

The economics of health system design

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Abstract There has been much rhetoric in global health about the need to consider the health sector as a ‘system’, defined by the World Health Organization as all the activities whose primary purpose is to improve health. The need to adopt a system-wide perspective arises from the complexity of the processes for delivering effective health services, and the important interdependencies between elements of the health system. However, there have hitherto been very few contributions from an economic perspective that explicitly address these issues. This paper argues that an economic paradigm of constrained optimization adapted to the systemic nature of the health sector could provide an analytical and practical approach to policy-makers in assessing their health systems and deriving solutions. The paper therefore discusses the objectives of the health system, the factors that constrain optimization, and the decision variables, in the form of policy levers. Economic approaches that could contribute to the associated research agenda include institutional economics, micro-simulation, and option pricing theory. The important feature of such methods is that they offer the possibility of developing tractable methods for addressing the complexity and interconnectedness of the health system.

Keywords: health economics, health systems, global health, universal health coverage

JEL classification: I10, I15, I18

I. Introduction

In recent years, the notion of the health system has received major attention within the global health community, with increasing numbers of publications, academic conferences, and post-graduate degree programmes devoted to its study. As an academic subject of inquiry, what is the intellectual foundation of national health systems? According to the Merriam-Webster dictionary, a system is defined as ‘a set of interacting or interdependent components forming an integrated whole’.¹ Given their nature, health systems are therefore necessarily complex and dynamic. This paper explores how economic thinking may contribute to the understanding of health systems.

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This is a contribution to the special issue of the *Oxford Review of Economic Policy* on the topic of global health. Thanks are due to participants in the editorial meeting in February 2015, an anonymous referee, and to Andrew Farlow for valuable guidance.

¹ <http://www.merriam-webster.com/dictionary/system>

doi:10.1093/oxrep/grv018

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The characteristics of health care have necessitated significant adaptations of the traditional economics modelling approaches towards goods and services. Most notably, the health sector suffers from numerous sources of market failure that violate many basic assumptions inherent in traditional economic models. To cite just a few: profound asymmetries of information between providers of health services and their patients; major economies of scope and scale, most obviously but not solely in the hospital sector, that inhibit the development of conventional competitive provider markets; existence of explicit or implicit insurance markets that are replete with problems of adverse selection and moral hazard; and countless externalities, especially in the form of infectious diseases (Smith, 2000). These market failures mean major policy interventions are needed for the health sector to achieve the social goals of efficiency and equity.

Equally important and much less studied is the immensely complex production process of health that arises from many interdependencies that occur in the delivery of services across a patient's treatment pathway. Such 'person-centred' care (that is, care organized around an individual's needs and preferences) reflects Baumol's characterization of healthcare as a handicraft industry (Baumol, 1995). The complexity of the production process makes coordination and governance of the health sector extremely challenging, as it requires the coordination of a range of providers while tailoring care to the specific needs of the individual. For example, to 'produce' health improvements for a patient with diabetes, it is necessary to coordinate care among primary care providers who are responsible for screening, case-finding, and disease management, and secondary care providers if and when the patients develop complications and require hospitalizations, and finally, post-discharge follow-ups. Another example is for cancer patients. When the first intervention in a patient's disease progression occurs too late, or is ineffective, this may lead to emergency treatment, which would result in use of specialist resources and the associated healthcare costs, and poorer patient outcomes that could have been mitigated if earlier intervention had occurred.

There could be numerous barriers to affordable access and efficient delivery of any service across a patient's treatment pathway, arising on both the demand side (for example, limited coverage or poor information for patients) and the supply side (for example, provider payment incentives). A package of coordinated policies is required to address the potential barriers to efficient patient care. These policy instruments might include financing, service organization, provider payment method, and regulation. Interdependencies between these policy instruments lead to a second aspect of health system complexity. Attempts to 'fix' part of the system through (say) regulation, payment incentives, or information provision may introduce unintended consequences elsewhere. There is furthermore a rich political economy associated with health services. Patients, the broader population, the workforce, medical industries, and local politicians often create formidable interest groups that can seriously constrain the scope for action to improve the allocation of resources (Tuohy and Glied, 2011).

Taken in combination with the scope for market failure, these personal and policy concepts of complexity have led to increasing interest in studying and designing health policies by conceptualizing the health sector as a 'system'. The advocates of the 'health system' viewpoint consider that conscious coordination of policy instruments and service delivery platforms is the most appropriate response to the distortions that arise in the absence of any intervention. This viewpoint recognizes that piecemeal attempts to correct distortions will often fail, and that, instead, the design of the different policy instruments and service

provision should be aligned in pursuit of a common set of goals, reflecting society's efficiency and equity objectives. Rather than seeking to correct market failures, therefore, the system approach addresses a more fundamental question: **what system design stands the best chance of securing a socially optimal allocation of goods and services in the health sector?** Such arrangements should meet the usual criteria for economic optimality (allocative and technical efficiency), while respecting society's equity requirements.

This paper seeks to examine the health system from an economic perspective. We argue that an economic paradigm of constrained optimization adapted to the systemic nature of the health sector could provide an analytical and practical approach for policy-makers in assessing their health systems and deriving solutions. The next section discusses the definition and goals of the health system, and its links to the rest of the economy. We then analyse some of the key constraints that confront policy-makers seeking to reform their health systems, before discussing the principal policy levers available to them. In both of these sections, we highlight areas where economics can make a fruitful contribution. Finally we draw conclusions on the major contributions that economic thinking may be able to make towards the design and operation of health systems.

