
Article:
Atella, V, Belotti, F, Bojke, C orcid.org/0000-0003-2601-0314 et al. (5 more authors) (2019) How health policy shapes healthcare sector productivity? Evidence from Italy and UK. Health Policy, 123 (1). pp. 27-36. ISSN 0168-8510

https://doi.org/10.1016/j.healthpol.2018.10.016

Does health policy shape healthcare sector productivity? Evidence from Italy and UK.

The English (NHS) and the Italian (SSN) healthcare systems share many similar features: basic founding principles, financing, organization, management, and size. Yet the two systems have faced diverging policy objectives since 2000, which may have affected differently healthcare sector productivity in the two countries. In order to understand how different healthcare policies shape the productivity of the systems, we assess, using the same methodology, the productivity growth of the English and Italian healthcare systems over the period from 2004 to 2011. Productivity growth is measured as the rate of change in outputs over the rate of change in inputs. We find that the overall NHS productivity growth index increased by 10% over the whole period, at an average of 1.39% per year, while SSN productivity increased overall by 5%, at an average of 0.73% per year. Our results suggest that different policy objectives are reflected in differential growth rates for the two countries. In England, the NHS focused on increasing activity, reducing waiting times and improving quality. Italy focused more on cost containment and rationalized provision, in the hope that this would reduce unjustified and inappropriate provision of services.

Keywords: Health policy; productivity; output growth; input growth.

1. INTRODUCTION

It is widely recognized that Europe is experiencing a productivity growth problem (1) (2). In the last 25 years, European countries have recorded the worst economic performance since the end of the Second World War. The financial crisis, which started in 2008, has exacerbated the problem: growth rates of total factor

productivity (TFP) have been falling continuously over the past three decades, a phenomenon described as “secular stagnation” (3).

Causes of poor economic growth among European countries include declining technological progress, a falling pace of sector-specific innovation, and structural shifts to lower productivity sectors (1). Based on sector data from the EU-KLEMS database (4), analyses show that traditional manufacturing no longer acts as the major engine for the European economy (5). All developed economies have shifted their production structure away from agriculture and manufacturing into the services sector, which accounts for more than three-quarters of the total labour share (6). But while productivity growth in the service sector has accelerated in the US, it has not in Europe.

This body of evidence suggests that poor productivity growth in the service sector is at the heart of the productivity slowdown in Europe. In the UK, the service sector makes up about 78% of GDP and 83% of employment. In Italy these percentages are lower, but still significant, at about 57% and 65% respectively. Within the service sector, government services, including public administration, education and health account for about a quarter of total sector output. The already high proportion of public expenditure devoted to healthcare in every EU country is likely to rise further due to aging populations and technological innovations.

In view of the growing demand for healthcare services, improvements in productivity may help relieve pressures to increase expenditure in direct proportion to demand. Under strict budget constraints, productivity growth measurement of healthcare systems thus enables policy makers to deal with allocative choices (between the public service sectors and within the healthcare sector) and facilitates an informed debate about the use of public funds. Analysis of the substantial cross-sector and cross-

country differences in productivity growth profiles may shed light on its potential drivers and associated policy implications. As suggested by (7), the measurement of productivity is not only critical for sound assessment but also for defining what is considered important at every level of a health system. However, international comparisons of productivity in health systems are challenging mostly because of the limited availability of comparable data (8) (9).

To this end, in this paper we assess the productivity growth rate of the English and Italian healthcare systems over an eight-year period from 2004 to 2011. We follow national accounting conventions to measure the change in the English National Health Service (NHS) and the Italian Servizio Sanitario Nazionale (SSN) productivity over time (10) (11) .

A key strength of this study is the comparison of trends in productivity growth of the English and the Italian healthcare systems. The two systems share many similarities in terms of founding principles, organisation, financing, management and size. But each country has followed a different path in defining and meeting their policy objectives. In England, the 2004-2011 period was characterised by year-on-year increases in healthcare expenditure, whilst Italian efforts were focused on cost containment and rationalization of provision of care. How these different strategies have affected productivity in Italy and UK and whether the methodology allows to quantify their role is the main focus of this research. For example, cost containment might affect productivity growth through the reduction in the growth rate of inputs. However, if the reorganization associated to cost containment strategies reduces waist in resource use, in principle productivity may also increase. Our empirical analysis will explore these links.

In what follows, Section 2 describes materials and methods, initially discussing the institutional features and policy setting of the two countries, subsequently providing details of the functional form of the output, input and productivity indices. Section 3 describes the data used to populate these indices, Section 4 presents the results and compares growth in output, input and productivity over time in the two countries. In section 5 we provide a discussion of similarities and differences in growth rates observed in England and Italy and in section 6 we draw conclusions.

2. MATERIALS AND METHODS

2.1 INSTITUTIONAL BACKGROUND

The English and the Italian healthcare systems share similarities that facilitate the comparison of the levels and trends in productivity.

The NHS in England and the SSN in Italy are based on principles of: universal coverage, provision of a full range of health services largely free at point of use, participation of citizens in the management of the system and organizational pluralism. Their main objective is to guarantee equal access to uniform levels of healthcare according to need, irrespective of individuals' income, demographic, social or geographic characteristics.

The systems serve a population of 53 million residents in England and 61 million in Italy. Over the time period considered, the systems were structured in three hierarchic levels: national, regional (10 in England and 21 in Italy) and local (151 Primary Care Trusts (PCTs) in England and 148 local health authorities (LHAs) in Italy).

At the national level, the Department of Health in England and the Ministry of Health in Italy are government bodies responsible for setting health policies and strategies to meet general principles, improving the health of the resident population, and dealing with legislation and regulation.

The regional governments are responsible for achieving national objectives, ensuring the quality and performance of local units within their geographic area. LHAs and PCTs cover geographically defined resident populations, which are able to freely access healthcare services in other LHAs and PCTs. LHAs and PCTs operate within target-based frameworks, allocating public funds to meet the health needs of their residents and to guarantee equal access, efficacy of preventive, curative and rehabilitation interventions and efficiency in the distribution of services.

Both the NHS and the SSN use a wide array of healthcare services providers. General practitioners (GPs) practices represent the first point of access for general medical care, supported by dentists, opticians and pharmacists, community health services and diagnostic centres. Except for emergency cases, GPs act as gatekeepers, regulating the flow of patients to more specialized, hospital-based healthcare services.

Most English hospitals are publicly owned, but a small number of private hospitals are contracted to provide care to NHS funded patients. Italy has a greater share of hospitals delivering SSN-funded care. Hospital activities are reimbursed according to a prospective payment system in both countries.

Hospital care can be accessed through private services, requiring out-of-pocket payment or private medical insurance. According to (12), in 2004 out-of-pocket payments and private medical insurance as share of total health expenditure were 23.8% and 19.1% respectively in Italy and in England. These figures slightly decreased over the period considered in our analysis (in 2011, 23% in Italy and 17.4% in England).

Social care lies within the statutory obligations of LHAs but is not considered part of the 'health system' in England.[1] Long-term care is mainly community based and provided predominantly by the private sector in both England and Italy. Both the NHS and the SSN provide mental health services funded through PCTs and LHAs respectively in England and Italy.

In both countries healthcare is mainly publicly funded, through general taxation and national insurance contributions through payroll and income taxes, along with co-payments and direct payments for privately delivered services. Total heath expenditure amounted to 9.9% of GDP in the UK and 9.0% in Italy in 2015, while public health expenditure amounted to 6.7% of the Italian and 7.9% of the UK GDP (12). In 2015 the NHS spent 3,286 and the SSN 2,509 US Dollar per capita, respectively (12).

