS from 1888 to 1924 (Crespi Reghizzi forthcoming b) and from 1956 to 2000 (Crespi Reghizzi forthcoming d). Using these data series, we built and computed an original financial model of these services. By itself, such a thorough analysis of the financing history of Milan and Paris WSSs based on rich primary data is one of the strengths of our research.

Main results

Through our analysis in the **three papers[137] in Part II (Crespi Reghizzi forthcoming a; Crespi Reghizzi forthcoming b; Crespi Reghizzi forthcoming c)** we show that both in Milan and in Paris, the municipality provided the infrastructure and financed it through debt at fixed interest rate with long payback duration. Due to the high inflation from the 1910s to the 1930s, the debt's service was lowered in real terms, and a significant part of the debt's burden ended up being absorbed by the lenders.

The debt was mostly multi-sector and managed as a whole at municipal level. In both cities, the endogenous revenues (Tariff) were insufficient at first to cover the full internal costs (operational expenditures OPEX and debt service). Moreover, the sanitation levy revenues were below the OPEX and a cross-subsidy was taking place between the water and sanitation services. Hence, the debt service was first covered by a mix of exogenous (Tax) and endogenous revenues (Tariff), and later by endogenous revenues only, once it had already been lowered in real terms thanks to inflation.

A major difference between the two cities is the large-scale land acquisition and resale policy implemented in Paris during Haussmann's massive urban renovation. In Milan, on the other hand, land value capture mechanisms did not play a significant role in financing urban infrastructure. Milan lacked the two essential conditions for such a

[137] The two first papers have been accepted by the book editors and submitted into the editorial process respectively at Oxford University Press and MIT Press. The third paper has been accepted by the journal Flux – International Scientific Quarterly on Networks and Territories. See also the Table in Appendix 2.

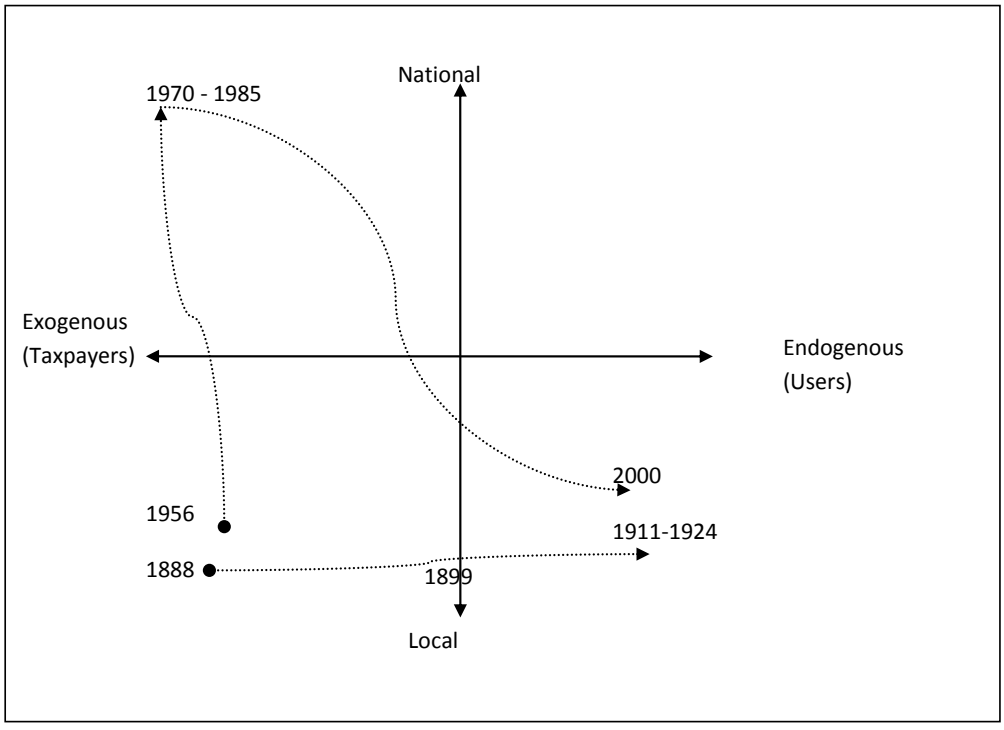
policy; available expropriation tools were weak and the municipal borrowing policy was very cautious and constrained[138].

8.1.2 Milan's water and sanitation services after WWII

In two of our papers in part III we extend our analysis on Milan's WSS from WWII to the present.

Specifically, in **Crespi Reghizzi (forthcoming d)** we examine the history and financial flows of Milan's WSS between the 1950's and 2000 through an original prism: we look at the long run evolution of the intergovernmental financial relations and the water and sanitation regulatory framework. Thanks to our analysis, we build a two-dimensional map of the evolution of the long run cost allocation of capital expenditures in Milan's WSS (graph here below). The x-axis tells us whether costs were covered by endogenous revenues or by exogenous ones. The y-axis shows whether exogenous revenues are local (Taxes : local general taxation) or national (Transfers from the central government).

Figure 7 : Long run cost allocation of capital expenditures in Milan's WSS



Source : author's elaboration

[138] In French, this is called '*gestion en père de famille'* to which Haussmann did not stick. Indeed, Morizet suggests that Haussmann was fired because *petits bourgeois* opposed government taking part in land speculation (Morizet 1932).

We show that while the operational costs of the WSS as a whole were initially largely subsidized by the municipal general budget (local exogenous revenues), after 1899 an increasing share of the costs was covered by endogenous revenues. Indeed, after 1911, and at least until 1924, endogenous revenues were high enough to cover capital expenditures (debt amortization) as well. In other terms, Milan's WSS financial autonomy was high.

The dynamics changed after WWII. The aftermath of the war greatly reduced Italian municipalities' financial autonomy. The own tax revenues to total spending ratio was very low. The combination of anti-inflation tariff regulations and fiscal centralization policies led to a switch in the long run cost allocation from endogenous revenues (before WWII) first to local exogenous revenues (1956) and to national exogenous revenues later (1970-1985). This partly explains why investments in drinking water and waste water treatments were constantly postponed in the 1970's and 1980's in Milan. These investments were not considered as "politically visible" and were completed (respectively in 1994 and 2005) only thanks to the tight pressure put on Milan's municipality by EU directives and national legislation.

It was only in the 1990's that the combination of higher municipal fiscal autonomy and a more cost-based water tariff regulation allowed Milan's capital expenditures to be covered again by local exogenous revenues first and endogenous revenues later.

Since 2003, Milan's WSS has been operated by a municipally owned corporation : Metropolitana Milanese SPA (MM), on which our last paper in Part III focuses **(Crespi Reghizzi forthcoming f).** MM appears to be a well-run company with good technical and financial performance. Despite being a corporatized entity, MM and its staff are strongly committed to public service goals with no significant differences with what was happening previously under full municipal provision. One could even argue that MM corporatized WSS is more effective in fulfilling public service goals than full municipal provision was previously, as the stories of postponed investments tell us.

However, we also show that MM is part of an imposed baroque institutional governance system which is neither very effective nor efficient. Indeed, the regulatory architecture at local level is perfectly performed from a formal point of view but does not seem to be truly taking place in substance. It remains to be seen whether the presence of a new

national regulator (AEEG) will fully imply a positive switch from detailed regulatory process on paper to its actual implementation.

8.1.3 A public finance insight on the key trade offs for water and sanitation services

In Part I, we discuss various aspects of public finance theory: impure public goods, natural monopolies, collective consumption units (CCU), land value capture tools, repayable finance for infrastructure and local public finance. Based on this public finance review, we build an original matrix of the trade-offs to be made in the water and sanitation sector (§5.3 and Table 3):

- Compulsory or voluntary membership to the CCU?
- Endogenous or Exogenous revenues?
- Institutional nature of the CCU
- Legal nature of the endogenous revenues
- Technical nature of the endogenous revenues
- Source of the Exogenous revenues
- Infrastructure project planning and management
- Who borrows ?
- Infrastructure end payer
- Spatial equalization and financial economies of scale

Such a trade-off matrix is a significant outcome of our research which can be used for many purposes. From a research perspective, the trade-off matrix can be an effective prism through which to analyse past and present policies in the water sector as we did for France and Italy (Section 6 in Part IV).

The trade-off matrix could be a powerful tool for policy makers too. Indeed it could be effectively used to challenge, reshuffle and improve present policies in the water sector but also (with some minor modifications) in other local infrastructure sectors (e.g. urban transport).

8.1.4 Four phases of development of Watsan infrastructure in France and Italy

Based on the trade-off matrix, we analyze the evolution of the water and sanitation sector in France and in Italy (Section 6 in Part IV and **Crespi Reghizzi (forthcoming e)**). Thanks to that analysis we suggest that the development of water and sanitation infrastructure in France and in Italy may be framed in four phases:

- Phase 0 : Privately owned water services based on the concession model.
- Phase 1 : Municipally driven infrastructure development (19th century - 1920's)
- Phase 2 : Local initiatives under the central government's influence
- Phase 3 : Self-financed CCUs & the decentralization paradigm

Phase 0: Privately owned water services based on the concession model

In many cities in the two countries (and elsewhere as we discussed in Section 7), water services developed first as private initiatives led by entrepreneurs. Generally speaking, in this phase, infrastructure was financed by private capital (both equity and debt). Formally, in this model, share holders' dividends and debt's payback were entirely covered by endogenous revenues.

However we showed that in many concession agreements (as in Naples and in Nantes - see § 6.4.3 and §6.5.3), a yearly fee was paid by the municipality to the private company for the so-called "public service" (fire protection, public fountains and other municipal water needs). This means that the service costs were covered *de facto* by a mix of Tariffs and Taxes.