II. An economic paradigm for studying health systems

(i) Definitions of health systems

The study of health systems is not new; it dates back to Roemer's work in 1993 (Roemer, 1993). However, the recent attention to health systems can be traced to the publication of the World Health Organization's (WHO) *World Health Report* (WHR) 2000, which explored the structure of the health system and ranked its member countries according to their performance. This triggered a worldwide debate. WHR 2000 defined the health system as 'all the activities whose primary purpose is to promote, restore or maintain health' (World Health Organization, 2000). This definition has not been seriously challenged, although there have at times been differences of interpretation. The Tallinn Charter (World Health Organization Regional Office for Europe, 2008) further elaborated the definition of health systems to 'encompass both personal and population services, as well as activities to influence the policies and actions of other sectors to address the social, environmental and economic determinants of health'.

By including all sectors associated with the production of health, there is a risk that this definition makes the study of health systems intractable. Defining the health system to include policies and actions that are directly within the influence of the health services sector is already complex. In this paper, we adopt this narrower definition of the health system, which can be loosely thought of as the actions within the control of a typical health minister. However, we also discuss the health system's connection to the rest of the economy where relevant.

(ii) Frameworks of health systems

A number of health system frameworks exist. They can be broadly classified into two approaches. The first seeks to describe the structural components of a system.

A representative model of this approach is the WHO's Building Block framework (2007) which identifies six health system 'building blocks': service delivery; health workforce; information; medical products, vaccines, and technologies; financing; leadership and governance. While this framework provides some guideposts to potential areas of attention, its conceptualization is rather *ad hoc*. For example, it mixes inputs (health workforce, vaccines and drugs, medical products, information system, and financing), output (service delivery), and broader institutional factors (leadership and governance) without specifying the relationships between them. It does not inform decision-makers about potential policy actions to take. Furthermore, the building blocks are primarily concerned with the supply side and the demand side is largely ignored.

The second approach, pioneered by [Hsiao \(2003\)](#), conceptualizes a health system as a set of relationships in which the structural components (the 'means') and their interactions are associated and connected to the goals the system desires to achieve (the 'ends'). This approach adopts a broadly cause and effect framework that aims to provide an analytical tool for policy-makers to relate the different components or policy levers of a health system to its performance ([Berman and Bitran, 2011](#); [De Savigny and Adam, 2009](#); [Roberts et al., 2008](#)). However, while both approaches acknowledge or describe the interconnection among different health system components and their relationship with the health system goals, neither provides an intellectual foundation to address the linkages between these different components, or attempts to model these interdependencies.

(iii) Objectives of a health system

Despite the various system frameworks and definitions, there is widespread agreement on what some of the fundamental objectives of the health system should be ([Papanicolas and Smith, 2013](#)). They include:

- improving health;
- protecting people from the financial consequences of ill-health;
- promoting associated equity objectives;
- minimizing inefficiency associated with the pursuit of these objectives.

These are the principal objectives that policy-makers are likely to have in mind when seeking to design, reform, or regulate a health system. For political support, health policy-makers may also aim to improve public satisfaction with a health system. The WHO coined the closely related term 'responsiveness', defined as being responsive to people's legitimate expectations of health services. However, there is perhaps less consensus on the precise formulation and importance of this objective, which is intended to embrace characteristics of encounters with health services such as patient satisfaction, waiting time, confidentiality, and respect ([Busse, 2013](#)).

Such formulations of objectives differ greatly from the usual productivity criteria associated with measuring the contribution a sector of the economy makes to economic growth and wellbeing. The fundamental interest is in promoting health improvement, while protecting from the associated expenditure shocks. A further major departure from conventional productivity measures is the high profile given to equity objectives, a fundamental concern for many individuals and societies ([Hernández-Quevedo and Papanicolas, 2013](#)). It is furthermore important to recognize that, in contrast to the

goal of many other sectors of the economy, many health policies seek to reduce health service activities, either by improving the health of the population and obviating certain treatments that would otherwise have been needed, or by reducing the incidence of inappropriate treatment of questionable value to payers and patients. These efficiency gains can in principle yield benefits for citizens, both as patients and as payers, and address market failures, but of course they serve to reduce the size of the health sector and its contribution to standard measures of overall economic activity.

In scrutinizing these objectives, it is worth dwelling on why 'health' should be afforded special status among policy goals, in contrast to more general measures of welfare. To some extent the limitations of the health focus are being recognized, as efforts are made to incorporate broader societal objectives into the evaluation of health technologies (Verguet *et al.*, 2015), and there is a debate among economists about whether to adopt a 'welfarist' or an 'extra-welfarist' perspective (Brouwer *et al.*, 2008). It is nevertheless the case that the focus on health as an objective has enabled policy-makers to assess health system reforms on a consistent basis, when a broader evaluative framework may have been intractable. The weakness of the extra-welfarist approach becomes evident only when seeking to assess health initiatives in relation to policies in other sectors.