At the national level the allocation of public resources for healthcare is negotiated according to a budget reviewed annually within the constraints of public finances. Healthcare funds are then distributed to regional administrations according to capitation-based formulae, adjusted for differences in healthcare needs. LHAs and PCTs are responsible for the balance between the funding provided by Regions and the expenditures for the provision of healthcare services.

Even though the English and the Italian healthcare systems are comparable from the organizational point of view, there are some differences in terms of the quality of the health outcomes of the two healthcare systems. For example, according to the

[1] Since 2012, several changes have been made to the Health and Social care landscape, with the Health and Social Care Act (UK Parliament) and successive reports by NHS England (40) and Next steps on the NHS (41) calling for increased integration of health and social care at least at the point of delivery of services.

OECD healthcare quality indicators (13), in 2004 the quality of cancer care measured by five-year net survival was higher in Italy, although the difference has narrowed down in recent years. Also in terms of acute care, thirty-day mortality rates after admission to hospital for several complications are lower in the Italian SSN with respect to the English NHS. A similar pattern can be detected in surgery quality indicators, where the rate of patient safety in the SSN exceeds that of the NHS in the indicators considered. Finally, mixed evidence is present in the case of primary care indicators, where depending on the disease considered, the two countries feature different patterns of excess hospital admissions. Appendix A reports the relevant figures.

2.2 POLICY CHANGES IN ITALY AND UK

Several important policies were adopted in the period 2004-2011 in both the English NHS (14) and in the Italian SSN that can help explain the the growth in the productivity indices of the healthcare systems in the two countries.

In the UK, the 2004 spending review set a high target input growth of above 7% to be attained between 2005 and 2008, coupled with centrally-determined quality targets, including a decrease in waiting times, improvement in patient choice, reduction in the prevalence of smoking and child obesity and halving the number of hospital acquired infections, such as meticillin-resistant Staphylococcus aureus (MRSA) and Clostridium difficile (15). The rise in funding reflected the political decision to increase the level of healthcare spending on par with the rest of the EU as well as a judgement about the quality of health care the UK should have, which was based on reports by Sir Derek Wanless (16).

Besides the increase in total spending, a major GP reform was also implemented in 2004 with the aim to improve the job satisfaction of GPs and to discourage them

from leaving the sector. It included changes to the GP work arrangements as well as extra top-up for practitioners who met targets in the voluntary pay for performance scheme – the Quality Outcomes Framework (17)

Several years of relatively big funding increases were followed by a period of relatively few reforms, perhaps a reflection of frequent changes of the Secretary of State for Health (18). Only in 2010, following the financial crisis, the NHS Annual Report 'Quality, Innovation, Productivity and Prevention (QIPP) programme', also known as 'The Nicholson Challenge' (19) introduced substantial changes to the NHS budget. It envisioned large efficiency savings of some £15-20 billion between 2011 and 2014, requiring approximately 4% year-on-year productivity gains, substantially higher than the historical rates, which showed practically a flat year-on-year productivity growth (14). While the majority of the savings was projected to result from increasing efficiency, around 40% of the total savings were to come from cutting central budgets, reducing management staff and restricting NHS staff pay (19). The Nicholson Challenge was implemented in 2011. While input growth remained positive after the implementation, it was significantly below the historical average, despite the output growth remaining on par with previous years.

Overall, the NHS witnessed a rise in healthcare funding, with the explicit aim of the policy to increase healthcare spending, reduce waiting times and widen access to healthcare services. The expected effect of the reform was primarily an increase of output volumes across all settings. As such, one should expect the policy to be reflected in an important increase in productivity growth. Moreover, a further policy objective aimed at enhancing incentives GPs should impact on the relative reduction of inpatient activity volumes, where management of health within primary care would become more efficient.

However, this aspect might not be captured by the productivity index, weighing more inpatient activity with respect to primary care activities.

In Italy the period under review witnessed various policy changes that substantially altered the institutional setting of the SSN. The policy reforms implemented between 2004 and 2011 were related to the agreement signed in 2000 between the Central Government and the Regions (20). Under the agreement, the State agreed to guarantee suitable resources to secure the so called "Standard Levels of Assistance" (Livelli Essenziali di Assistenza - LEA) and Regions agreed not to run budget deficits, assuming the responsibility to find "local" financial resources to balance deficits via fiscal leverage. While the agreement was supposed to put an end to subsidising regional deficits by the State, Regions continued to run deficits. As a result, in 2005 a new agreement between the State and the Regions was signed in order to reduce inappropriate spending. First of all, it introduced analytical accounting for cost centres which enabled the analysis of the costs sustained by and the efficiency of each LHA. Moreover, it introduced a rationalization of the hospital sector. The analytical accounting demonstrated that 10 out of 20 Regions generated large budget deficits for health care, making it necessary for the Central Government to bail them out (the so called "Piani di Rientro"). At the same time, the rationalization process of the hospital sector set the standard number of beds per thousand inhabitants to 4.5 (down from an average of 5.1 registered in 2000, ranging between 3.9 and 6.3 at regional level). The process of rationalization and tightening of controls continued with another reform launched in December 2009, which introduced a further reduction of the number of beds per thousand inhabitants to 4 (with 0.7 for rehabilitation and post-acute long-term care). Furthermore, the reform established that in case of a deficit, Regions should increased the regional income taxes up to its maximum rate, the employment turnover

in that Region's health care system would be blocked together with all its "non-compulsory" expenses.

Finally, in order to improve the appropriateness of care provided and reduce spending, Regions were tasked to promote continuity of care by integrating general practice with other forms of health care services within each region, that is integrating family doctors with doctors working in emergency care settings and carers working in home-cares. In addition, with regard to general practitioners, Regions were asked to promote initiatives aimed at improving the appropriateness of community prescribing.

From an expenditure point of view, the reforms lead to a decline in the growth rates of healthcare spending, from an average annual growth rate of 7.4% in the 2001-2005 period, to 3.1% in the subsequent five-year period.[2]

Summarizing, the main focus of the Italian policy objectives entailing de-hospitalization and more stringent budget constraints, was concentrated on inappropriate spending and reduction of deficit, without any explicit goals in terms of quality. The expected effect of the policy was a reduction of outputs, in particular in terms of inpatient care (high cost activity). The excess hospital activity was supposed to be overtaken by the outpatient setting, while the remaining part would constitute forgone care. On the one hand, shifting a part of the activities constituting inappropriate

[2] This trend was further consolidated in the period 2011-2016, when health expenditure recorded a slightly negative annual rate of change of -0.1%. The containment of the expenditure mainly concerned the Regions subject to bail-out plan, which in the period 2011-2016 recorded a change in the expenditure substantially non-existent. Regions without bail-out plans recorded a slight increase, equal to 0.6%. This result confirms that, in general, the instrument bail-out plan was able to determine greater responsibility for the behaviour of the Regions involved.

hospitalizations to the cheaper outpatient setting is likely to increase the efficiency of the system. On the other hand, a part of foregone care might potentially result in long-term negative consequences in terms of health status. The overall result on productivity growth might be driven by the relative effectiveness of output capping with respect to the cost containment. Cost containment reduces the growth of inputs and outputs, while cutting down on hospitalizations is likely drive down the output index growth due to the relative high weight of inpatient activities.