In Paris, an example of private concession is the early and short experience of the *Compagnie des Eaux de Paris* (*Perier* brothers) (§6.2.1) which however did not receive any revenue from the municipality (Crespi Reghizzi forthcoming a, Box 1). In fact, one could wonder whether this was one of the reasons behind the company's early failure.

On the contrary, Milan did not even go through this phase because the attempt to award a concession for the water failed (Crespi Reghizzi forthcoming b).

In many cities, at a certain point the water service was municipalized on sanitary grounds as early private initiatives did not manage to extend water service to the whole city.

Phase 1: Municipally driven infrastructure development

This second phase began sometime in the second half of the 19th century and lasted until the 1920's. It is analyzed in the papers in Part II and discussed further in §6.2.

During this phase, the municipality led the development of urban infrastructure in the larger and wealthier[139] cities in both countries[140]. A hybrid solution which was also often adopted in France consisted in choosing the delegated management model (*affermage*) where the investments in infrastructure are kept under municipal responsibility (Pezon, 2011).

Municipalities were largely autonomous in their revenues (no recurrent transfers from central government). Water and sanitation infrastructure developed as part of the whole urban infrastructure with little or no separation from the municipal general budget. It was largely financed using long term repayable finance which had municipal fiscal revenues as collaterals. Debt service was lowered in real terms thanks to high inflation in the early 20th century. Total costs (including investments costs) were covered by a mix of endogenous and local exogenous revenues. The cases of Milan and Paris also illustrate this phase.

Phase 2 : Local initiatives under central government influence

This phase starts in the 1920's and lasts until the 1970's / 1980's in France and until the 1990's in Italy.

Municipalities (or inter municipal entities) were still responsible for water and sanitation services; however this took place under a tight influence of the central government:

- Through various reforms, municipal finance was made less autonomous and more dependent on central government transfers and shared revenues. This phenomenon was particularly sharp in Italy.
- Municipal borrowing was also heavily constrained too.

[139] « *Cette antériorité des villes polyvalentes et prospères leurs assure une avance considérable sur le reste des cités et bien plus encore, sur l'ensemble du monde paysan »* (Goubert 2008, 197)

[140]« *Les grandes villes de province, héritières d'une tradition urbaine ancienne, ont pour l'essentiel réussi à s'équiper souvent en ayant recours à l'emprunt. Ce choix a débuté avant le premier conflit mondial. Les équipements ont alors été remboursés d'autant plus facilement que l'inflation consécutive au conflit a joué en leur faveur. »* (Pinol 1999, 80)

- Infrastructure planning, design and financing was increasingly centralized.
- Water tariffs were subjected to an upper level of government approval and constrained in the dominant anti-inflation macro-economic policies of the time.
- A dual system was in place where the central government had great influence on the infrastructure development while it left the provision of the service to the municipalities.

Milan, Paris and many large and wealthy cities in both countries had already developed a significant part of their infrastructure during Phase 1. They pursued the infrastructure development in phase 2 sometimes with constant investment postponing (such as in Milan).

Smaller or poorer municipalities (particularly in rural areas or in the South of Italy for example) had not been able to develop the Watsan infrastructure in Phase 1. Central government subsidies policies in phase 2 (e.g. in France FNDAE) were an attempt to reduce disparities in infrastructure endowment through incentivizing local authorities to develop a Watsan infrastructure. However the effectiveness of such a policy was partially jeopardized by the constraints on municipal financial autonomy and on public services tariffs.

Phase 3: Self-financed CCUs & the decentralization paradigm

The fourth phase started in the 1970's/1980's in France and in the 1990's in Italy. It is characterized by the following major trends.

- With the decentralization reforms, municipalities were given more fiscal and financial autonomy. The ratio of local exclusive taxes to total municipal revenues increased.
- Municipal borrowing became less constrained
- Water and sanitation services were given more autonomy from the municipality through the creation of more legally and financially autonomous collective consumption units (CCU) *regimes.*

- Local Government Units were increasingly encouraged to cover water and sanitation costs through endogenous revenues and to avoid covering them through exogenous revenues[141]. Progressively, the "water pays water" principle was adopted by policy makers in France. The full cost recovery principle was then adopted in Europe on environmental grounds.
- In France, thanks to the spatial equalization (cross subsidies) implemented by the *Agences de l'eau* mutual system, the transition to full cost recovery was gradual while in Italy the shift was abrupt (Crespi Reghizzi forthcoming e).

8.1.5 Sketching the 19th century expansion phase of water and sanitation infrastructure in selected countries in the western world

In section 7, we compare our analysis on France and Italy with the literature on the experiences in other countries (UK, USA, Germany). Each country and each city followed a specific path. Nevertheless, we sketch a general path that countries in the West followed in developing their water and sanitation infrastructure with some common features among the 5 countries we compared: France, Italy, UK, USA and Germany.

Generally speaking, in all selected countries there has been an **initial phase** where the water infrastructure developed under the **private concession model**. In such a model, the water infrastructure costs were covered in the long run by a city-specific mix of endogenous and exogenous revenues. In some cities, municipalities paid the concessionaire a yearly fee for the "public service" scope of the infrastructure. These yearly fees can be considered as exogenous revenues coming from local general taxation. They covered a part of the infrastructure costs and lowered the investor risk.

In other cities, no exogenous revenues came from the municipality and all costs were covered by endogenous revenues only. However, this model had problems. Relying on endogenous revenues only was one of the reasons behind the failure of the concession model to effectively generalize the water infrastructure to the whole city in a context of fast urban expansion. This was the case in Paris with the short experience and failure of the *Perier* brothers company.

[141] « *Faire payer l'usager plutôt que le contribuable semble de bonne politique financière. C'est aussi une politique de vérité des prix qui permet à chacun de mieux saisir le coût réel du service qui lui est rendu* » (Chaix 1986, 18)

The private concession model phase was particularly significant and long lasting in the UK. On the contrary, that phase was much shorter and less relevant in Germany, the USA, Italy, and France.

Despite these differences, all five countries switched to a **municipally-driven model to develop water and sanitation infrastructure** between the middle of the 19th century and the early decades 20th century. In all considered countries[142], the municipal switch coincided with the inception of the expansion phase of a city-wide and universal water and sanitation infrastructure. We shall refer to this second phase as the "**expansion phase**."

A clarification has to be made for France to anticipate a possible objection. The private sector continued to play a significant role in the French water sector even during the expansion phase of water services. Nevertheless, the private sector did not have a major role in the expansion of the infrastructure *stricto sensu* since it was mainly involved through the delegation model (*affermage*). In these contracts, the most of the investments were a municipal responsibility and not delegated to the private partner (see also § 6.4.3)

Taking this into account, we argue that **most of the expansion of water and sanitation infrastructure in large cities in selected countries in the western world was a municipally-driven story.** This statement should however not be read as an expression of the classical public versus private debate. On the contrary, we already wrote that such a debate is not relevant when one focuses on investments and infrastructure as we do.

There are at least four other issues implied in the previous statement which are relevant in terms of infrastructure financing during the expansion phase: i) large municipal autonomy and low central government involvement in the expansion phase, ii) a municipal debt story, iii) water and sanitation services as merit goods which should be incentivized and iv) local exogenous revenues to cover the initial infrastructure costs.

i) Large municipal autonomy and low central government involvement during the expansion phase. We show through our analysis of intergovernmental relations that during the 19th century expansion phase, municipalities in all 5 countries were largely

[142] However we have to take into account that London and some other British cities already had a relevant endowment in water infrastructure when the municipal switch took place.

autonomous in their fiscal revenues. No significant and recurrent transfers from the central state were in place. Thus, the first issue implied in the previous statement is that "the expansion phase of water and sanitation infrastructure was municipally driven" since the central state was not significantly involved**.** In fact, in many countries the central state became increasingly involved in water and sanitation infrastructure issue much later in a subsequent historical phase (see also §8.1.4 for France and Italy, §7.1 for the UK and Box 14 for the USA). The progressive involvement of central government in the water sector can be considered as an attempt to equalize the infrastructure endowment over the whole country and to smooth the inequalities among wealthier and poorer areas and among urban and rural ones.

ii) A municipal debt story. The second issue is that the huge expansion of water and sanitation in large cities was financed by the massive use of municipal debt (both bonds and loans). This was only possible because of the existence of modern financial markets, of the availability of capital and savings banks in the context of economic growth and of the financial credibility of municipalities as responsible borrowers. At that time most, of municipal loans had long payback duration at a fixed interest rate. Thus, the high inflation of the early decades of the 20th century significantly lowered the cost of debt service in real terms, meaning that the lenders absorbed a significant part of municipal infrastructure costs.

iii) Water and sanitation services as merit goods. In most cities municipalities pursued the expansion of water and sanitation infrastructure as the major strategy for improving sanitary conditions their citizens and fighting against recurrent epidemics. Both carrot and stick approaches were adopted by municipalities in order to enhance the subscription rhythm of water and sanitation services as they were considered as merit goods. In the general case, connection to the sanitation service took place on a compulsory basis. Often sanitation endogenous revenues were collected through compulsory levies and taxes.

On the contrary, connection to water supply was usually left to individual voluntary decision and incentivized both through setting a low exclusion level (low endogenous revenues level) and subsidizing the necessary investments, even in private properties (standpipes and other works). In some cases however, such as in Paris and in Montreal,

connection to the water service was explicitly made compulsory. In other countries, such as in Italy, the obligation to have tap water in flats was indirectly made compulsory through housing standards set by law.

iv) Local exogenous revenues to cover the infrastructure costs. The main incentive to connect to water and sanitation services consisted in the low endogenous revenue level (Tariff in the OECD 3T's) adopted by most municipalities in the early expansion phase. By definition, costs that were not covered by endogenous revenues were covered by exogenous ones. At the time, municipalities had great financial autonomy with no recurrent transfers being paid by the central government. Thus, exogenous revenues had a local origin: they came mostly from local general taxation. In some cases, cross-subsidies from other municipal trading sectors (mostly gas and electricity) and land value capture tools also played a financing role.