(iv) Linkage with other sectors

The health system does not exist in isolation. Its performance can have profound implications for the performance of the broader economy, and conversely many features of other sectors of the economy have important implications for health and the performance of the health system. These interactions have increasingly become the focus of detailed policy attention (World Health Organization, 2001). Space precludes treatment in this paper. However, it is especially important to note the impact of the broader economy on the health system, which has been the subject of scrutiny under the rubric of the 'social determinants of health' (World Health Organization, 2008). Broadly speaking, this perspective argues that many of the major determinants of ill-health lie outside of the health system, and these factors need to be addressed by policy-makers interested in improving the health status of the population. The debate on social determinants has placed a particularly strong emphasis on the role of factors such as education, housing, employment type, income and income inequality, and social status, to name a few, in influencing health and health inequalities. It implies a major role for health policy in influencing and coordinating with policies in those other sectors.

(v) An economic paradigm for health system study

We noted in the introduction the profound influence of interdependencies within any health system, creating the rationale for a system perspective. It is therefore curious that few of the existing frameworks take much consideration of such interdependencies. Yet the optimal design of a health system crucially depends on the balance between different components of service delivery, such as preventative services, primary care, community services, local clinics, long-term care, secondary and tertiary hospital services, and palliative care. Although there is no single model of a health system that fits all countries, a common principle will be that the efficient functioning of the system, in line with chosen

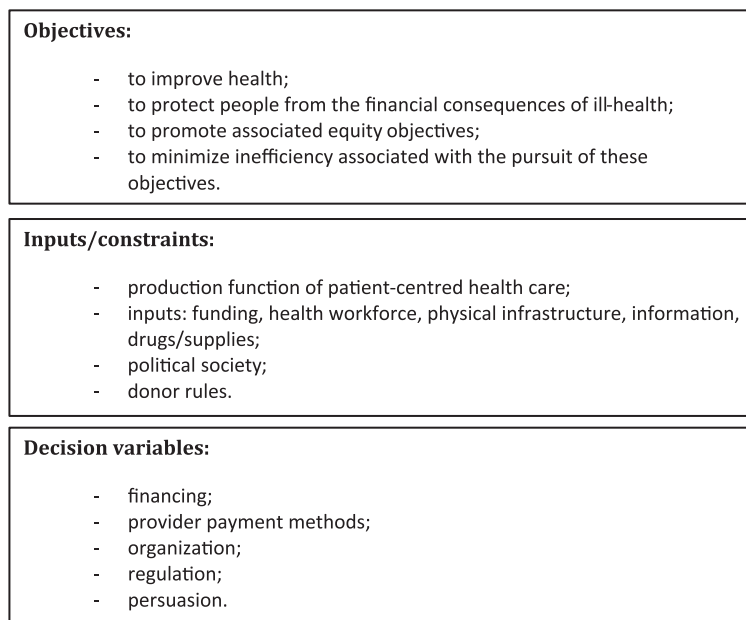
objectives, depends on securing an optimal balance between the components (subject to a budgetary constraint) and on all policy levers being aligned with securing that optimality.

Furthermore, policy choices are often highly constrained by numerous factors (other than finance) that militate against immediate or even long-term progress towards improvements. Constraints arise from physical sources such as the current stock of capital and workforce availability, and also from the profoundly political environment within which any health system must function. We discuss constraints in more detail in section III. At this stage we simply note that it is the presence of these constraints, and the necessary interdependencies of different policy levers and sub-components of a system, that forms the framework for the policy-making challenge.

We propose the use of the economic paradigm of constrained optimization as a framework to guide policy-making in health systems. The usual micro approach towards economic optimization is to maximize some function of social welfare subject to a single budgetary constraint. For example, in health technology assessment, the dominant economic approach has been to assess the cost-effectiveness of technologies assuming health maximization subject to a single sectoral budget constraint.

From a system perspective, the health policy-maker's problem is much more complex. Here the policy-maker's optimization problem is to choose a mix of policy levers that maximize a set of multiple objectives, many of which involve trade-offs that reflect underlying societal value, subject to multiple constraints, including the production function of health (which could exhibit considerable economies of scope and scale) and other constraints such as inputs, political economy, and, in some countries, rules imposed by donors. To complicate the optimization problem further, some factors that act as constraints in the short run can become malleable and therefore a decision variable in the long run. [Figure 1](#) provides a summary of the optimization problem. We are

Figure 1: Components of the health system optimization problem



not aware of any serious efforts to undertake such optimization, yet policy-makers are in practice seeking to apply a constrained short-run, or long-run, optimization when proposing policy reforms. If economists are to make an impact on the ‘health systems’ movement, it is likely to be such constrained optimization models that gain most traction among policy-makers.

III. Constraints

A key concern for policy-makers considering reforms to the health system is the daunting set of short-run or long-run constraints they face in securing change of any sort. The most fundamental constraint that is often analysed is the availability of finance. Beyond that, however, there are likely to be numerous other constraints, including but not limited to: the size and skills of the available workforce; the configuration of physical resources, such as clinics and hospitals; the health, preferences, and characteristics of the population; managerial capacity and information resources; the influence of powerful interest groups; and (for low-income countries) constraints imposed by financial donors. In the short run, many of these constraints will effectively be fixed, and policy-makers must seek to optimize while accommodating them. To relax such constraints will often require a long-run view and prolonged political commitment to reforms. In this section we summarize four broad categories of constraint, and assess the contribution that economic thinking can make towards their conceptualization and resolution.