2.3 OUTPUT, INPUT AND PRODUCTIVITY INDICES

The change in productivity of the healthcare system is measured by comparing the change in input with the change in output. We calculate Total Factor Productivity (TFP) by dividing an index of output growth by an index of input growth.

The output index captures changes in the amount of the valuable things produced by the health system over time. As patients in both England and Italy face zero or very low prices for the care they receive, the output index uses unit costs to aggregate the diverse array of health care services and goods provided. The cost-weighted output is then scaled to take account of any change in the quality of care.

The input index measures changes in the volume of inputs used over time. Healthcare inputs consist of labour, intermediate goods and services and physical capital. In principle this could be measured analogously to the output index with disaggregated measures of distinct inputs weighted by their (lagged) cost or price (direct method). In practice, since such data are very rare, we construct the SSN input index using expenditure data (indirect method) and the NHS index using a mix of direct

and indirect methodology.[3] Expenditure is a function of both the volume and price of inputs. To convert the observed change in expenditure into an input growth index it is necessary to wash out the price effect using price deflators specific for each input.

Further, in order to determine the utilization of capital inputs in any specific period, assumptions are required about what proportions of past and current expenditure on capital assets are used in each period (21) (22) (23) (24) .

Finally, year-on-year productivity growth rates are used to construct a chained index for each country summarising the productivity growth of the healthcare sector over the entire period (25) (26) .

Details on how the output and input indices are constructed are presented in Appendix B.

3 DATA SOURCES

Output and Input indices are constructed from 2004 to 2011, corresponding to the calendar year in Italy and financial year in England (April to March). Data are taken from a number of different sources as summarised in Table 1.

The patient level hospital episode statistics (HES) for the NHS and the hospital discharge data (SDO) for the SSN identify the provision of services by public and publicly funded private hospitals. The records contain demographic data, clinical information and hospitalisation details. The HES data also contain information on the waiting times between GP referral and hospital admission.

[3] In order to check the comparability of the two methodologies, we additionally compute the NHS input index based on the indirect method only. The two methods deliver comparable results, which are available upon request.

In order to create output categories, SDO activity is aggregated using Diagnosis Related Groups (DRGs) and HES activity using Healthcare Resource Groups (HRGs), to which costs are assigned. The construction of DRGs is based on diagnoses and that of HRGs on diagnoses and procedures. For both NHS and SSN hospital admissions 'continuous inpatient spells' (CIPS) are constructed, which track patients when transferred between doctors and hospitals as part of their care pathway (27).

Outpatient activity for the NHS is reported in the Reference Costs database. In Italy, outpatient activity is derived from the Health Search Database (HSD), including computer-based patient records collected by General Practitioners (GPs) on drug prescriptions, clinical events and diagnoses. Participation of GPs is voluntary, but their selection guarantees the representativeness of the SSN regional organisation and includes a number of patients proportional to the size of the Italian adult population (28). More details on the HSD are provided in Appendix C.

In terms of primary care, SSN data source is again the HSD, while NHS information up to 2009 is based on the QResearch project, after which the estimates are derived from household surveys (14).

The volumes and costs of prescribing for the NHS are derived from the Prescription Pricing Authority (PPA) data, while for the SSN from the HSD. Both the PPA and the HSD data are a reliable and comprehensive measure of the volume of prescriptions dispensed in the two countries.

Volume of inputs used to produce outputs in the NHS and the SSN are taken from financial accounts data reported by all purchasers and providers as well as, but limited to England, from databases recording the number of Full Time Equivalents (FTEs) employed in any given year in the NHS.

The financial accounts provide detailed expenditure data on both NHS and SSN staff by broad categories of labour. In terms of FTEs, the English Electronic Staff record and the Workforce Survey provide also information on average staff group salaries. Intermediate inputs comprise a wide array of purchases of both medical and non-medical goods and services, which also include healthcare purchases from non-NHS/SSN bodies. Finally, capital inputs comprise current outlays on equipment and past expenditure reported as depreciation on assets.

HERE INSERT TABLE 1

4. RESULTS

4.1 HEALTH CARE OUTPUTS AND INPUTS: DESCRIPTIVE STATISTICS

Table 2 provides summary statistics for the English NHS and the Italian SSN. The first panel of Table 2 presents total volumes, average per thousand inhabitant volumes, average unit costs, and in-hospital survival rates by elective vs. non-elective admissions, with mental health hospital admissions summarised in a separate panel. Mental health outputs for non-inpatient mental healthcare in the English NHS are presented as a separate category. It is not possible to disaggregate this type of output in the Italian SSN, but it is accounted for in the overall health care output index.

The overall and average volume of SSN hospital activity, particularly elective care, have decreased over time, while the reverse occurred in the NHS. There is proportionally lower non-elective activity in the SSN than the NHS, with the difference being most pronounced in 2011. Inpatient mental health care has decreased in both the NHS and the SSN.

Overall, NHS and SSN outpatient activity follow comparable trends. The cost of English outpatient activity reflects the contact or main procedure associated with the visit, while the Italian cost represents a fixed tariff received by providers, where each

procedure is registered separately. Consequently, the outpatient SSN average unit costs are more then 10 times lower than the respective NHS costs, while volumes are approximately 10 times higher.

In both countries the total and average volumes of primary care contacts have risen during the period of analysis, although both the level and the trend are more pronounced for Italy. Primary care costs are considerably lower in Italy than in England, mainly due to differences in the capitation schemes adopted in the two countries. While GPs in Italy are reimbursed 40-55 euro per patient a year, English GPs receive approximately 169 euro (29).

Prescription drugs in both countries have increased in volumes and decreased in unit prices.

Finally, an additional category of 'Other outputs' is created for England, encompassing community care services provided to NHS patients (e.g. nursing, midwifery, A&E activity, para-medicine, a specific group of diagnostic tests an therapies).

HERE INSERT TABLE 2

Table 3 reports input expenditure in terms of labour, intermediate goods and services, prescribing, primary care, capital and other inputs, all deflated using country, year and item specific price indices in order to wash out the price effect.

HERE INSERT TABLE 3

Labour input as a proportion of total factor input is considerably lower in Italy than in England. For both England and Italy, the share of labour input has decreased over time.

The proportion of intermediate inputs in the overall expenditure is smaller for England than for Italy, since in the latter it also comprises purchases of healthcare services from other SSN bodies, such as hospital services or rehabilitation. For both the

SSN and the NHS the proportion of intermediate inputs has grown over the period of the analysis.

SSN primary care expenditure constitutes a smaller proportion of overall inputs than the NHS, with the proportionate shares relatively stable over the period considered. The differences between NHS and SSN prescribing inputs have narrowed over time, and are negligible in 2011.

SSN capital inputs amount to a slightly higher proportion of the overall inputs than NHS capital inputs. In both countries the proportionate share of capital inputs increased in the first years of the analysis, but has decreased since 2007.