8.2 Challenging today's policy

Financing needs for urban water infrastructure in the forthcoming years are huge. This is true not only in developing countries where a generalized access to clean water and sanitation is still a key challenge, but also in the western world where the water industry is mature and has "an increasing need to reproduce the (huge) infrastructure capital which was set up over decades" (Barraqué 2009).

Our long run analysis shows which choices were made by policy makers in terms of trade-offs in each country and in each historical phase. In the previous paragraphs, we summarized our main research outcomes from an academic research perspective, trying to generalize and sketch the major development patterns of the water and sanitation infrastructure in France, Italy and in three other countries in the western world (UK, USA and Germany).

De Luca and Lorenzini wrote: "history teaches us that one single model or pattern, fitting all at the same time, does not exist. The same financing system can be successful in one country while it can fail in others, or even in other parts of the same state" (De Luca and Lorenzini 2013, 26). We fully agree with such a vision which is particularly true for a local infrastructure like water and sanitation. That is why one should be very cautious and humble when extracting some policy lessons from a historical analysis.

Nevertheless, in this paragraph we adopt a policy oriented attitude and attempt to challenge today's policy, using the main findings from our long run analysis.

Sub-paragraph 8.2.1 focuses on the case of developed countries while sub-paragraph 8.2.2 addresses the case of developing countries.

8.2.1 The case of developed countries with a mature infrastructure

Reproducing a mature infrastructure

At the opening ceremony of the last World Water Forum in Marseille, the OECD General Secretary warned the audience about the growing financing needs for the water sector in developed countries who will "now face huge costs to replace and modernise ageing water infrastructure, and to upgrade systems to meet stricter quality standards" (Gurria 2012).

These financing needs for infrastructure replacement take place in a historical phase where water demand is decreasing in most large cities in the developed world. This implies also lower revenues for the water operator since in most countries[143] water and sanitation endogenous revenues are paid by the users on a volumetric basis. In particular, in Europe, water pricing through volumetric rates has been imposed (or at least heavily recommended) by European legislation on environmental grounds in order to incentivize users to conserve water (UE 2000; UE 2003, 180–181).

Challenging the Full Cost Recovery & volume-indexed rates paradigm

Water consumption kept increasing through the 20th century in western countries. In that context, the volume-indexed rating provided increasing revenues for water and sanitation services. Today, water and sanitation endogenous revenues in Europe have been rigidified by Full Cost Recovery (FCR) principle on the one hand, and by volumetric water pricing on the other hand. Thus, lower volumes distributed imply lower revenues for water and sanitation utilities. By definition FCR means that all costs have to be covered by endogenous revenues. However, there is a tragic mismatch between volume-indexed revenues and costs which in the water industry are mostly fixed. Indeed, the present business model is "being questioned" in the context of a

[143] This is not the case in the UK and in Ireland where water is still often unmetered and charged through fixed rates proportional to the rateable value of houses. "Today still, 60 % of British households (and even more in Irish ones) have no meter and pay rates instead"(Barraqué, Trancart, and Leflaive 2013, 6).

"looming crisis" of water and sanitation services which "brings operators to look for new business models" as Barraqué et al. write in an OECD report (Barraqué, Trancart, and Leflaive 2013, 3–5).

In our opinion, water pricing is a public policy tool which is presently being twisted by two conflicting views and objectives. One view considers water pricing to be a public finance tool: water rates should cover the water utilities costs and allow a sufficient level of self-financing for upcoming investment plans to be bankable. A second view considers water rates to be an environmental incentive: water-pricing should be mostly proportional to the consumed volumes in order to encourage water conservation. In a decreasing consumption phase, the two objectives are in conflict and a trade-off among the two goals appears.

The environmental incentive conception of water pricing is behind the adoption of FCR and volume-indexed water pricing in EU policies. However we offer two arguments against the soundness of such a policy: i) water conservation is not an absolute objective to be achieved *per se*; its relevance depends on the local area conditions (e.g. is it an area with abundant or scarce water resources?); and ii) the price-elasticity of domestic water consumption is not such a clear-cut issue, particularly in presence of collective metering as in many large European cities (including Paris and Milan). Moreover, Massarutto reminds us that "once the pricing rule deviates from the orthodox Long Run Marginal Cost, the choice of the pricing structure is by far a political decision whose pros and contras originate from other reasons than allocative efficiency" (Massarutto 2002, 66).

Both in areas where water resources are not scarce and in contexts where water pricing is not such an effective tool to incentivize water conservation, the EU policy, of FCR and fully volume-indexed rates, raises more than one question from a public finance perspective. Looking into the past helps us challenge present policy solutions. Full cost recovery based on fully volume-indexed water pricing is not the only possible water pricing policy.

This does not mean however that pricing policies should go back to cost sharing systems purely based on exogenous revenues (Taxes and Transfers). Indeed, such a solution would heavily jeopardize the water sector's financial autonomy in the context

of the financial crisis of European national states. Low financial autonomy could in particularly threaten the capability of the water sector to reproduce its infrastructure capital. Indeed, we showed in Crespi Reghizzi (forthcoming d) how the low financial autonomy of the water sector Collective Consumption Units was one of the cause of the dramatic underinvestment in water and sanitation infrastructure in Milan (and also in other Italian cities) in the second half of the 20th century.

Cost recovery based on tailored endogenous revenues

What we propose instead is to keep full cost recovery but to take some distance from the volume-indexed rates *dogma*. We suggest a c**ost recovery system based on tailored endogenous revenues** where the latter could be collected in various ways, not only by fully volume-indexed rates: through a two part tariffs, through a flat fee, through volume-indexed rates, or through a mix of all three.

This could allow local policy-makers to balance the revenue and cost structures and to adopt a pricing solution tailored to the local context. For example, in areas without major water scarcity problems, rates could rely more on flat fees rather than on volumetric ones; and *vice versa* in areas where water conservation must be heavily incentivized. Moreover, when water pricing systems are designed to encourage water conservation, their effectiveness should be measured and tested.

Local policy makers could also adopt endogenous revenues systems based on ear-marked levies having a fiscal nature. Depending on the local context, these levies could be based on the rateable value of houses (as it is presently done in the UK) or on other specific parameters (e.g. on a flat fee per family as waste water treatment in the Netherlands).

In fact, we do not suggest a 'the' perfect water pricing policy since we doubt that it exists. A long run perspective tells us that each historical phase and each local context calls for specific pricing policies. The time to challenge and re-shuffle water pricing policies in Europe may now have come.

A fair accounting of the costs

Today in France and Italy, all internal costs of the water and sanitation collective consumption units (CCUs) are charged to the users. However, a part of these costs

comes from appendix functions which could be considered as public goods and should not be billed to the users of the water and sanitation CCUs. These appendix functions include fire protection, urban drainage, street washing and irrigation for public parks. In France, a recent report by the *Comité National de l'Eau* argued that the costs of all these appendix functions should not be covered by water and sanitation endogenous revenues but by exogenous revenues (local taxation) (CNE 2013). We agree with that position.

Another issue is that the existence of a well-maintained water and sanitation infrastructure has a positive impact on the abutting properties. A parallel can be made with a condominium (a jointly owned block of flats). Long-lasting investments in the condominium are shared among all the co-owners. The better the building is maintained, the higher the property value.

Similarly, water and sanitation infrastructure can be considered as a condominium among all the abutting properties owners. Here too, the infrastructure endowment and the level of maintenance has an impact on properties values. Thus, according to land value capture theory, the infrastructure costs (new infrastructure and renewal) should be charged to the properties owners.

The water pricing system in the Fribourg canton in Switzerland is an example of the application of these two principles in practice: the variable costs are charged to the users, the infrastructure costs are charged to the properties owners and the public good functions costs are covered by general taxation (see Box 2 on page 102).

On the one hand, cost recovery systems, based on fair cost accounting which allows distinguishing among appendix functions, investments costs and variable costs, could be an attractive way of financing water and sanitation services. On the other hand, one potential problem with this kind of recovery approach is its accounting complexity. A trade-off has to be made between a fair cost sharing with complex accounting system with sophisticated sharing keys and a simple accounting system in which no costs are charged to property owners.

Equalization and repayable finance

No matter the chosen long run cost-sharing policy, repayable finance tools will be needed to smooth the investment renewal burden overtime. Three issues should be

carefully considered: i) equalization, ii) financial economies of scale and iii) financial and borrowing autonomy.

Water and sanitation CCUs in developed countries will have to reproduce the existing mature water and sanitation infrastructure in the forthcoming years. A part of this infrastructure was financed in the past with significant contributions from exogenous revenues. Today water and sanitation CCUs are asked to reproduce it under the tight constraint of the Full Cost Recovery principle which has rigidified the financing system of the water sector. This might be particularly critical in rural areas where the infrastructure costs per capita are very high due to diseconomy of density. Some type of **spatial equalization** system is required among the different CCUs in countries such as Italy where these kind of equalization funds do not exist (see also § 5.2 in Part I).

The equalization systems can also be designed to fulfill a **financial economies of scale** function. This means that the equalization fund helps the CCUs to pool together to get easier and cheaper access to debt financing. Such mechanisms could be essential to lower the costs faced by water and sanitation CCUs.