The first category of constraint concerns the many physical constraints that are typically inputs to the production of health. These will include the prevailing capital infrastructure, the geographical distribution of resources, and the nature of the workforce. In the short run, such constraints must often be taken as absolute. In determining priorities for reform, policy-makers can compare the impact on performance of relaxing different constraints. In doing so, it will often be necessary to model demand-side and supply-side responses to new arrangements, alongside their costs. For example, relaxing the government budget constraint to provide subsidized insurance is likely to stimulate new demand, which would then necessitate increase in supply of facilities or human resources to meet that demand, with implications for health outcomes and costs. In principle, economic analysis (especially on the demand side) has much to offer in this respect, for example in the emerging area of microsimulation of future health scenarios (Rutter *et al.*, 2011).

A second category of constraint arises from the many interdependencies that exist within the production of ‘patient-centred’ health as discussed in the introduction. Because of the major economies of scope that exist in all aspects of the system, specific treatments, or even disease areas, cannot be considered in isolation. For example, treatment of many disease areas relies on common resources (such as district nurses for many child health programmes, or hospitals which act as central resources for many acute diseases). Such interdependencies are, of course, a prime reason for adopting the health systems perspective. However, the complexity and uncertainty they introduce can also inhibit reform, as policy-makers may be concerned about the unintended side effects of any actions. The major contribution that economics can make in this respect

is to offer a better understanding of the magnitude and nature of any economies of scale and scope that exist within the health system. Once again, the volume of existing evidence in this area is slight.

A third category of constraint, covering some of the most severe limitations to health system reform, arises from political considerations (Fox and Reich, 2013). Interest groupings such as the electorate, patient interest groups, the healthcare industry, the workforce, bureaucrats, and geographical interests create a daunting political economy of health services that has a profound impact on the scope for reform. For example, in Mexico, opposition from the union of the Instituto Mexicana del Seguro Social (IMSS—one of Mexico's largest unions) to being pooled with the previously uninsured resulted in the establishment of a separate national health insurance system for the uninsured (the Seguro Popular), rather than an integrated system (Lakin, 2010). In principle the health sector should provide a fertile area for a public-choice analysis of political constraints, although the range of reported studies is in practice quite small (Hauck and Smith, 2014). At the very least, economic analysis can provide evidence on the opportunity costs associated with any failure in implementation caused by political constraints.

Finally, it is worth noting a fourth category of constraint that occurs in low-income countries, concerning donor requirements. Many donor agencies place conditions on the use that can be made of the health funds they provide, effectively creating constraints on a recipient country's freedom to shape its health system (Schieber *et al.*, 2006). For example, the World Bank estimated that only 0.8 per cent of donor spending on HIV/AIDS was on interventions targeted for sex workers, despite 76 per cent of all new HIV infections occurring between sex workers and their partners (Forsythe *et al.*, 2009). In addition, misalignment among donor agencies leads to major waste and inefficiencies. For example, in the Dominican Republic of Congo, there were 195 ongoing projects supported by international aid projects in the health sector between 2006 and 2012. Most aid was earmarked for specific programmes rather than the delivery of basic health services. In 2009, 85 per cent of international partners were using their own procurement agencies, warehouses, and distribution systems, resulting in almost 100 parallel medicine supply channels for essential medicines (Reveillon and Sibomana, 2015).

IV. Policy levers

Policy levers are the key decision variables for the health policy-maker's constrained optimization problem. In considering policy levers, an important requirement is to ensure that all policies are aligned in pursuit of agreed objectives, in light of the many interdependencies and interactions. Roberts *et al.* (2008) set out five policy levers, relating to the:

- sources and nature of health system *financing*;
- modalities of *provider payment*;
- *organization* of the delivery system;
- *regulation* of the system;
- *persuasion* of individuals and other sectors to modify behaviour in pursuit of health system goals.

We consider each of these optimization decision variables briefly in turn, focusing particularly on the scope for economic models to influence reforms. The section concludes with a discussion of the potential interactions among these various policy levers.

(i) Financing

Financing decisions include how much money to mobilize, from whom, for what services, and what population groups. They are of fundamental importance in determining the size of the health system, who secures access to treatment, the degree of financial protection citizens enjoy, and, ultimately, the health outcomes for the population. Relative to a position of universal health coverage, the traditional reliance on out-of-pocket payments for treatment has adverse consequences for the individual utility of poorer people in the form of reduced utilization, financial risk exposure, and poorer health, and therefore compromises pursuit of equity objectives. Furthermore, widespread use of voluntary health insurance has generally been shown to be unviable, except for supplementing a core publicly funded insurance package. The move towards universal health coverage (UHC) implies a widespread belief that some form of universal social health insurance is likely to be optimal for social welfare, by both protecting the sick and the poor, and also satisfying demands for a fairer distribution of resources (Jamison *et al.*, 2013).

Optimizing the exact nature and magnitude of public insurance is a matter for national policy, depending on national income and social preferences. In particular, the magnitude of the ‘health basket’ of treatments to be subsidized from the social insurance will ultimately be dependent on the willingness of policy-makers to redistribute resources from the wealthy and healthy towards the poor and sick. Incidence analyses could help clarify winners and losers under different options. The nature, magnitude, and incidence of user charges for treatments are intimately related to the chosen health basket (see below). It is important to note that, although who pays for health insurance is initially a public finance issue, it eventually becomes a public health issue, as poorer people are most likely to be deterred by out-of-pocket payments from seeking treatment. They are also likely to stand to gain most health by securing that access (Moreno-Serra and Smith, 2012). There is therefore an efficiency argument to support progress towards UHC, as well as the usual equity argument. Many countries have recently introduced insurance programmes targeting the poor using general tax revenue, for example, Indonesia, India, and Vietnam (La Forgia and Nagpal, 2012; Harimurti *et al.*, 2013; Somanathan *et al.*, 2013).