4.2 OUTPUT GROWTH

Table 4 reports output growth, with quality adjustment for both countries. The quality adjustment for the NHS output index is based on hospital survival rates and waiting times, while the one for the SSN output index is based only on hospital survival rates.[4]

There has been a more pronounced increase of the output index in England (40.4%) than in Italy (13.7%) from the 2004 baseline. The difference is driven mainly by increased NHS hospital activity, particularly elective inpatient activity although non-elective activity has also increased gradually year-on-year. Italy saw a decrease in elective activity and a slight initial increase in the volume of non-elective cases up till 2005, followed by a decreasing trend thereafter. NHS in-hospital survival rates

[4] As sensitivity analysis, we also compute the cost-weighted output index without quality adjustment. The results based on this additional analysis are comparable to quality adjusted indices and are available upon request.

improved year-on-year and waiting times have fallen, contributing positively to growth. Unit costs in England increased over the period of the analysis, implying a shift toward more costly and complex activity, while the opposite happened in Italy. NHS hospital activity increased by 35% over the full period of the analysis, while there was a 7% decrease in the hospital activity in the SSN.

HERE INSERT TABLE 4

Both countries have seen a reduction in elective in-patient mental health activity, levelling off from 2008 onwards. Volumes of non-elective activity increased gradually, more so for the NHS.

The total volume of outpatient activity increased steadily, by 44% for the NHS and 46% for the SSN (Table 2). But, the average cost of these attendances decreased over time for the NHS, implying a shift towards less complex activities, while the opposite occurred in Italy. The output growth index increased by 37% in England and 52% in Italy.

Primary care activity increased by 13% for the NHS and 36% for the SSN. Both countries saw strong growth in the volume of prescriptions, accompanied by sharply decreasing unit prices, resulting in an overall output growth of 50% for prescribing activity for the NHS and 57% for the SSN.

These changes in outputs by setting have contributed to the different overall trends in the two countries, which are clearly reflected in the overall output index growth in Table 4. Output growth in the NHS has been subject to stronger and less year-on-year variation than in the SSN. In England growth has been consistently positive, averaging about 5% per year. In Italy, there was negative growth in two periods (2006-2007; 2010-2011), but it has generally been positive, averaging 2% per year.

4.2 INPUT GROWTH

Table 4 reports the input growth index for the NHS and the SSN.

The overall input index increased by 28% for the NHS and by 8% for the SSN. The major contributors to the NHS trend were labour inputs, which increased by 13%, and intermediate inputs, which increased by 89%. The use of intermediate inputs also increased substantially in Italy, by 24% but SSN labour inputs increased by less than 1% over the full period.

There was a similar increase in primary care inputs in both countries of respectively 14% increase for the NHS and 12% for the SSN. The SSN witnessed a 28% decrease in prescribing inputs, versus a 48% increase in the NHS.

There has been also a similar increase in the use of capital over time, with real expenditure increasing by 21% in England and 24% in Italy.

Overall input utilisation increased over time in both countries, but the pace of this tendency was much slower in Italy, averaging to 1.14% per year compared to 3.57% per year in England.

4.3 PRODUCTIVITY GROWTH

Table 4 and Figure 1 report the indices of productivity growth, taking 2004 as the base year, together with year-on-year estimates of productivity growth.

HERE INSERT FIGURE 1

In the NHS, outputs increased markedly and at a fairly constant rate over time, a consequence of both year-on-year volume increases and quality improvements. Initially input growth tracked output growth closely, but the rate of input growth increase was slower from 2005, resulting in an overall increase of the productivity growth index. Divergence in the rates of output and input growth became even more pronounced after

2009, with input growth slowing considerably. Over the full series, the NHS productivity growth index increased by 10%, at an average of 1.39% per year.

SSN productivity growth closely reflects the dynamics of output growth, which was strongest from 2004 to 2006, but experienced a retraction between 2006 and 2007, after which output grew steadily, until levelling off between 2010 and 2011. Utilisation of inputs increased over time but at a slower pace than outputs. Input utilisation increased at a declining rate until 2009, after which input growth was negative. This was mainly due to a slowdown of growth of expenditure on staff and intermediate inputs. Figure 2 illustrates that the pace of output growth exceeded the pace of input growth in 2006 and subsequently from 2008 onwards, which resulted in an overall increase of the productivity growth index. The productivity growth index increased at a fairly constant rate from 2007 onwards. Over the full period, the SSN productivity increased by 5%, at an average rate of 0.73% per year.

HERE INSERT FIGURE 2

In both countries the rate of annual productivity growth was erratic initially, switching from negative to positive over the first four pairs of years. This pattern continued in England, with two consecutive periods of positive productivity growth not observed until the last two paired years of the series. In contrast, the SSN has witnessed four successive periods of positive productivity growth since 2007.

5. DISCUSSION

Although the NHS and the SSN share similar institutional backgrounds and important challenges imposed by aging populations and stringent public finances, the English healthcare system is subject to greater intervention by central government, while the Italian system is much more decentralised at the regional level. Moreover, the different starting positions of the NHS and the SSN, combined with different

expenditure regimes and policies over the period of the analysis, have resulted in different evolutions of the inputs and outputs growth indices. These differing dynamics are evident in the findings of our analysis, where productivity growth in England exceeds that evident in Italy over the period considered.

Despite recording positive growth over the full period considered, both countries experienced phases of negative productivity growth. This was most pronounced in Italy between 2005 and 2007, because of the introduction of the bailout plans for 10 insolvent Regions out of the total of 20, following the long focus of the SSN on cost containment. Figure 3 describes the pace of output, input and productivity growth for Regions subject to bailout plans and those without a bailout plan. The figure provides a clear representation of what the cost containment and hospital rationalization reform entailed. Until about 2006 the two groups of Regions featured similar output, input and productivity growth. When the reform was introduced in 2006, all Regions faced the 4.5 cap in terms of hospital beds reimbursed by the SSN, and additionally, the bailout Regions underwent important revisions of expenditure, the aim being to reduce unjustified and inappropriate costs with rationalized provision of services. From that year on, Italy witnessed a gradual but significant change in the pattern of inpatient activity, which reduced hospitalization for elective and non-elective activity and in mental health elective cases. The phenomenon of "de-hospitalization" brought a progressive shift of a wide set of inpatient activities into the outpatient setting. The introduction of the bailout plans in 2006 is reflected in a slowdown of the output growth index. This was true in particular for the insolvent Regions which were additionally forced to cut any unjustified spending. In fact, the input growth index slowed down to a narrower extent in 2006, which was reflected by a significant drop in the productivity growth index. The group of bailout Regions faced a progressive contraction of the input

growth index in the following years, with a more stable output index growth. Overall, for both bailout and non-bailout Regions, productivity growth since 2008 has been positive, reflecting the efficiency gains resulting from expenditure reductions. The shift of inpatient activity to the outpatient setting may imply that the resulting estimates of productivity for the SSN could be understated because of the much lower unit costs associated with outpatient activity. Moreover, what emerges from figure 3 is the surprising comparability of the productivity growth indices of the bailout and non-bailout Regions, with the two averaging on a 5% increase of productivity over the whole period. The evidence suggests that the policy efforts in the SSN turned out to be successful, where a parallel output caps and expenditure revision forced in the insolvent Regions did not slow down the pace of their productivity growth with respect to the rest of the SSN.

Overall, Italy indeed reduced inappropriate inpatient care, which according to the OECD quality indicators can be interpreted as higher primary care quality (see figure A2). At the micro level, table 2 shows that over the study period the reduction in inpatient activity (-26% for electives and -9% for non-electives in per capita terms), is almost mirrored by the increase in outpatient activity (+39%) and primary care activity (+32%). These positive effects reflecting the allocative efficiency gains of the cost containment policy are not reflected in the productivity index growth for the SSN, since the weight associated with outpatient and primary care activities is much lower than inpatient costs. Finally, the limited with respect to the NHS productive efficiency gains of the SSN were achieved at much narrower cost, where the healthcare spending in real per capita terms has increased by only 6% over the period of the analysis. This evidence supports the initial hypothesis that the overall result on productivity growth has been driven by the relative effectiveness of output capping with respect to the cost containment.