One last issue is that the water and sanitation CCUs should be given enough **financial and borrowing autonomy** (together with **budget accountability**) in order to be able to use debt to finance their investments plans. In the current period of financial distress for European states, national governments might be tempted to include water and sanitation CCUs into the national public deficit accounting, or more generally to include the water sector financial circuit in austerity policies.

This is what happened in Italy when the *Monti* government tried to make it compulsory for water sanitation services to comply with the national stability pact. Luckily, until now this regulation has not been applied in practice (see § 6.4 in Crespi Reghizzi (forthcoming f) and §3.4 in Crespi Reghizzi (forthcoming e) in Part III).

Another example is the decision made by the French Parliament in the 2014 Budget bill to cut the French River Basin agencies' budgets by 10% and transfer it to the general

budget of the French government[144]. This means transferring money fuelled by levies paid by water and sanitation users to the general budget.

Clearly there is no public finance rationality behind this type of decision, except for political will to grab easy money from less politically visible sectors such as water and sanitation. To be consistent, one cannot ask the water sector to be fully based on endogenous revenues and then use the water sector budget to fuel the national government general budget. Similarly one cannot transform WSS CCUs into corporatized entities which should service their debt with endogenous revenues, and at the same time cap their debt to conform to the national borrowing capping.

8.2.2 The case of developing countries with a water and sanitation infrastructure in expansion

Improved access to water and sanitation is still a key issue for many developing countries. This is particularly true in urban areas where there is an urgent need to develop a modern water and sanitation infrastructure in response to rapid rural migration to cities and demographic growth. There are some similarities[145] between cities in developing countries today and cities in the western world during their infrastructure expansion phase. Based on our long run analysis, we are brought to challenge today's policy in developing countries. Due to our past experience in Sénégal, we restrain our geographical area of interest to French-speaking western African countries.

Public vs private production is not the most relevant debate when focusing on infrastructure financing.

Since the last decades, the public policy debate on water and sanitation services has mostly focused on the choice of management models (Direct Public Management - DPM, Regulated Monopoly -RM or Delegated Management - DM) and on whether to support (or not) private sector participation (PSP) in the management of these services.

We already discussed that the management model and the degree of PSP is not very relevant when looking at infrastructure expansion, as investments in water and sanitation infrastructure are under the financing responsibility of the public sector (with

[144] See http://www.maire-info.com/UPLOAD/FICHIERS/AMF_308_P018.pdf, and http://www.senat.fr/questions/base/2013/qSEQ130908157.html retrieved online on June the 25th 2014

[145] There are also some key differences to bear in mind when making this comparison. See Box 16

the notable exception of the RM model - full private concession[146]). This does not mean that PSP in the water sector is useless or negligible, but only that it is bound to have a marginal role in financing the infrastructure expansion.

We showed that through history there are many other trade-offs which were more relevant than the public-private debate from an infrastructure financing perspective.

How to share responsibilities on the water and sanitation infrastructure between Local Government Units (LGU) and National Governments is a very relevant issue.

A key trade-off has to be made when allocating responsibilities on water and sanitation infrastructure development between Local Government Units (LGU) and central government or other national institutions. On the one hand, decentralizing the power to the LGU is justified by the devolution principle (§4.2 in Part I) since it "makes it possible to match local public services with citizens' preferences" (Dafflon and Madiès 2011, 13). On the other hand, the unitary principle justifies some kind of centralization or equalization among LGUs in order to smooth spatial inequalities in infrastructure endowment between areas.

We showed through our historical analysis that in France and Italy (and in other countries), water and sanitation infrastructure first developed under municipal responsibility. The inception and initial expansion of modern water and sanitation infrastructure in larger and wealthier cities (such as Milan and Paris) took place in that phase with full municipal mastery and little financial help coming from central government.

The involvement of an upper scale of government (e.g. central government, national equalization funds or regional authorities) in the expansion of water and sanitation infrastructure took place progressively through the 20th century in France, in Italy and in the UK. The increasing influence of central government (or regional authorities in the UK) over the water and sanitation sector can be considered as an attempt to reduce inequalities in infrastructure endowment in particular in the rural and less wealthy areas where water and sanitation had not developed previously.

[146] Concession which is now found rigid and risky, just as it was in Europe at the end of 19th century

History tells us that water and sanitation developed in large cities in the western world mostly under municipal control. On the contrary, there are many developing countries[147] where the responsibility on water and sanitation infrastructure has been granted to a national public entity. In these countries, municipalities have little or no say over their water and sanitation services. Although history cannot give a one-fits-all policy solution, it questions the rationale of such a choice. Why do municipalities in large[148] cities in developing countries lack the same level of control over and responsibility for their water and sanitation infrastructure that many cities in the western world had in the 19th century ? Probably some help from sociology and other social sciences would be needed to answer this question.

Municipal financial autonomy and municipal debt to finance urban infrastructure

In many large cities in the western world, water and sanitation infrastructure was financed by municipal debt in a historical phase where municipalities had great financial autonomy. Municipal debt was used to finance urban infrastructure in many different sectors and municipal revenues as a whole were used as collateral.

On the contrary, in many French-speaking African countries municipal financial autonomy is very low. Indeed, in many of these African countries, decentralization reforms took place only on paper with no or little decentralization taking place in practice in terms of municipal financial autonomy. This is one of the reasons behind the fact that municipal debt does not play a significant role in financing urban infrastructure.

In these countries, most of the time, water and sanitation infrastructure is financed through sovereign grants and loans awarded by international lending institutions to the central governments, and then transferred either as grants or loans to the national public entity in charge of water and sanitation.

[147] This is particularly true in some French speaking African countries e.g. Sénégal with SONES or Burkina Faso with ONEA, Mali with EdM and so on…

[148] The issue is different for rural areas where the argument in favour of centralization comes from the fact that local government units often lack of the technical and financial capabilities to manage water and sanitation infrastructure.

We believe that unless municipal entities in those African countries are given some financial autonomy, as European municipalities in the 19th century had, they will hardly be able to take control over their water and sanitation infrastructure development,.

Box 9 : Key Differences between municipal debt in the 19th century and today

If there are some similarities between some 19th century European cities and today's cities in the developing world there are also many differences to bear in mind when making some comparisons:

i) In the 19th century, municipal debt had a long payback duration and fixed interest rates. High inflation played a significant role in lowering the debt service in real terms. This a key economic context factor to take into account.

ii) European and American municipalities managed to issue huge amount of municipal debt thanks to various factors: a) the existence of well established financial markets, b) a high economic growth phase with high amount of capitals available, c) municipalities were considered as credible borrowers, d) middle classes were ready to pay for all this.

Many of these conditions are not easily met today in developing countries.

Defining the best policy mix to incentivize connections to the water and sanitation service

We showed that during the expansion phase, cities in the western world had a merit good conception of the water service and adopted a great variety of 'carrot and stick' approaches to enhance the subscription rhythm to the water and sanitation service. Specifically, "stick" approaches consisted either in explicit or implicit enforcement to connect while "carrot" approaches included subsidizing the necessary investments in the private properties (standpipes and other works) and setting a low exclusion level (Tariff).

On the contrary, in the 1990's, developing countries were adviceds by international institutions to adopt full cost recovery pricing in application of a market-based conception of the water service rather than a merit good rationale.

> "The World Bank believes that cost recovery should be sufficient to pay for operations, maintenance and a fair return on capital investment, and provide for

> this outcome through loan covenants" (Bartlett 2003, 12 quoting a 1993 World Bank report)"

History suggests that during the initial expansion phase, access to water and sanitation should be considered as a merit good and encouraged both through a mix of coercion and exogenous support. Policy makers in each country should define their own policy mix to make everyone to join the water club.

History also tells us that once everybody is connected to the service (after the expansion phase), the CCU level of exclusion can be progressively increased as users "after enjoying [the water service] for one year, neither they nor their families, would abandon for ten times its cost" (Boston's mayor in 1848 quoted by Bartlett 2003).

Challenging the best mix of the 3T's

In the last ten years, international institutions and donors progressively softened their position from *full cost recovery* to the more realistic and pragmatic concept of *sustainable cost recovery* and the 3T's (OECD 2009a).

Nevertheless, when manipulating the OECD 3T's paradigm, there is still the widespread belief among international institutions, that Tariffs (Endogenous Revenues) are more legitimate than Taxes (Local Exogenous Revenues) and Transfers (National Exogenous Revenues) to finance water and sanitation services. The OECD general secretary expressed this opinion at the opening ceremony of the 2012 Marseille World Water Forum:

> "Key amongst these is the need to take a strategic approach to financial planning, to encourage greater use of water pricing and to enhance the use of water tariffs as a central part of what we call the 3Ts – Tariffs, Taxes and Transfers!"(Gurria 2012)

Through our long run analysis, we showed that in each city and each specific infrastructure phase a different mix of the 3T's was chosen to cover the infrastructure costs. History reminds us that one policy solution does not fit all situations. Covering the infrastructure costs with endogenous or exogenous revenues is a trade-off to be made by policy makers on normative grounds depending on the local context and on the specific phase within the infrastructure cycle.

In particular, we showed that during the inception and expansion phase in many large cities in the western world, water and sanitation infrastructure was financed by local exogenous revenues (mostly local general taxation - Taxes). This was the expression of the municipal wish to set a low level of exclusion to the service and to encourage everybody to be member of the 'water club' and enhance the subscription rhythm. Should water and sanitation services in developing countries follow the European example which comes from the past?