Whatever system of finance is in place, there is (except in the smallest countries) a need to redistribute the pooled funds between the devolved entities that are responsible for the detailed procurement of health services. These might take the form of social insurance funds, local governments, or local offices of national insurance schemes. Where there is no such redistribution, funds with poorer, sicker populations will have lower resource bases and have lower capacity to deliver services than their counterparts with richer, healthier populations. A fundamental requirement of implementing universal health coverage is that there is ‘fair’ funding of all devolved entities charged with delivering services, a technically challenging undertaking that often leads to quite marked redistribution (Smith, 2008).

(ii) Provider payment

Provider payment has been a major focus of policy attention in many countries, as it has a fundamental influence on the quality, level, and efficiency of services provided. In designing payment systems, key considerations include: (i) whether payment is made prospectively or retrospectively; (ii) the unit of payment; and (iii) the level of payment. Together, these determine the amount of risk borne by the providers versus the purchaser. Any provision of service involves some level of uncertainty in costs. The more risk borne by the provider, the greater incentive there will be for the provider to reduce costs—especially if the provider is able to retain savings, but the greater incentive too for reducing necessary care and compromising quality (Christianson and Conrad, 2011).

As a result, governments are progressively moving towards blended or mixed payment regimes that capitalize on the benefits of different approaches. There is also growing interest in pay-for-performance (p4p) under which providers receive increased payment when certain quality criteria are satisfied. A wide range of payment mechanisms has been tested, in both hospital and primary care settings in both advanced economies and low- and middle-income countries, including China, the Philippines, Rwanda, and England (Basinga *et al.*, 2011; Peabody *et al.*, 2011; Sutton *et al.*, 2012; Witter *et al.*, 2012; Cashin *et al.*, 2014; Yip *et al.*, 2014). The quantifiable impact of such schemes vary depending on context, and experience shows that p4p needs to be complemented with other pre-conditions, for example functioning information systems, managerial capacity, and provider autonomy, in order to effect behavioural change.

(iii) Organization

Because of the manifest market failures, the organization of the health system is a key policy issue that cannot be left to consumer choice markets alone. To do so would risk serious departures from socially optimal levels of supply and demand, and fail to address the many sources of potential distortion, such as information asymmetries, moral hazard, supplier-induced demand, and externalities. Examples of quite fundamental organization choices for policy-makers include the:

- vertical and/or horizontal integration of service delivery;
- permitted ownership and scope of health service providers;
- extent to which markets and competition play a role in both insurance and provider markets;
- organization of health insurance, for example, single or multiple management funds;
- extent to which insurers are independent of the providers of health care.

A number of economic models have been applied to the above organizational choices, usually with ambiguous predictions, implying a need for careful empirical study. For example, organizational economic models hypothesize that under some circumstances integrated systems are more likely to be able to provide more efficient, coordinated care by economizing on contractual and coordination costs (Bresnahan and Levin, 2012). The ownership of hospitals and other providers has rarely been found to be a major influence on performance (Gaynor *et al.*, 2012; Cutler and Scott Morton, 2013).

Competition appears to have some influence on performance in the hospital sector, but its magnitude is often modest (Gaynor *et al.*, 2012). Health insurance has been extensively studied, with an increasing tendency for theory and empirical evidence to favour a single universal payer model in low-income settings, given the regulatory and financial complexity brought about by competing insurers (Hsiao, 2007). At the same time, there has been a growing tendency to separate the insurance function from the provider function, given the obvious risks that arise when purchasers have no contestability for the services they require (Robinson *et al.*, 2004).

A fundamental policy decision regarding purchasing is the organization of the purchaser. Because of asymmetry of information, patients do not possess the knowledge and information to be effective purchasers. An entity with the responsibility to purchase on behalf of the people or enrolled population is therefore needed. Such entities can take a variety of organizational forms and ownership—for example, government health ministries, local health authorities, public autonomous agencies, private health insurers (whether commercial or not-for-profit), or non-governmental organizations (NGOs). Some countries in which governments do not have the capability to take on this role within their core line ministries or government departments (either due to lack of relevant skills, or the rigidity of public finance systems that do not allow movement away from rigid line-item budgets, or a combination) have either established public autonomous agencies (e.g. the National Health Security Office in Thailand) or have contracted out the purchasing function to NGOs or private insurance companies (e.g. India's RSBY (*Rashtriya Swasthya Bima Yojna*) government-sponsored health insurance scheme for persons below the poverty line). Institutional economics and the emerging field of organization economics (Gibbons and Roberts, 2012) can provide fertile frameworks for examining the effectiveness of different forms of purchasers, including but not limited to how the incentives and accountabilities of purchasing agencies can be aligned with public policy objectives. Furthermore, there is immense scope for economic theories of contract design to inform health system purchasing, particularly given the need to align with other policy levers.