HERE INSERT FIGURE 3

In England, annual productivity growth tended to be positive, though it was negative between 2008 and 2009, when a sharp increase in labour inputs did not realise an immediate and commensurate increase in outputs. Over much of the period considered the English NHS focused on expanding the provision of health services, in order to meet increasing demand and reduce waiting times. It also aimed at quality improvement. These ambitions were pursued by the move from global budgets to activity based funding of hospital care, by paying private providers to care for NHS patients, and by increased performance assessment, increased recruitment of staff and greater investment in the capital stock. As a consequence, there was substantial output and input growth, with the former generally being stronger than the latter, yielding positive NHS productivity growth. The last two years of our period coincide with the wider economic recession which brought about a slowdown in the growth or NHS funding and demanded larger savings and increased efficiency. This resulted in slower input growth but output growth remained relatively strong, thereby yielding positive productivity growth over this later period.

Overall, the results for UK support the initial hypothesis that the increase in productivity growth was related in particular to the relevant rise in inpatient activity volumes, as described in table 2 (+32% in per capita terms for elective cases and +11% for non elective cases). These changes were not reflected in better quality according to the OECD healthcare quality indicators. In parallel, primary care activity underwent a very narrow increase (+9%), not proportional to what happened in the inpatient care. Moreover, over the period of the analysis per capita health care spending in the UK has increased by 22%.

It is also important to mention some unavoidable limitations of the study, resulting from data availability issues. First, quality adjustment is partial, being restricted to consideration of hospital survival rates only in Italy and hospital survival rates and

waiting times in England. The analysis would greatly benefit from the introduction of other quality measures to evaluate more detailed outcomes of healthcare services, processes followed and patient experience (30). The quality indicators discussed in the institutional background section implied important heterogeneities in terms of quality of care across the two countries. According to the figures in Appendix A, the SSN provides higher quality than the NHS, and this holds true for a wide array of indicators. Consequently, one might hypothesize that if corrected for a multi-dimensional quality indicator, the two productivity growth indices might reflect minor differences between the two healthcare systems. Subject to data availability, a further investigation of this issue would constitute an important research question.

Second, due to the unavailability of data, the measurement of healthcare inputs in this study is derived mainly from expenditure data. Current recommended accounting practice is to employ direct measurement of factors of production, relying on the actual physical volumes utilized. For the NHS, direct measurements of volumes and prices were directly derived only for labour inputs, while for the SSN no direct input data are collected. In relying on expenditure data rather than direct input measures it is essential that price deflators are calculated and applied accurately.

Third, in order to aggregate healthcare activities into an overall output index, different types of output are weighted by their respective costs, rather than their "value" to patients. This means that costs reflect producer rather than consumer valuations (10). This drawback is partly addressed by incorporating measures of quality into the output index. The optimal solution would be to attach a social weight to each type of output, but there is little prospect of a comprehensive set of social values being available in the foreseeable future.

Finally, it is also debatable whether prescription drugs should be incorporated into both the output and input indices. The rationale for incorporating them in the output index is that primary care consultations do not adequately represent the value of contact with GPs, and that consultations that involve receipt of a prescription are more valuable than those that do not (31). If data were available on the health improvements achieved following a GP consultation, prescribing activity could be omitted from the output index. If so, prescriptions would be considered only as inputs into the healthcare production process.

6. CONCLUSIONS

The output and input growth indices provide evidence that conform to patterns of different health policy objectives in the two countries, with increased expenditure in the NHS and cost containment strategies applied to the SSN. The positive productivity growth over the full period in both countries reflects output growth being faster than input growth over much of the period considered. While we cannot explicitly attribute changes in productivity to specific initiatives or policies, we discuss and contrast the productivity growth trends in relation to the policy initiatives undertaken in both England and Italy during the period of the analysis. We infer that the pace of the productivity growth in the two healthcare systems is driven by two opposing tendencies in the expansion or contraction of the hospital inpatient setting and the budget dedicated to the NHS and the SSN. On the one hand, a particularly sustained growth in hospital elective cases witnessed by the NHS results in pronounced productivity gains over the study period. On the other hand, the shift of hospital activity from inpatient care to

outpatient care, with the aim of achieving efficiency gains in the Italian SSN, created a short-term productivity growth slowdown.

In comparison to the fairly flat aggregate productivity growth for the two economies as a whole, the healthcare sector seems to have performed relatively well (32) (33) .

Bibliography

1. **M.P., Timmer, et al.** *Economic Growth in Europe: A Comparative Industry Perspective.* Cambridge : Cambridge University Press, 2010.

2. **Economist Intelligence Unit.** The secular slowdown in European productivity. *The Economist.* January 26, 2016.

3. *U.S. Economic Prospects: Secular Stagnation, Hysteresis, and the Zero Lower Bound.* **Summers, L.** 2, 2014, Business Economics, Vol. 49, pp. 65-73.

4. *Recent Trends in Europe's Output and Productivity Growth Performance at the Sector Level, 2002-2015.* **van Ark, Bart and Jäger , Kirsten.** 2017, International Productivity Monitor.

5. **Dabla-Norris, E., et al.** *The New Normal: A Sector-Level Perspective on Growth and Productivity Trends in Advanced Economies.* Strategy, Policy, and Review Department, IMF. Washington : s.n., 2015.

6. *Structural Change in Advanced Nations: A New Set of Stylised Facts.* **Jorgenson, D. and Timmer, M.P.** 113, 2011, The Scandinavian Journal of Economics, Vol. 1, pp. 1-29.

7. **Smith , P.C., et al.** *Performance measurement for health system improvement. Experiences, challenges and prospects.* Cambridge : Cambridge University Press, 2009.

8. **Street, A. and Häkkinen, U.** Health system productivity and efficiency. [book auth.] P.C. Smith, et al. *Performance measurement for health system improvement. Experiences, challenges and prospects.* Cambridge : Cambridge University Press, 2009.

9. **Papanicolas, I. and Smith, P.C.** *Health system performance comparison.* Berkshire : Open University Press, 2013.

10. **Eurostat.** *Handbook on price and volume measures in national accounts.* Luxembourg : Office of Official Publications of the European Communities, 2001.

11. —. Employment growth and activity branches - annual averages. [Online] 2016. Labour Force Survey database. http://ec.europa.eu/eurostat/web/lfs/data/database.

12. **OECD.** Health Statistics. [Online] 2017. ttp://stats.oecd.org/Index.aspx?DataSetCode=SHA.

13. —. Data for Measuring Health Care Quality and Outcomes. [Online] 2018. https://www.oecd.org/els/health-systems/health-care-quality-indicators.htm.

14. *Productivity growth in the English national health service from 1998/1999 to 2013/2014.* **Bojke, C., et al.** 2016, Health Economics.

15. **HM Treasury.** Stability, security and opportunity for all: Investing for Britain's long-term future. 2004 Spending Review New Public Spending Plans

2005-2008. [Online] 2004. http://news.bbc.co.uk/nol/shared/bsp/hi/pdfs/sr2004_complete_120704.pdf.

16. **Appleby, J. and Harrison, A.** Spending on health care: How much is enough? The King's Fund. [Online] 2006. https://www.kingsfund.org.uk/sites/default/files/SpendingonHealthCare.pdf.