Financing urban infrastructure through land value capture tools

We showed that in Paris, land value capture tools played a significant role in financing water and sanitation networks in the 19th century expansion phase (Crespi Reghizzi forthcoming a, §3.5). On the contrary, in Milan, these tools played a very limited role as as neither of the two essential conditions for such a policy were met: available expropriation tools were weak and the municipal borrowing policy was very cautious and constrained.

A greater use of land value capture tools to finance urban infrastructure is a key recommendation made by many experts and international institutions (Peterson 2009; Paulais 2012a) and we fully agree on that vision. Until now however this seems to be a vain wish in French speaking African countries where land value capture policies are very rarely implemented[149]. Land is often a sensitive issue. Implementing a land value capture policy not only requires specific policy tools to be available but also a strong political will.

8.3 Further research

At a certain point during a PhD research, one has to decide to restrain his research scope and leave other research topics and questions for the future.

Here below are listed some of the topics left apart for further research.

i) There is some asymmetry in our research since we did not have the time to make a detailed and deep analysis of the financial flows of Paris water and sanitation

[149] On the contrary China is often quoted as an example where land value capture policies are effectively used to finance urban infrastructure (Lorrain 2011). Medellin in Colombia is also quoted as an example of this kind of policies (Paulais 2012b; Paulais and Stein-Sochas 2007; Paulais 2012a). See also the following link http://www.landandpoverty.com/agenda/pdfs/paper/walters_full_paper.pdf.

service from WWII to present time as we made it for Milan. This could be a first direction for further research. Specifically, it would be very interesting to analyze the temporal and spatial averaging out role played by the Agence de l'eau Seine Normandie[150] (AESN) in Paris. Each water and sanitation service (each Collective Consumption Unit) is both a contributor to the AESN mutual and a recipient of the AESN loans and grants. In the long run was Paris' WSS a net financial contributor to the AESN mutual fund or a net recipient from it ? And also, what was the effect of AESN mechanism in terms of intergenerational transfers between Paris water users ?

ii)A second theme could be the implementation of land value capture tools to finance urban infrastructure today. We believe that this theme is very relevant both for developing countries and for developed ones. In the former, the issue is how to finance the development of a modern urban infrastructure while in the latter, a hot topic is how to finance the transition to a more sustainable city.[151]

iii) Another research direction would be to apply our trade-offs matrix to other case studies within the water and sanitation sector in developing countries.

iv) A last research topic could consist in adapting the trade-offs matrix to a different local infrastructure sector such as urban transport and subsequently analyse a few case stories in that sector.

[150] Some of these questions are analyzed through an anthropological and social science prism by Patrick Laigneau in his PhD thesis (Laigneau 2014)

[151] See for example the « urban fabric » research theme at IDDRI, http://www.iddri.org/Themes/Urban-Fabric/,

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10 Synthèse en français

Le cœur de cette thèse est composé de six essais qui constituent les partie II et III. Les six essais sont actuellement dans le processus de soumission à des revues et des ouvrages collectifs, certains d'entre eux ont déjà été acceptés par l'éditeur (cf. tableau en Annexe 2). Cette thèse est également composée d'une partie introductive (Partie I) et d'une partie conclusive (Partie IV).

Cette thèse repose sur trois piliers: d'un point de vue disciplinaire elle est enracinée dans l'économie publique, d'un point de vue sectoriel elle se concentre sur les infrastructures urbaines d'eau et d'assainissement et d'un point de vue méthodologique, elle est basée sur l'utilisation d'une analyse historique de long terme.

Nous avons analysé l'histoire du financement des infrastructures urbaines d'eau et d'assainissement à travers le prisme de l'économie publique. Notre démarche de recherche est bidirectionnelle: d'une part, nous avons utilisé les termes et les paradigmes actuels pour analyser les politiques publiques du passé. D'autre part, nous sommes convaincus qu'une analyse sur la longue durée peut être utile pour donner plus de profondeur et questionner les politiques publiques d'aujourd'hui.

10.1 Des 3T de l'OCDE aux revenus endogènes et exogènes

Dans la terminologie des « 3T » de l'OCDE, les coûts des services d'eau et d'assainissement peuvent être couverts *in fine* par trois sources de revenus : les Tarifs (prix de l'eau), les Taxes (impôts non affectés) et les Transferts (en provenance du gouvernement central ou de l'aide internationale). Nous préférons faires référence à deux catégories légèrement différentes proposées par Antonio Massarutto: les revenus endogènes et exogènes par rapport au service d'eau et d'assainissement. Selon cette classification les revenus endogènes (Tarif selon l'OCDE) englobent en leur sein tout type de paiement affecté au service de l'eau et de l'assainissement indépendamment du fait qu'ils ait un caractère fiscal ou pas. Ainsi cela inclut les revenus tirés des factures d'eau mais aussi les redevances d'assainissement qui souvent ont un caractère fiscal. Les revenus exogènes, quant à eux, font référence au budget municipal et ne sont pas affectés spécifiquement au service de l'eau et de l'assainissement. Les revenus exogènes peuvent être alimentés par la fiscalité locale (Tax selon l'OCDE) ou par des transferts

en provenance d'un échelon supérieur de gouvernement (Transfer selon l'OCDE). Par définition les coûts qui ne sont pas couverts par les revenus endogènes sont couverts par des revenus exogènes.

10.2 Histoire Economique : la génèse des services publics d'eau et d'assainissement à Paris et à Milan

10.2.1 Une modelisation financière originale de données issus de sources primaires

Une partie importante de notre travail est basée sur une utilisation originale de sources de données primaires : les rapports financiers annuels des municipalités de Milan et de Paris. Aucune étude précédente n'avait exploité ces sources de données pour analyser l'équilibre financier des services d'eau et d'assainissement.

Pour effectuer notre analyse, nous avons recueilli manuellement trois séries de données financières provenant des sections comptables « eau et assainissement » des rapports financiers municipaux annuels: une série concerne le service d'eau et d'assainissement de Paris de 1865 à 1930 (Crespi Reghizzi forthcoming a) et deux séries concernent le service d'eau et d'assainissement de Milan entre 1888 et 1924 (Crespi Reghizzi forthcoming b) et entre 1956 et l'année 2000 (Crespi Reghizzi forthcoming d). En utilisant ces séries de données, nous avons construit et calculé une modélisation financière de ces services. Ce type d'analyse approfondie de l'histoire du financement des services d'eau et d'assainissement à Milan et à Paris basée sur des données issues de sources primaires est l'un des points à forte valeur ajoutée de notre recherche.

10.2.2 Principaux résultats

A travers notre analyse dans les trois articles que constituent la Partie II de la thèse (Crespi Reghizzi forthcoming a; Crespi Reghizzi forthcoming b; Crespi Reghizzi forthcoming c) nous avons montré qu'à Milan et à Paris l'infrastructure urbaine d'eau et d'assainissement a été réalisée par la municipalité et financée par de la dette à taux d'intérêt fixe et à longue maturité. En raison de la forte inflation des années 1910-1930, le service de la dette a été fortement réduit en termes réels et une partie importante de la charge de la dette a été absorbée par les prêteurs.

La dette a été souscrite et gérée dans sa globalité au niveau municipal : dans la plupart des cas les emprunts ou obligations ont financés des investissements dans plusieurs

secteurs dont l'eau et l'assainissement. Plus rarement des emprunts uniquement affectés au Service Public d'Eau et d'Assainissement (SPEA) ont été utilisés.

Initialement, dans les deux villes les revenus endogènes au service (Tarif) étaient insuffisants pour couvrir les coûts totaux (coûts d'exploitation-OPEX + service de la dette). Le service d'assainissement, quant à lui, avait un équilibre financier encore moins basé sur des revenus endogènes : les revenus collectés à travers les redevances d'assainissement étaient même en dessous des coûts d'exploitation du service qui étaient partiellement couverts par une subvention croisée venant des excédents du service de l'eau.

Ainsi, dans une première phase, le service de la dette a été couvert en partie par des revenus endogènes au service (Tarifs) et en partie par des revenus exogènes (Taxes). Dans une deuxième phase, les recettes endogènes des services d'eau et d'assainissement étaient suffisamment élevés pour couvrir à elles seules le service de la dette qui entre temps avait déjà été réduit en termes réels grâce à l'inflation.

Une différence importante entre les deux villes est l'utilisation à Paris d'outils de captation des plus-values foncières pour financer les infrastructures urbaines (dont celles d'eau et d'assainissement) dans le cadre de la rénovation urbaine massive qui a été entreprise sous Haussmann jusqu'aux années 1880. Ces mêmes mécanismes de captation de la plus-value foncière n'ont pas joué un rôle significatif dans le financement de l'infrastructure urbaine à Milan étant donné qu'aucune des deux conditions préalables n'étaient remplies : les outils légaux permettant des expropriations étaient peu puissants et la politique municipale d'endettement était très prudente et timide.