In practice the organizational aspects of a health system are often the result of historical accident, and are highly path dependent. Changes can be made only infrequently, entailing major transition costs. If they are to be successful, they will often require commitment over an extended time period, of the type, for example, secured in the Netherlands, as it implemented an approach described as 'managed competition' in both insurance and provider markets (Schut and Van De Ven, 2005). The alternative is to risk perpetual piecemeal reforms that are soon dismantled by new ministers and governments, a model that has been especially evident in the English National Health Service (Walshe, 2010).

At a micro level, the delivery of a specific treatment can rarely be considered in isolation from the system-wide implications of its adoption (or abandonment). Most treatments rely on infrastructure such as physical capital, the workforce, various supply chains, and information technology for delivery. Such resources are usually shared with many other treatments, often yielding substantial economies of scope. Changes to the mix of services using the infrastructure may alter the costs and effectiveness of all treatments that rely on it. Similarly, the adoption (or absence) of certain treatments may have implications for other programmes of care. The most obvious example of this is the impact of preventive treatment on the need for subsequent curative care.

However, numerous other treatment complementarity and substitution effects can be identified, such as the potential for certain primary care services to moderate demands for some types of secondary care, an issue of growing importance as the prevalence of non-communicable chronic disease increases in most countries. Such relationships can in some respects be considered ‘externalities’ of the treatment under scrutiny, and the presence or absence of complementary services may therefore greatly alter assessments of its cost-effectiveness.

At the macro level, many countries, especially low- and middle-income ones, have a large private sector that co-exists with the public sector in provision. Within the private sector is also a mix of for-profit and not-for-profit providers. How the two sectors interact and strategically choose their optimal actions is under-studied. Yet, without such knowledge, policy-makers cannot predict the sequence of responses that may be stimulated by a policy intervention in one sector. For example, a change in provider payment method for public hospitals will lead to changes in cost and quality of public service, leading to changes in patients’ demand for public versus private care, and subsequently private providers’ choice of price, location, and quality. These interactive reactions would be quite dependent on the objective functions of the public and private providers and the constraints they face.

(iv) Regulation

The need for regulation in any health system is manifest, including but not limited to concerns with health care quality, fraud and corruption, competition and the operation of markets, workforce accreditation and quality, clinical education, determining the health basket to be funded from public insurance, setting prices and quality criteria, medical research, and medical product approval. However, it is often the case that—even when an extensive regulatory structure is in place—the missions of the individual regulators are not aligned to a single set of health system objectives, and there are often ambiguities, redundancies, and gaps in the regulation of the health system.

Notwithstanding the large number of regulators found in many health systems, just two broad classes of regulation can be identified: *ex ante* specification of market rules and performance criteria, and *ex post* assessment of adherence to those rules and criteria. From an economic perspective, a particularly important example of the former type of regulator is the range of health technology assessment (HTA) agencies now established in many high-income countries, and an increasing number of middle-income countries. As usually implemented, HTA seeks to apply economic principles of cost-effectiveness to the choice of publicly funded health services, by selecting treatments for reimbursement that secure the maximum social benefit (usually expressed in terms of health gain) for the limited resources available (Drummond *et al.*, 2005). The focus is on allocative efficiency, with the aim of ensuring that only those technologies that secure the best value are selected for funding from public resources. HTA can help guide both investment and disinvestment decisions, either when public budgets are growing or when cost containment is required. It can be extended to indicating the circumstances (for example, patient types or stage of disease progression) in which certain

technologies are used, informing pricing decisions, and even facilitating the development of detailed clinical guidelines.

The fundamental requirement for *ex post* assessment is to have in place adequate information sources with which to evaluate the performance of the system, institutions, or practitioners under scrutiny. The public-good nature of such information means that—whatever the characteristics of the health system—the specification, mandating, and dissemination of performance information is a governmental policy role. Once that is secured, the policy challenge is to ensure that appropriate accountability mechanisms are in place, so that proportionate actions can be taken to address weaknesses. Such mechanisms—which might include markets for patient choice and electoral processes as well as direct regulatory intervention—need to balance adherence to prescribed practice with allowing scope for innovation and seeking out new approaches to service delivery. It is noteworthy that—although performance information is increasingly recognized as an important instrument for health system improvement—relevant economic thinking (such as principal–agent models) has not played a major role in the design of regulatory instruments in health systems (Laffont and Tirole, 1993).

(v) Persuasion

Persuasion is a demand-side policy lever that refers to a set of policies aimed at changing the preferences and behaviour of individuals. Such policies include advertisement, social marketing, and a number of health interventions aimed at changing risky behaviour of individuals, such as smoking, consumption of fatty and sugary food, and lack of exercise. Recent development of behavioural economics presents ample opportunities of application to this set of policies (World Bank, 2015). A number of policies under this umbrella involve policy actions taken beyond the domain of the health system or the formal responsibility of health policy-makers, including advocacy to ensure that health-related considerations are given full consideration in areas such as legislation (e.g. smoking bans), taxation (e.g. sugar taxes), and influencing policies in non-health government ministries, such as education and transport (Harris-Roxas and Harris, 2011).

The important interaction between the health system and other sectors raises the issue of how beneficial joint actions across sectors of the economy can be funded and incentivized. For example, actions in mental health care might to some extent yield benefits in the social security sector (by reducing the number of welfare claimants and helping people maintain active employment) as well as improvements in health status. Conversely, actions in (say) the education sector might improve health status by reducing the prevalence of childhood obesity and its health consequences. In either case, the beneficial consequences of policy may be inadequate to prompt one sector on its own to act. However, if the net social benefits of a policy are sufficiently great in aggregate, it is in principle desirable for it to be implemented, and mechanisms should be sought to ensure that the joint benefits of the policy are properly recognized.