17. *Pay-for-Performance in the United Kingdom: Impact of the Quality and Outcomes Framework—A Systematic Review.* **Gillam, S.J., Niroshan Siriwardena, A. and Steel, N.** 10, 2012, Ann Fam Med, pp. 461-468.

18. **Vizard, P. and Obolenskaya, P.** Labour's Record on Health, Social Policy in a Cold Climate. *Centre for Analysis of Social Exclusion Working Paper.* 2013.

19. **Appleby, J, Galea, A. and Murray, R.** The NHS productivity challenge: Experience from the front line. *The King's Fund.* [Online] 2014. https://www.kingsfund.org.uk/sites/default/files/field/field_publication_file/the-nhs-productivity-challenge-kingsfund-may14.pdf.

20. **Conferenza Stato-Regioni.** Proposta di accordo tra i Ministri del tesoro, del bilancio e della programmazione economica, della sanita' e le regioni e province autonome di Trento e Bolzano in materia di spesa sanitaria. *GU Serie Generale n.227.* 2000.

21. **Oulton, N.** ICT and productivity growth in the UK. *Bank of England Working Paper.* 2001. 140.

22. —. Ex Post Versus Ex Ante Measures of the User Cost of Capital. *CEP Discussion Papers, Centre for Economic Performance, LSE.* 2005.

23. **Oulton, N. and Srinivasan, S.** Capital stocks, capital services, and depreciation: an integrated framework. *Bank of England Working Paper.* 2003. 192.

24. **Street, A. and Ward, P.** NHS input and productivity growth 2003/4–2007/8. *Centre for Health Economics Research Paper.* 2009. 47.

25. **Lehr, J.** *Beiträge zur Statistik der Preise, insbesondere des Geldes und des Holzes.* Frankfurt am Main : J. D. Sauerländer, 1885.

26. **Marshall, A.** *Remedies for Fluctuations of General Prices, Memorials of Alfred Marshall.* [ed.] A. C. Pigou. s.l. : MacMillan, 1887.

27. *Creative Use Of Existing Clinical And Health Outcomes Data To Assess Nhs Performance In England: Part 1-Performance Indicators Closely Linked To Clinical Care.* **Lakhani, A., et al.** 330, 2005, British Medical Journal, pp. 1426-1431.

28. *Health Search: istituto di ricerca della Società Italiana di Medicina Generale: la realizzazione di un database per la ricerca in medicina generale.* **Fabiani, L., et al.** 28, 2004, Epidemioliogy and Prevention, pp. 156-62.

29. **NHS Digital.** NHS Payments to General Practice . 2016.

30. **Bojke, C., et al.** Accounting for the quality of NHS output. [CHE Research Paper, no. 153]. York, UK : Centre for Health Economics, 2018.

31. *A New Approach To Measuring Health System Output and Productivity.* **Dawson, D., et al.** 1, 2007, National Institute Economic Review, Vol. 200, pp. 105-116.

32. **Bojke, C., et al.** Productivity of the English NHS: 2014/15 Update. *Centre for Health Economics Research Paper.* 2017. 146.

33. **ISTAT.** Rapporto sulla competitività dei settori produttivi. [Online] 2017. http://www.istat.it/storage/settori-produttivi/2017/Rapporto-competitivita-2017.pdf.

34. *Adherence to antihypertensive medications and cardiovascular morbidity among newly diagnosed hypertensive patients.* **Mazzaglia, G., et al.** 2009, Circulation.

35. *Prevalence estimates for chronic diseases in Italy: exploring the differences between self-report and primary care database.* **Cricelli, C., et al.** 25, 2003, J Public Health Med, p. 2003.

36. *Drug therapy adherence and health outcomes in the presence of physician and patient unobserved heterogeneity.* **Atella, V., Belotti, F. and Depalo, D.** 2017, Health Economics, Vol. 26.

37. *Who is responsible for your health: is it you, your doctor or the new technologies?* **Atella, V. and D'Amico, F.** 8, 2015, The European Journal of Health Economics, Vol. 16, pp. 835-846.

38. *The impact of cost-sharing schemes on drug compliance in Italy: evidence based on quantile regression,.* **Atella, V. and Kopinska, J.** 2, 2014, International Journal of Public Health, Vol. 59, pp. 329-339.

39. *The effect of age and time to death on primary care costs: The Italian experience.* **Atella, V. and Conti, V.** C, 2014, Social Science & Medicine, Vol. 114, pp. 10-17.

40. **NHS England.** Five Year Forward View. [Online] 2014. https://www.england.nhs.uk/publication/nhs-five-year-forward-view/.

41. —. Next Steps on the NHS Five Year Forward View. [Online] 2017. https://www.england.nhs.uk/publication/next-steps-on-the-nhs-five-year-forward-view/.