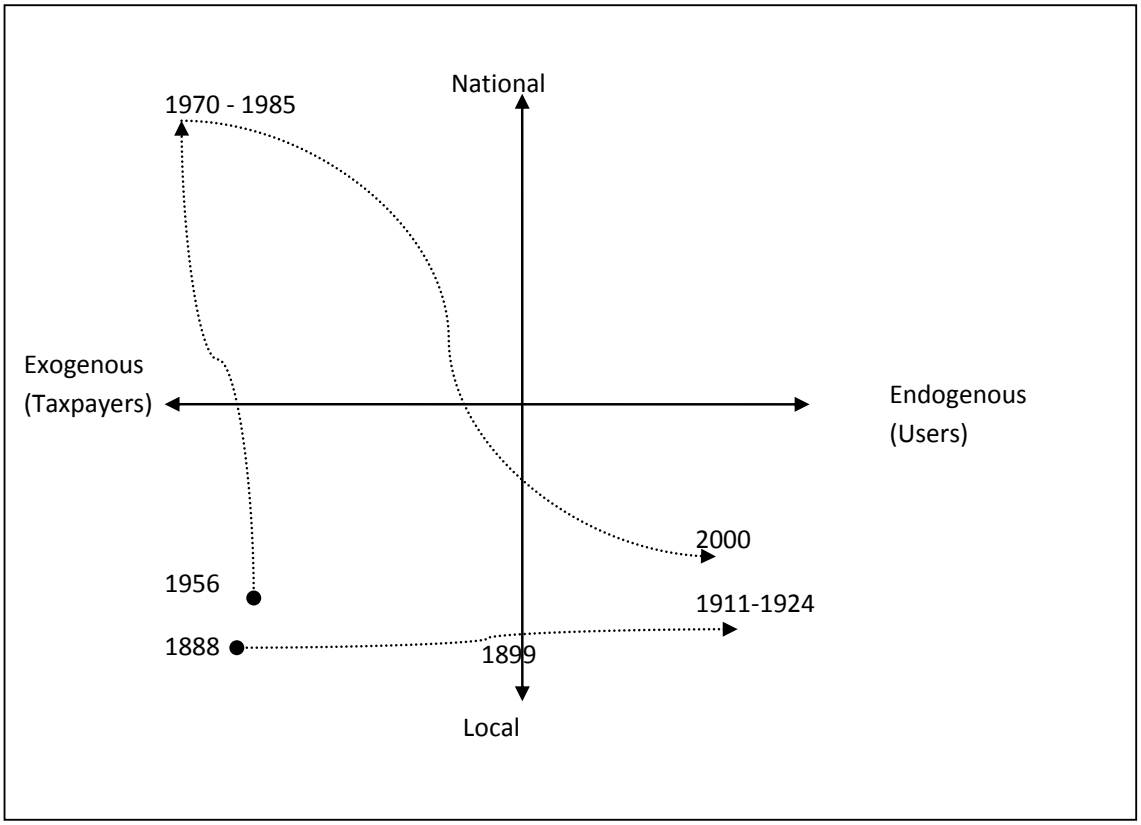
10.3 Le service d'eau et d'assainissement à Milan après la deuxième guerre mondiale

A travers deux de nos articles au sein de la Partie III, nous avons étendu notre analyse du service d'eau et d'assainissement de Milan à la phase historique qui va de la Seconde Guerre mondiale jusqu'à aujourd'hui.

Plus précisément, dans un premier article (Crespi Reghizzi forthcoming d) nous avons examiné l'histoire et les flux financiers du service d'eau et d'assainissement de Milan entre les années 1950 et 2000 avec un cadre d'analyse qui tient compte de l'évolution à la fois des relations financières entre les municipalités et l'Etat central et des politiques

nationales de régulation du secteur de l'eau. Cette analyse a permis de construire une carte bidimensionnelle de l'évolution du partage des coûts d'investissement du service d'eau et d'assainissement de Milan en terme de payeur final (graphique ci-dessous). L'axe des abscisses nous indique si les coûts ont été couverts par les revenus endogènes ou exogènes. L'axe des ordonnées indique si les revenus exogènes sont de source locale (Taxes : local) ou nationale (Transferts du gouvernement central).

Figure 8 : Evolution des payeurs de long terme des dépenses d'investissement du service d'eau et d'assainissement de Milan



Source : élaboration de l'auteur

Alors que dans une première phase les dépenses d'exploitation du SPEA dans son ensemble ont été largement subventionnées par le budget général municipal (revenus exogènes locaux), à partir de 1899 une part croissante des coûts a été couverte par les revenus endogènes du service. En effet, après 1911, et au moins jusqu'en 1924, les revenus endogènes étaient suffisamment élevés pour couvrir également les dépenses en capital (amortissement de la dette). En d'autres termes l'autonomie financière du SPEA de Milan était très significative.

Les choses ont changé après la Seconde Guerre mondiale. En effet l'autonomie financière des municipalités italiennes a été fortement réduite et le ratio des revenus de la fiscalité locale sur le total des dépenses est devenu très faible. L'effet combiné de la régulation nationale des tarifs de l'eau par des prix-plafonds anti-inflation et des politiques budgétaires de centralisation a fait en sorte que les coûts d'investissements du SPEA de Milan ont été de plus en plus pris en charge par des revenus exogènes au SPEA. Dans un premier temps il s'agissait de revenus exogènes locaux (Taxes)(1956 dans le graphique) puis de revenus exogènes nationaux (Transferts) (1970-1985 dans le graphique).

Le SPEA de Milan était donc de moins en moins autonome et responsable de ses choix. C'est l'une des raisons expliquant les reports successifs des investissements dans les traitements de l'eau potable et dans l'épuration des eaux usées dans les années 1970 et 1980 à Milan. Ces investissements n'ont pas été considérées comme suffisamment « politiquement visibles » et ont été menés à leur terme (respectivement en 1994 et 2005) uniquement grâce à la forte pression mise par les directives européennes et la législation nationale.

Ce n'est que dans les années 1990 que l'effet combiné d'une autonomie financière municipale retrouvée et d'une régulation tarifaire basée sur le recouvrement des coûts a permis à nouveau une couverture des coûts d'investissement du SPEA de Milan par les revenus exogènes locaux dans un premier temps et par les revenus endogènes du service ensuite.

Depuis 2003 une « entreprisation » du service a eu lieu : le SPEA de Milan est géré par une société anonyme appartenant à la municipalité de Milan: *Metropolitana Milanese SPA* (MM) sur laquelle nous avons réalisé une étude de cas dans notre dernier essai au sein de la partie III (Crespi Reghizzi forthcoming f).

MM est une société bien gérée avec de bonnes performances techniques et financières. Nonobstant l'entreprisation du service, MM et son personnel sont fermement attachés à des objectifs et à des valeurs de service public sans qu'il y ait de différence significative avec ce qui se passait auparavant lorsque le service était géré en régie municipale directe.

On pourrait même soutenir l'idée que la gestion du service par la société anonyme MM est plus efficace dans l'atteinte des objectifs de service public que la régie directe ne l'était auparavant (il suffit de faire référence au sous-investissement chronique dans lequel versait le service).

Cependant, nous avons également montré que MM fait partie d'un système de gouvernance baroque qui n'est ni efficace, ni efficient. En effet, l'exercice de régulation est parfaitement mis en œuvre au niveau local d'un point de vue formel mais n'a pas lieu en substance.

Nous verrons à l'avenir si l'arrivée d'un régulateur national (AEEG) réussira à transformer l'exercice de régulation d'acte purement formel à substantiel.

10.4 Une matrice de choix issue des théories de l'économie publique

Dans la partie introductive (Partie I), nous avons passé en revue plusieurs concepts de la théorie de l'économie publique : les biens publics impurs, les monopoles naturels, les unités de consommation collective (CCU), les outils de captation de la plus-value foncière, l'utilisation de la dette pour le financement des infrastructures et les finances publiques locales. Sur la base de cette revue des théories de l'économie publique, nous avons construit une matrice originale des choix à accomplir par les décideurs :

-L'adhésion à la CCU est-elle obligatoire ou volontaire?

-Les coûts sont-ils couverts par des revenues endogènes ou exogènes au service ?

-Quelle est la nature juridique de la CCU ?

-Quelle est la nature juridique des revenus endogènes ?

-Quelle est la nature technique des revenus endogènes ?

-Quelle est la source des revenus exogènes ?

-Quel échelon institutionnel a la maîtrise de la planification et de la gestion des projets d'infrastructure ?

-Qui est l'emprunteur ?

-Qui est le payeur final de l'infrastructure ?

- Y-a-t-il des mécanismes de péréquation spatiales ? Ceux-ci permettent-ils de réaliser des économies d'échelle sur les coûts financiers ?

Une telle matrice de choix est un apport original de notre recherche qui peut être utilisé à de nombreuses fins. D'un point de vue académique, la matrice des choix est un prisme efficace pour analyser les politiques passées et présentes dans le secteur de l'eau. C'est ce que nous avons fait pour la France et l'Italie (chapitre 6 de la partie IV).

La matrice des choix pourrait également être un outil puissant pour les décideurs. En effet, elle pourrait être utilisée efficacement pour remettre en question, remanier et améliorer les politiques actuelles dans le secteur de l'eau mais aussi, avec quelques modifications mineures, dans d'autres secteurs d'infrastructures urbaines (transport urbain par exemple).

10.5 Quatre phases de développement de l'infrastructure eau et assainissement en France et en Italie

Sur la base de la matrice des choix précédemment développée, nous avons réalisé une analyse détaillée de l'évolution à long terme du secteur de l'eau et de l'assainissement en France et en Italie (chapitre 6 de la partie IV). Grace à cette analyse, nous avons proposé un découpage du développement de l'eau et d'assainissement en France et en Italie en quatre phases historiques:

- Phase 0: Services d'eau privés en concession
- Phase 1: Maitrise d'ouvrage municipale sur le développement des infrastructures (19ème siècle - 1920)
- Phase 2: Maitrises d'ouvrage locales sous l'influence du gouvernement central
- Phase 3: Unités collectives de consommation autofinancées et le paradigme de la décentralisation

10.5.1 Phase 0: Services d'eau privés en concession.

Dans de nombreuses villes dans les deux pays (et ailleurs ainsi que nous l'avons discuté au chapitre 7), les services d'eau se sont initialement développés comme des initiatives privées dirigées portées par des entrepreneurs. D'une manière générale, au cours de cette phase, l'infrastructure était financée par des capitaux privés (sous la forme d'apports en

capital et de dette) Formellement, dans ce modèle, les dividendes versés aux actionnaires et de le remboursement de la dette de récupération ont été entièrement couverts par des revenus endogènes.