From the general government policy perspective, mobilizing such cross-cutting policies represents a major challenge, as they require budgeting, incentives, performance assessment, and accountability regimes that transcend usual ministerial boundaries. This would appear to be a fertile area for economic modelling. However, to our

knowledge, few relevant economic models have been developed. Attempts were made by the UK government to implement cross-sectoral instruments under its 'public service agreement' initiative (Smith, 2007). However, little progress was made before the scheme was abandoned. In the same vein, efforts to make industries incorporate public health and other social objectives into their actions have so far made only slow progress (Sharma *et al.*, 2010).

It may be the case that more direct efforts to persuade citizens to adopt healthier lifestyles will prove more fruitful, through, for example, the provision of clearer information to citizens on the health consequences of their choices. A review of possible scenarios for the English health system concluded that the future trajectory of health-related behaviour would be the major determinant of future health system productivity and expenditure (Wanless, 2002). The main class of public health policies adopted to date have been taxation (on alcohol and tobacco) and prohibition (Mackenbach and McKee, 2013). Early efforts to tax other 'bads', such as saturated fat and sugar, have been tentative, and have exposed the powerful lobbying power of affected industries to moderate or deter government actions (Hauck and Smith, 2014).

(vi) Alignment across policy levers

This section has considered five policy levers: financing, provider payment, organization, regulation, and persuasion, each of which has a profound impact on the functioning of the health system and the objectives that it seeks to promote. However, in practice, there are major interactions between these policies that mean that consideration of any one of these policy levers in isolation may be ineffective.

For example, there are important interactions between provider payment methods and financing. In China, combining fee-for-service payment (FFS) with expansion of insurance coverage led to over-treatment of profitable services and rapid health expenditure growth that can threaten the sustainability of financing (Wagstaff *et al.*, 2009; Meng *et al.*, 2012). Similarly, fragmentation in financing often leads to different financing schemes paying providers with different methods, leading to problems of cost shifting, whereby providers respond to a cost-saving incentive from one payer by increasing service volume and intensity of care to other payers that continue to pay using FFS, as experienced in the United States (Wu, 2010; Frakt, 2011; Robinson, 2011). In Burundi, in an effort to reduce infant and maternal mortality rate, the country introduced a free care policy for children under five and pregnant women which led to a dramatic increase in deliveries in health facilities and utilization of covered services. The increase in demand put pressure on already scarce staff and resulted in the frequent stock-out of medicines leading to a deterioration of performance. To meet increased demand, performance-based payment was introduced to incentivize providers to increase the supply of services and improve quality, and encourage the use of maternal and child health services (Reveillon and Sibomana, 2015).

There are important interactions between how provider payments are designed and the incentives they provide to facilitate integrated delivery. As most countries face an increased disease burden due to chronic diseases, many health systems are seeking to transform their episodic-based delivery system to patient-based integrated models. One approach to supporting integrated delivery is to introduce a capitation payment system,

whereby providers are paid a fixed amount per person registered with the provider or residing in a catchment area for a given period of time, usually a year. Depending on the scope of services included in this capitation payment rate, the incentives embodied in a capitation payment method vary. If only outpatient services are included, providers have incentives to refer patients to inpatient facilities. In contrast, if the capitation rate embraces all types of service, providers have an incentive to treat patients at the lowest cost settings, invest in prevention, and coordinate care with other providers. Yet they also have an incentive to skimp on care. To be fully effective, capitation needs to be designed alongside regulatory control, in the form of performance information, to ensure people are receiving appropriate care of adequate quality.

Other examples of policy interactions include the following.

- User charges may be introduced to moderate utilization of primary care services. However this may lead to increased, inefficient use of hospital services at a later stage of disease progression, leading to increased costs elsewhere in the system, and poorer health outcomes.
- Health insurance programmes that cover only hospitalizations, with the rationale to provide financial risk protection, produce unintended incentives for patients to bypass primary care, leading to unnecessary use of hospital services and health expenditure growth but little improvement in patients' health.
- Reorganization of provider markets to improve access for patients in rural areas may be ineffective if skilled workers are reluctant to work in some areas. Simultaneous policy attention to workforce payment, training, and regulation may therefore be necessary.
- The recommendations of health technology assessment agencies may be ignored unless accompanied by simultaneous adaptation of information systems, payment mechanisms, and workforce training.

Such potential conflicts argue for the alignment of policies across the entirety of the health sector. This requires clarity on health system objectives, adequate policy-making capacity, careful articulation of system-wide policies, and a long-term vision that recognizes the long time horizon over which the necessary programme of policies must be implemented.

(vii) Timing of reforms

One dimension of policy decision that we have not addressed is the issue of the timing of any reform. Although in the short run some constraints may be binding and some policy levers not options for change, a longer-term perspective is to consider them from the viewpoint of implementation costs. Any reform will usually entail the commitment of irrecoverable sunk costs. Yet there is always a high degree of uncertainty about many aspects of reform, such as future demand, the nature and rate of technological progress, and linkages to other parts of the health system. The joint presence of sunk costs and uncertainty will often inhibit change, even when expected net benefits are high. In principle, economic tools such as decision trees and 'real options' analysis should be able to help rank priorities for implementation, and inform whether reform should be implemented immediately or delayed. The essence of the approach is to

compare the expected costs and benefits of implementing a reform immediately with the expected costs and benefits of delaying, pending the emergence of new information on those costs and benefits. One of the costs of delay is that patients who may have benefited from reform will be denied that benefit. On the other hand, the delay may obviate unnecessary sunk costs of a reform that subsequently turns out to be poor value for money (Palmer and Smith, 2000). While the conceptual relevance of options theory to the reform decision has been established, we are not aware of any practical application.