APPENDIX A

Figure A1. Cancer care quality

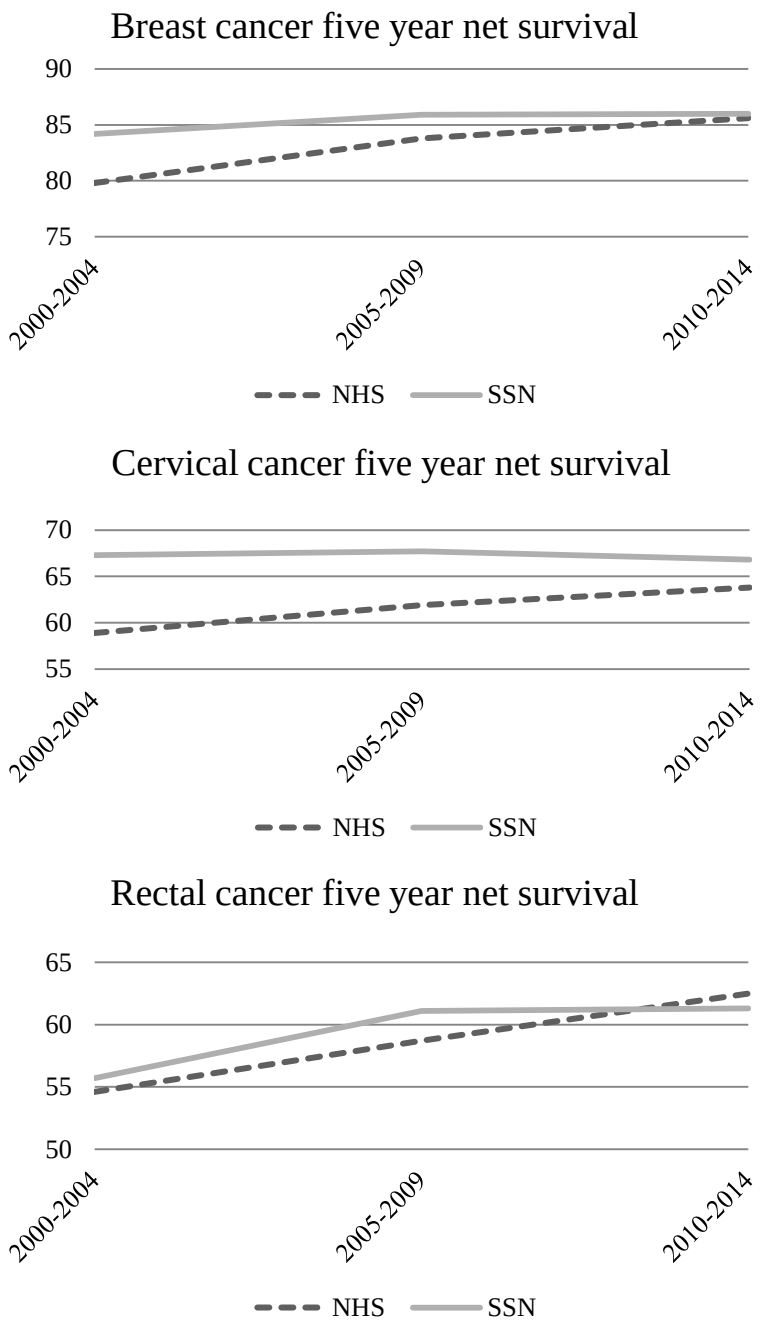


Figure A2. Primary care quality

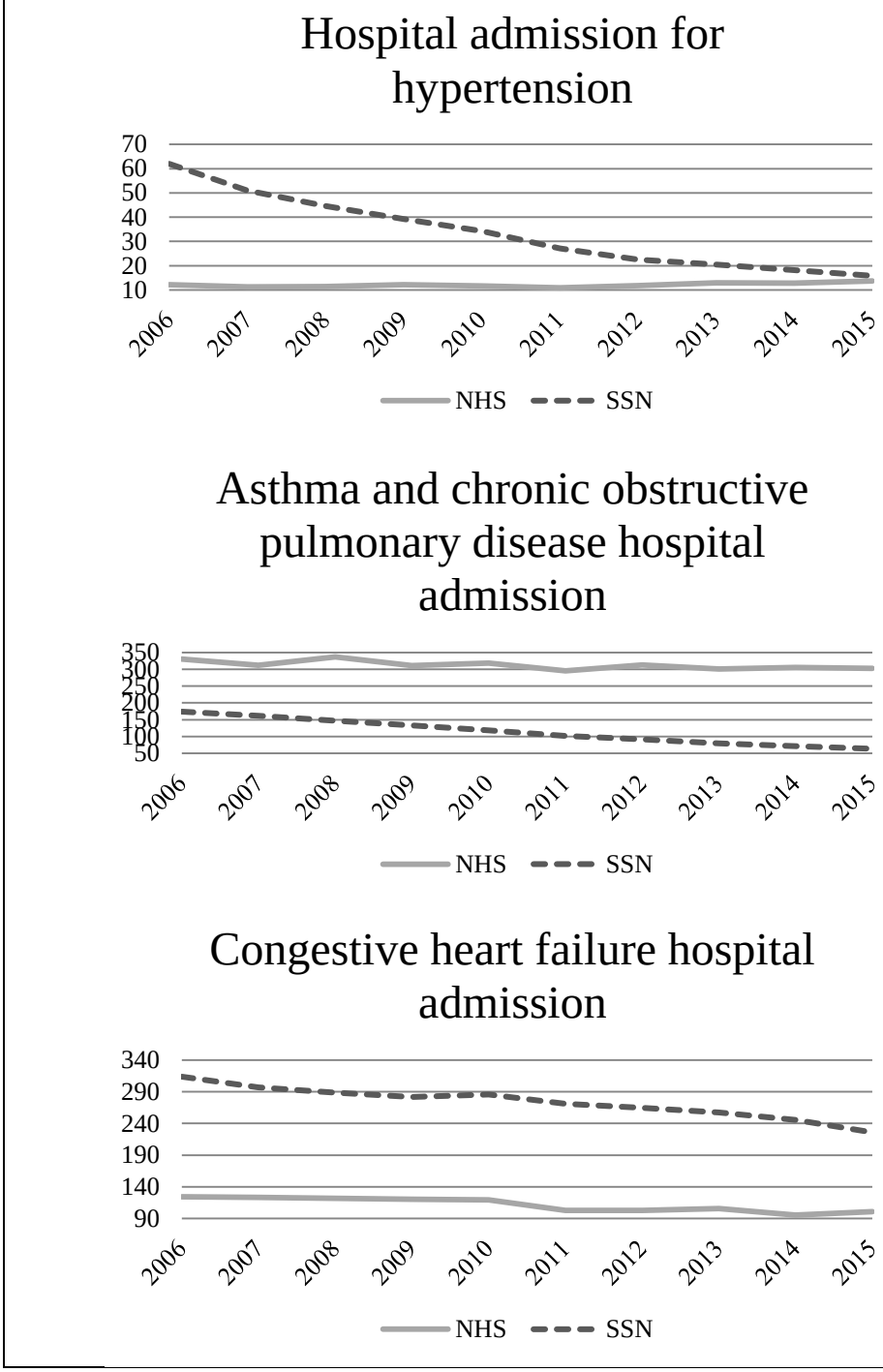


Figure A3. Acute care quality

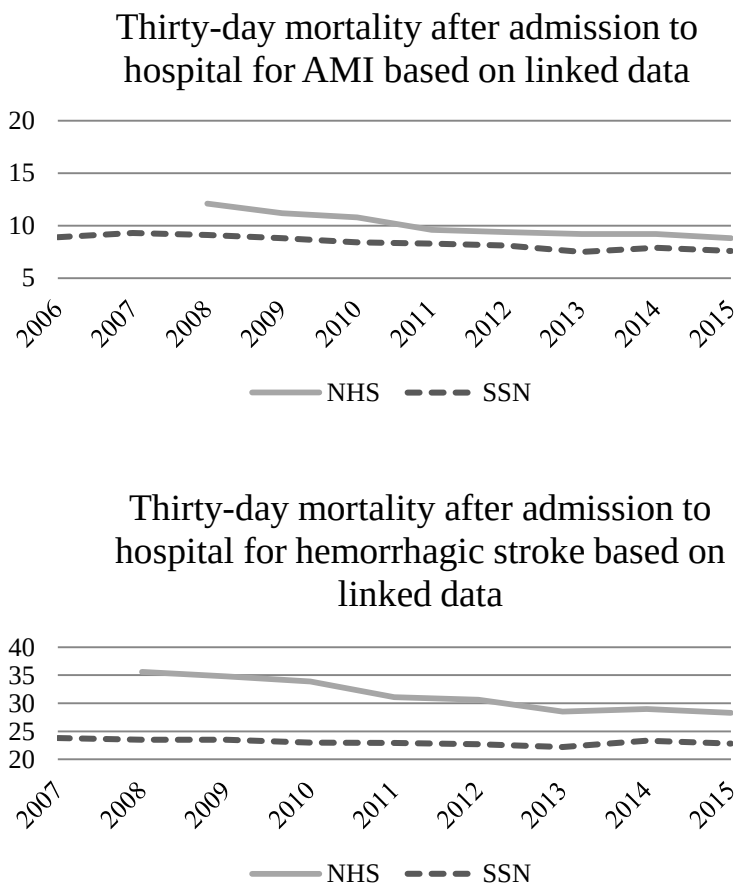
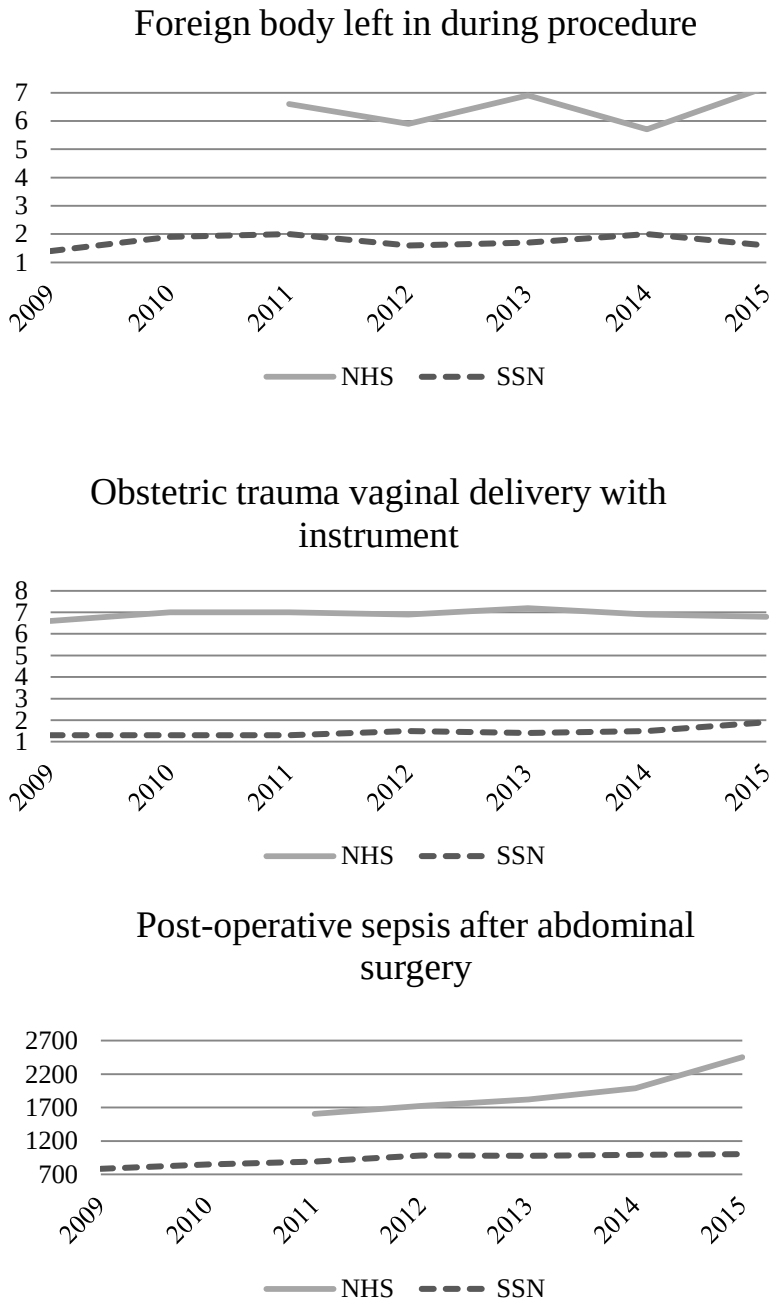


Figure A4. Patient safety



APPENDIX B

Total factor productivity growth is calculated by dividing an index of output growth by an index of input growth:

$\Delta TFP = [I/Z]-1$

where ΔTFP is total factor productivity growth, I is the index of output growth and Z is the index of input growth. In order to estimate total factor productivity, it is necessary to correctly define and measure the output and input indices.

However, it is difficult to measure value because public funding in both England and Italy ensures that patients face zero or very low prices for the care. In the absence of prices, the output index for the English and Italian national accounts is based on Dawson et al. [14], taking the general form:

$$I = \frac{\sum_{j=1}^{J} x_{jt+1}\, c_{jt} \left[v_{jt} \frac{q_{jt+1}}{q_{jt}} \right]}{\sum_{j=1}^{J} x_{jt} c_{jt}}$$

where x_{jt} is the number of patients, c_{jt} is the cost of output type j, where j=1,…,J at time t. Since costs are likely to be an imperfect reflection of the relative value of different types of output, the cost-weighted output is scaled by the change in quality, where q_{jt} represents a unit of quality for output j, and v_{jt} is the value of a unit change in quality. Prices of treatments vary across countries and contribute different "value" to the output index, reflecting differences in technology, case-mix and preference across countries.

Expenditure (E) is a function of both the volume (z) and price (ω) of inputs, for input

n such that $E_n = z_n \times \omega_n$. The observed change in expenditure over one period to the next is given by:

$$\Delta E_n = \frac{E_{nt+1}}{E_{nt}} = \frac{z_{nt+1}\omega_{nt}}{z_{nt}\omega_{nt}}$$

To convert the observed change in expenditure into an input growth index it is necessary to wash out the price effect in the numerator using price deflators specific for each input γ_n such that $\omega_{nt} = \gamma_n \times \omega_{nt+1}$.

The change in the input index can be specified as:

$$Z = \frac{\sum_{n=1}^{N} E_{nt+1}\,\gamma_n}{\sum_{n=1}^{N} E_{nt}} = \frac{\sum_{n=1}^{N} z_{nt+1}\omega_{nt+1}\gamma_n}{\sum_{n=1}^{N} z_{nt}\omega_{nt}}$$

APPENDIX C