Cependant, nous avons montré que dans de nombreux contrats de concession (comme à Naples et à Nantes - voir § 6.4.3 et § 6.5.3) une redevance annuelle devait être payée par la municipalité à l'entreprise privée en contrepartie du «service public» (protection contre l'incendie, fontaines publiques et autres usages municipaux de l'eau). Cela signifie que *de facto* les coûts du service ont été couverts par un mélange de revenus endogènes et exogènes.

A Paris, un exemple de ce modèle est fourni par l'expérience de la Compagnie des Eaux de Paris (créée par les frères Périer) (§ 6.2.1) (Crespi Reghizzi forthcoming a, Box 1) qui cependant a rapidement fait faillite. Au contraire, à Milan, cette phase historique n'a pas eu lieu car la tentative d'octroyer une concession a échoué tout de suite (Crespi Reghizzi forthcoming b).

Dans de nombreuses villes à un moment donné le service de l'eau a été municipalisé pour des raisons sanitaires en réponse à l'incapacité des premières initiatives privées à étendre le réseau d'eau à toute la ville.

10.5.2 Phase 1: Maîtrise d'ouvrage municipale sur le développement des infrastructures

Cette deuxième phase s'ouvre au cours de la seconde moitié du 19ème siècle et dure jusqu'aux années 1920. Elle a été analysée dans les essais de la Partie II et au §6.2

Grâce à cette phase, les infrastructures urbaines d'eau et d'assainissement se sont développées sous maitrise d'ouvrage municipale dans les grandes villes riches des deux pays. Une solution hybride qui a souvent été adoptée en France a consisté à choisir des modèles de gestion sous la formes de contrats d'affermage qui laissaient la maitrise d'ouvrage des investissements aux municipalités.

A l'époque, les municipalités étaient largement autonomes dans leurs revenus (il n'y avait pas de transferts récurrents de la part du gouvernement central). Les services d'eau et d'assainissement se sont développés comme des infrastructures municipales parmi d'autres sans qu'ils soient clairement séparés du budget général de la commune.

Les infrastructures réalisées au cours de cette phase ont étés financées en grande partie grace à des emprunts et à des obligations qui étaient gagés sur les recettes fiscales municipales. Le service de la dette a été réduit en termes réels grâce à la forte inflation des décénnies 1910-1930. Les coûts d'investissement ont été couverts par une combinaison de recettes locales endogènes et exogènes. Les cas de Milan et de Paris que nous avons analysés dans le détail illustrent cette phase.

10.5.3 Phase 2 : Maîtrises d'ouvrage locales sous l'influence du gouvernement central

Cette phase commence dans les années 1920 et dure jusqu'aux années 1970/1980 en France et aux années 1990 en Italie. Les municipalités (ou entités inter-municipales) ont gardé la maitrise d'ouvrage des services d'eau et d'assainissement d'un point de vue formel, mais elles ont étés soumises à une forte influence d'institutions nationales:

- A travers plusieurs réformes, les finances municipales ont été rendues moins autonomes et plus dépendantes des sources fiscales partagées et des transferts en provenance du gouvernement central. Ce phénomène a été particulièrement fort en Italie.
- L'accès des municipalités à l'emprunt a été fortement règlementé.
- La planification, la conception et le financement des infrastructures ont été de plus en plus centralisés.
- Les tarifs des services d'eau ont été soumis à l'approbation d'un échelon supérieur de gouvernement et contraints dans le cadre de politiques macro-économiques anti-inflation
- Un système dual était en place où le gouvernement central avait une grande influence sur le développement de l'infrastructure alors que l'exploitation du service restait pleinement une responsabilité municipale (ou inter-municipale).

Milan, Paris et de nombreuses grandes villes riches dans les deux deux pays avaient déjà développé une partie importante de leur infrastructure au cours de la phase 1. Elles ont poursuivi le développement de leur infrastructure dans la phase 2, parfois en

reportant constamment dans le temps certains investissements pourtant essentiels (cf. cas d'études sur Milan).

Les municipalités plus petites ou moins riches (en particulier dans les zones rurales ou dans le sud de l'Italie par exemple) n'ont pas été en mesure de développer les infrastructures en eau et assainissement dans la phase 1. La politique de transferts et de subventions venant du gouvernement central dans la phase 2 était une tentative de réduire les disparités entre territoires dans leur dotation en infrastructures en encourageant les autorités locales à développer une infrastructure en eau et assainissement. Cependant, l'efficacité d'une telle politique a été partiellement compromise par les contraintes posées en matière d'autonomie municipale et de régulation tarifaire des services publics.

10.5.4 Phase 3: Unités collectives de consommation autofinancées et le paradigme de la décentralisation

La quatrième phase a débuté dans les années 1970/1980 en France et dans les années 1990 en Italie. Elle est caractérisée par quelques grandes tendances.

- Grâce aux reformes de décentralisation les municipalités ont reçu une plus grande autonomie fiscale et financière. Le ratio des revenus fiscaux autonomes sur le total des revenus municipaux a fortement augmenté.
- L'accès des municipalités à l'emprunt a été soumis à moins de contraintes
- Les services d'eau et d'assainissement ont reçu une plus grande autonomie vis-à-vis des municipalités par la création de typologies d'unités collectives de consommation plus autonomes sur le plan juridique et financier.
- Les municipalités et autres institutions gouvernementales locales ont été de plus en plus encouragées à couvrir les coûts des services d'eau et d'assainissement à travers les revenus endogènes au service plutôt que par des revenus exogènes. Progressivement le principe "l'eau paie l'eau" a été adopté par les décideurs en France. Ensuite le principe du recouvrement intégral des coûts a été adopté également en Europe en le justifiant par des motivations environnementales.
- En France, grâce aux péréquations mis en œuvre par le système mutuel des Agences de l'Eau, la transition vers le recouvrement intégral des coûts n'a pas

été trop brusque, tandis qu'en Italie le changement de paradigme a rencontré de nombreux écueils (Crespi Reghizzi forthcoming e).

10.6 Une esquisse de l'expansion des infrastructures urbaines d'eau potable et d'assainissement au 19ème siècle dans une sélection de pays occidentaux

Au sein du chapitre 7, nous avons comparé notre analyse des cas français et italiens avec les expériences dans d'autres pays (Royaume-Uni, USA, Allemagne) telles qu'elles ont été analysées par plusieurs auteurs. Chaque pays et chaque ville ont suivi un chemin spécifique. Néanmoins, nous sommes en mesure d'esquisser une trajectoire stylisée d'expansion des infrastructures urbaines d'eau et d'assainissement au 19ème siècle dans une sélection de pays occidentaux : France, Italie, Royaume-Uni, Etats-Unis et Allemagne.

D'une manière générale, dans tous ces pays, il y a eu une phase initiale où les infrastructures d'eau ont été développées par des investisseurs privés sous la forme de concessions. Dans un tel modèle, les coûts des infrastructures d'eau potable et d'assainissement ont été couverts sur le long terme par un ensemble de revenus endogènes et exogènes dont la répartition dépendait du cas spécifique de chaque ville. En effet dans certaines villes, les municipalités se sont engagées à payer au concessionnaire une redevance annuelle au titre du "service public". Ces frais annuels peuvent être considérés comme des revenus exogènes provenant de l'impôt général local. Ils couvraient une partie des coûts d'investissement et permettaient de réduire le risque perçu par les investisseurs.

Dans d'autres villes, tous les coûts devaient être couverts uniquement par les revenus endogènes étant donné qu'aucune subvention n'était versée par la municipalité. Le fait de pouvoir compter uniquement sur les revenus endogènes du service était l'une des raisons de l'échec des concessions à faire façe à l'expansion urbaine galopante et à étendre l'infrastructure de l'eau à toute la ville. Ce fut le cas à Paris avec la courte expérience et l'échec de la compagnie créée par les frères Périer.

Nous avons montré que la phase de développement des réseaux d'eau sous la forme de concessions privées a été particulièrement significative et longue au Royaume-Uni. Au contraire cette phase a été beaucoup plus courte et moins significative en Allemagne,

aux Etats-Unis, en Italie et en France. Nonobstant ces différences, une trait commun à tous ces pays est le passage à une **deuxième phase de développement des infrastructures d'eau et d'assainissement sous maîtrise d'ouvrage municipale.** Un tel changement a eu lieu entre le milieu du 19ème siècle et les premières décennies du 20ème siècle. Dans tous les pays étudiés, la municipalisation a coïncidé avec la généralisation à toute la ville des réseaux d'eau et d'assainissement. Nous ferons reference à cette phase comme à la «**phase d'expansion**».

Une clarification doit être faite pour la France afin d'anticiper une possible objection. Le secteur privé a joué (et joue encore) un rôle important dans le secteur de l'eau en France. Néanmoins, il n'a pas eu un rôle majeur dans l'expansion de l'infrastructure *stricto sensu*, puisque le secteur privé a été principalement impliqué à travers des contrats d'*affermage*. Dans ces contrats, au cours de la phase d'expansion, la grande majorité des investissements était une responsabilité municipale et non déléguée au partenaire privé (Pezon 2011, voir aussi § 6.4.3).

Tout en prenant en compte les clarifications précédentes nous estimons que **l'expansion des infrastructures urbaines d'eau et d'assainissement dans les grandes villes au sein des 5 pays considérés a eu lieu pour l'essentiel sous maîtrise d'ouvrage municipale.** Cette affirmation ne doit pas être interprétée comme une prise de position au sein de l'éternel débat sur la gestion privée ou publique. Bien au contraire, nous avons déjà indiqué qu'un tel débat n'est pas une question très pertinente lorsque l'on se focalise sur le financement de l'infrastructure comme nous le faisons.