V. Conclusions

A functioning health system is essential for a country to produce health and protect its citizens from the financial consequences of ill-health in an efficient and equitable manner. Despite its central attention in global health, there is no well-established intellectual foundation to the study of health systems. This paper seeks to sketch out a potential research agenda for ‘health system economics’ by examining the health system from an economic perspective, while acknowledging that an interdisciplinary approach would eventually be necessary to address the complex nature of health systems.

The strength of economics is that it provides an analytical framework to summarize the otherwise complex nature of a policy question and allow the users to derive logical predictions and generalizable lessons. We argue that the central tenet of economic enquiry of constrained optimization provides an analytical and practical approach for policy-makers in assessing their health systems and deriving solutions. To do so, the usual micro approach that typically maximizes a single objective, subject to a single budgetary constraint and focusing on a single policy intervention (which is the dominant application in the existing literature) is of only limited help for health system studies or for policy-makers.

As the paper discusses, there are a number of interdependencies within a health system that call for a ‘systemic’ approach. Policy-makers usually have to maximize multiple goals with the weight for each goal determined by politicians, the people, or even interest groups, depending on the political structure of a country. This process involves difficult trade-offs. Policy-makers also face a large number of constraints that go beyond just the usual budgetary constraints, many of which are interdependent and cannot be relaxed in the short run. To be useful for policy-making, a systemic constrained optimization would have to make adaptations in order to incorporate these unique features of health policy-making. Policy-makers then optimize by selecting their policy levers, again recognizing that there are significant interdependencies among the different policy levers as we have analysed in section IV, leading to derivation of generalizable lessons that are ‘conditioned’ on constraints and contexts.

We argue that alignment across different policy levers and across the different health service delivery sectors that contribute to the production of ‘patient-centred’ health is key to policy-making in health systems. This should also be the overarching principle in guiding the application and development of health system economics. At present, as

discussed throughout the paper, there is limited knowledge regarding these interactions. The discussion suggests a huge research agenda, which might include:

- developing a tractable framework of the health system, at an appropriate level of detail, capable of addressing the key decisions required by policy-makers and incorporating short-run and long-run constraints;
- seeking out existing evidence and putting in place new research to quantify and parameterize the key relationships in the model, including interactions between policy choices and the influence of constraints;
- simulating system behaviour in response to policy changes, possibly using micro-simulation but more likely at first using aggregate models such as system dynamics;
- translating findings from this improved system framework and empirical evidence for policy-making.

Some potentially fertile research applications capable of informing this agenda include: modelling demand and supply responses simultaneously in predicting the effect of a policy intervention; applying theories of economies of scope in the study of production of patient-centred health; modelling institutional and political constraints using institutional economics and public choice theories; modelling the alignment of payment incentives across the spectrum of providers in the production of integrated/co-ordinated care, for example, for chronic disease patients using organization economics; modelling the complementarities and substitution in both demand and supply of health; exploring the emerging field of network economics that models the interactions of actors within a network; and the use of option pricing methods to optimize the nature and timing of system reforms—to name just a few.

To accompany the development of theories, significant and coordinated effort at the national and international level is needed to standardize definitions and collect relevant data to test and validate the derived relationships. The Organization for Economic Cooperation and Development (OECD) has started with efforts to collect information on health system characteristics in high-income settings (Paris *et al.*, 2010), but more efforts are required to expand the principle to low- and middle-income countries where much vibrant health reform is taking place. More importantly, data collection, and specification of the decision variables and the units of observation, should be guided by hypotheses derived from a systemic model that can inform policy-makers' decisions. Collection of apparently relevant variables not guided by theories is a waste of resource and compromises the credibility of the research effort.

Similarly, major efforts are required to develop evaluation methods that take into account the complex and dynamic nature of health systems. Any single intervention in a health system can trigger a sequence of changes in different parts of the systems, with potential feedbacks, and effects are dependent on constraints (De Savigny and Adam, 2009). Existing evaluation methods that focus on single interventions assuming everything else is constant are of only limited use at the system level. The recent surge in interest in applying randomized control trials (RCTs to health system studies has in some ways constrained the growth of the field), as researchers using such methods focus only on studies that fit a traditional RCT design.

In conclusion, we reiterate that economics is not the only discipline that is useful for studying health systems. There is great scope for collaboration with disciplines such as

operational research, political science, and other social sciences. Furthermore, we do not underestimate the analytic challenges involved in making our ideas operational. In the interest of space, this paper has also not addressed issues such as interactions between health systems and outbreaks such as pandemic flu or Ebola (Boozary *et al.*, 2014; Rid and Emanuel, 2014), or the relationship between health systems and the broader economy. However, the central principle of constrained optimization can provide a useful way to improve the modelling and understanding of health systems and to inform policy in a domain that has hitherto provided little practical help for policy-makers.

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