The HS database (HSD) contains detailed information on prescribed drugs, laboratory tests, outpatient visits and hospitalizations of more than 2 million patients, managed by over 1000 GPs overtime. This pool of registers has produced a stock of information of about 25 million medical diagnosis, 100 million laboratory and diagnostic tests, 10 million blood pressure measurements and 50 million drug prescriptions. Based on the data collected, a representative panel is constructed by selecting a longitudinal balanced sample of 900 GPs. The GPs are selected so as to reproduce the Italian distribution of GPs' patients by sex and region and on the basis of their capacity to deliver accurate and consistent records of their patients' medical history, diagnoses, diagnostic tests' results, specialist visits and hospitalizations. Each patient's visit to their GP gives rise to a record containing the data and type of the visit, the relative prescription of drugs, diagnostic tests, specialist visits and hospitalisations. The HSD constructed according to this procedure is representative of the population of Italian GPs' patients, with the only exception of the two smallest Italian regions, Molise and Valle d'Aosta, for whom the information collected are insufficient. As mentioned before, the clinical information collected by GPs is further complemented with external sources. In particular, drug prices and tariffs for diagnostic tests and hospital DRGs are obtained from the Italian National Drug Agency (Agenzia Italiana del Farmaco - AIFA) and from the Department of Health (Ministero della Salute), respectively. This approach narrows possible GPs' errors in price imputation, and allows a consistent evaluation of health related expenditure. The data analysis is limited to individuals aged between 15 and 95. The restriction follows from the fact that, on the one hand, individuals under 15 are customary managed by paediatricians in the Italian health care system, while on the other hand, the sample of patients over 95 is extremely narrow leading to poor quality

estimates. For each year in the sample (2004-2011) we define the active population as individuals aged between 15 and 94, who have not revoked their GP, and have been observed for at least 2 years. Furthermore, according to patients' age and sex, observations in the follow-up years are also required. For example women aged 15-24 are required to have at least 1 observation in one of the following 5 years, while at least 1 observation in each of the following 5 years is required for women older then 55. Accordingly, expenditures are computed only for patients who have actually received a prescription of any type from their GPs.

In order to assess the validity of the HSD data, several benchmarking exercises have been carried out. In particular comparison of the data with the Italian National Statistical Institute (ISTAT) surveys confirmed the statistical representativeness of the HSD data at regional level. Data from HSD have been used in several publications, both in clinical and social sciences peer reviewed journals (e.g (34), (35), (36), (37), (38), (39))