Quatre autres enjeux de politique publique qui découlent de l'affirmation précédente nous paraissent bien plus pertinents pour ce qui concerne le financement de l'infrastructure : i) autonomie municipale importante et faible implication du gouvernement central dans la phase d'expansion, ii) une histoire basée sur de l'endettement municipal, iii) une vision des services l'eau et d'assainissement comme des biens tutélaires (*merit good*) dont l'accès doit être encouragé et iv) l'utilisation de revenus exogènes de source locale pour couvrir les coûts d'investissement dans une première phase.

i) **Autonomie municipale importante et faible implication du gouvernement central dans la phase d'expansion.**

Au cours de la phase d'expansion, au 19ème siècle, au sein des 5 pays considérés, les municipalités bénéficiaient d'une large autonomie financière. Leurs budgets étaient alimentés pour l'essentiel par de la fiscalité locale étant donné qu'il n'y avait pas de transfert annuel récurrent de la part de l'état central à l'époque.

Ainsi, l'affirmation précédente peut être complétée de la manière suivante : « l'expansion des infrastructures urbaines d'eau et d'assainissement dans les grandes villes au sein des 5 pays considérés a eu lieu pour l'essentiel sous maîtrise d'ouvrage municipale», car le gouvernement central n'était pas impliqué. En effet, dans de nombreux pays, le pouvoir central est intervenu dans le secteur de l'eau et de l'assainissement uniquement dans une phase historique ultérieure (voir aussi § 8.1.4 pour la France et l'Italie, § 7.1 pour le Royaume-Uni et l'encadré 14 pour les Etats Unis). L'implication progressive du pouvoir central dans le secteur de l'eau peut être considérée comme une tentative de péréquation spatiale visant à universaliser la dotation en infrastructures dans l'ensemble du pays et à atténuer les inégalités entre zones riches et pauvres et entre zones urbaines et rurales.

ii) Une histoire basée sur de l'endettement municipal

Un deuxième aspect qui doit être souligné est le fait que l'expansion des infrastructures urbaines d'eau potable et d'assainissement a été financé dans les grandes villes grâce à une utilisation massive de l'endettement municipal (obligations et emprunts). Cela a été rendu possible par un ensemble de facteurs parmi lesquels : l'existence de marchés financiers modernes, la disponibilité importante d'épargnes et de capitaux dans un contexte historique de croissance économique et la crédit donné aux municipalités considérées comme des emprunteurs fiables. A cette époque, la grande majorité de la dette municipale a été émise à taux fixe et avec une longue durée de remboursement. Cela a impliqué que la forte inflation des premières décennies du 20ème siècle a réduit considérablement le coût du service de la dette en termes réels. De fait, les prêteurs ont absorbé une part importante des coûts d'investissement des infrastructures municipales.

iii) Une vision des services l'eau et d'assainissement comme des biens tutélaires (*merit good*) dont l'accès doit être encouragé

Dans la plupart des villes, les municipalités se sont engagées dans la fourniture et l'expansion des infrastructures d'eau et d'assainissement parce qu'elles considéraient une

telle infrastructure comme particulièrement méritoire et stratégique pour l'amélioration des conditions sanitaires et la lutte contre les épidémies récurrentes. Les municipalités ont manié à la fois la carotte et le bâton pour encourager les connections au service d'eau et d'assainissement. Dans le cas général, la connexion au service de l'assainissement a été rendue obligatoire et souvent, les revenus endogènes au service d'assainissement ont été recueillis sur la base de redevances ayant un caractère fiscal.

Au contraire, dans le cas général, la décision de se connecter au service de l'eau a été laissée sur une base volontaire et encouragée à la fois en établissant un faible niveau d'exclusion (faible part des coûts couverts par des revenus endogènes) et en subventionnant les investissements nécessaires dans les propriétés privées (colonnes montantes et autres travaux). Cependant, dans certains cas, comme à Paris et à Montréal, la connexion au service de l'eau a été explicitement rendue obligatoire. En Italie, et d'en d'autres pays, l'eau potable dans les logements a été rendue indirectement obligatoire par les normes sanitaires sur les conditions d'habitation.

iv) Utilisation de revenus exogènes de source locale pour couvrir les coûts d'investissement dans une première phase.

Dans de très nombreuses municipalités, l'outil principal utilisé pour encourager les connections résidait dans le faible niveau des revenus endogènes (Tarif selon les 3T OCDE) qui était fixés bien en dessous des coûts totaux du service.

Par définition, les coûts non couverts par les revenus endogènes ont été couverts par les revenus exogènes. Il s'agissait en particulier de revenus issus de la fiscalité locale, étant donné qu'il n'y avait pas à l'époque de transferts récurrents en provenance du gouvernement central. Dans certains cas, une subvention croisée a eu lieu en provenance d'autres secteurs d'activité industrielle et commerciale des municipalités (principalement secteur du gaz et de l'électricité). Dans d'autres cas des outils de captation de la plus-value foncière ont participé de manière significative au financement des infrastructures urbaine.

Appendix 1 : Main steps in the institutional history of the Paris water service,

Years	**Institutional phase**	**Water production and transport**	**Water distribution**	**Sanitation**	**Comments**
1807 - 1860	Pure municipal service	Municipal department	Municipal department (mainly through public fountains)	Not existing yet (but already drainage)	Private concession on the Canal de l'Ourcq and canal Saint Martin
1860 – 1984	Mixed scheme	Municipal department	Municipal department + *régie intéressée*with the *Compagnie Générale des Eaux* (CGE)	Municipal department, progressively with intermunicipal cooperation	
1985 – 1986	Transition scheme	Municipal department	Privatecompanies*CGE* and *Lyonnaise*	Municipal department + SIIAP at the intermunicipal scale	
1987 – 2009	Delegation scheme	SAGEP	Privatecompanies*CGE* and *Lyonnaise*	Municipal department + SIIAP at the intermunicipal scale	SAGEP (70 % of shares owned by the city of Paris and 28 % of the shares owned by *CGE* and *Lyonnaise)*
After 2009	Municipalization	Eau de Paris	Eau de Paris	Municipal department + SIIAP at the intermunicipal scale	

Source : author's elaboration

Appendix 2 : A summary table of the various essays

	Title	First conference	Other conferences	Working paper publication	Essays in Phd thesis	Publications
I	The financing history of urban water infrastructure in Paris (1807-1925) : lessons from the past to enlighten present and future challenges ?	Milan European Economic Workshop – University of Milan – June 2012	Congrès de l'association française de science économique – Aix en Provence – June 2013	Already published as a working paper online on REPEC. http://ideas.repec.org/p/mil/wpdepa/2012-22.html	**a - The Finance of Paris Water: Local Public Goods at the Onset of Industrialization**	In "Infrastructure Finance in Europe - Insights into the History of Water, Transport and Telecommunication" –Y. Cassis, G. De Luca, M. Florio editors – **Oxford University Press** **Accepted by the editor, under OUP blind review process**
II	Providing and financing a municipal infrastructure : a long run analysis of water and sanitation investments in Milan (1888-2000)	CESIFO summer institute Venice – July 2013	Annual meeting of the Società Italiana di Economia Pubblica – Pavia – September 2013	Already published as a working paper online on CESIFO http://www.cesifo-group.de/portal/page/portal/CFP_CONF/CFP_CONF_VSI/VSI%202013/vsi13-eip-Picot/Papers/vsi13_eip_CrespiReghizzi.pdf	**b - Providing and financing a municipal infrastructure: water and sanitation investments in Milan (1888-1924)** **d - Water, sanitation and intergovernmental relations in Italy after WWII : a case study on Milan's water and sanitation service**	In "The Economics of Infrastructure Provisioning - The (Changing) Role of the State" – A.Picot, M. Florio, N. Grove, J. Kranz editors – **MIT Press** **Accepted with minor revisions** **Journal of Competition and Regulation in Network Industries** **Accepted with minor revisions**
III	Providing a municipal infrastructure: how did Paris and Milan finance their water and sanitation infrastructure (1853-1925) ?	International Water History Association – Montpellier June 2013		No	**c - Providing a municipal infrastructure: how did Paris and Milan finance their water and sanitation infrastructure (1853-1925) ?**	**FLUX** International Scientific Quarterly on Networks and Territories **Accepted with minor revisions**
IV	Milan's water and sanitation service: from full direct provision to corporatization	Milan European Economic Workshop – University of Milan & CIRIEC – June 2013	Sixth Annual CRNI conference – November 2013	Already published as a working paper online on CIRIEC http://www.ciriec.ulg.ac.be/fr/telechargements/WORKING_PAPERS/WP13-08.pdf	**f - Milan's water and sanitation service after corporatization: Metropolitana Milanese SpA** **d - Water, sanitation and intergovernmental relations in Italy after WWII : a case study on Milan's water and sanitation service**	In "Case histories of Public Enterprises: learning from success and failure" – L. Bernier editor - **Peter Lang International** **Accepted with minor revisions** **Journal of Competition and Regulation in Network Industries** **Accepted with minor revisions**
V	Institutions, comptabilité et financement des services d'eau et d'assainissement en Italie et en France	Le service d'eau potable à l'épreuve du développement durable – Grenoble November 2012	Poster at ASTEE congress in June 2013	NO	**e Institutions, comptabilité et financement des services d'eau et d'assainissement en Italie et en France**	**Published** in « Le service public d'eau potable et la fabrique des territoires », L'Harmattan 2013