

Europe and Central Asia's Great Post-Communist Social Health Insurance Experiment: Aggregate Impacts on Health Sector Outcomes

by

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Abstract

The post-Communist transition to social health insurance in many of the Central and Eastern European and Central Asian countries provides a unique opportunity to try to answer some of the unresolved issues in the debate over the relative merits of social health insurance and tax-financed health systems. This paper employs regression-based generalizations of the difference-in-differences method on panel data from 28 countries for the period 1990-2004. We find that, controlling for any concurrent provider payment reforms, adoption of social health insurance increased national health spending and hospital activity rates, but did not lead to better health outcomes.

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1. Introduction

All but two of the OECD's thirty countries—Mexico and the United States—finance the majority of their health spending publicly, with half operating broad-based 'tax-financed' health systems (e.g. Canada and the United Kingdom) and half operating payroll-based 'social health insurance' (SHI) systems (e.g. Germany and Japan).¹ Outside the OECD, the fraction of countries financing the majority of their health spending publicly is smaller (56%), and only one fifth of these countries finance the majority of their government spending through SHI.²

The relative merits of SHI and tax finance is an old debate, but one that has recently resurfaced. In part this is due to the fact that three of the world's oldest SHI countries—France, Germany and the Netherlands—are in the process of reducing their reliance on payroll contributions in favor of a broader financing base.³ But the renewed interest in the SHI vs. tax-finance debate also stems from the current interest in SHI in the developing world.⁴ Many developing countries that have relied largely on general revenues (and out-of-pocket payments) to finance their health systems have introduced SHI, or are thinking about doing so.⁵ And

¹ Figures calculated from data in the World Health Report annexes. Korea is around 50% public-private. Mexico's public share is increasing quickly (OECD 2005).

² These countries are almost all in Europe and Latin America.

³ France widened the tax base from earnings to include nonwage income, Germany is contemplating reducing the emphasis on payroll taxes, while the Netherlands introduced a reform in 2005 where insurers receive only half their income from payroll revenues (albeit channeled through a central fund), the rest coming from flat-rate direct contributions from members (with offsetting income supplements for low income groups) (Gottret and Schieber 2006; International Network on Health Policy & Reform 2006). In addition, to these changes, it is worth noting that Iceland and Spain both shifted wholesale from SHI to tax-finance in the late 1980s.

⁴ Two recent conferences focused on SHI in developing and transition economies, one in Berlin in November 2005, the other in Manila in October 2006. Details are to be found at <http://www.shi-conference.de/> and <http://www.shiconferencemanila.info/>.

⁵ Examples include Vietnam (1993), Nigeria (1997), Tanzania (2001) and Ghana (2005). Discussions are underway in South Africa, Zimbabwe, Cambodia and Laos. Malaysia also recently began debating a shift to SHI. See Hsiao and Shaw (2007) on some recent experiences of SHI in the developing world.

countries that have a fledgling SHI scheme in place are redoubling their efforts to expand its reach, especially to the informal sector.⁶

Despite the topicality and vibrancy of the SHI vs. tax-finance debate, the evidence base is surprisingly thin. Some comparisons have been undertaken, especially on distributional issues: payments for health care tend to be more progressive or less regressive in tax-financed systems than in SHI systems; and tax-financed systems seem to be more successful at ensuring universal coverage within a single health system.^{7,8} But on aggregate system-wide differences, there appears to be no rigorous evidence. We do not know whether SHI systems spend more on health care, and if they do whether this translates into higher levels of throughput and better health outcomes.

Getting at these questions through a cross-country econometric analysis where some systems are financed through SHI contributions and others are financed through general revenues would be problematic because there are likely to be unobservable variables that would be correlated with the type of financing system in place and the outcomes of interest (i.e. SHI is likely to be endogenous). A more promising strategy would be to look for *changes* in the way countries finance their health care, exploiting the variations in changes across countries to eliminate (time-invariant) unobservable variables. The difficulty with this approach is that in the group of countries that have the best data (those in the OECD), there have been very few

⁶ Examples include Colombia, Mexico, the Philippines, and Vietnam. Cf. Hsiao and Shaw (2007).

⁷ Wagstaff et al. (1992; 1999) find that SHI is less progressive than tax-financed systems (in fact, is mostly regressive) in the OECD countries. O'Donnell et al. (2008) find the same in Asia.

⁸ The European SHI countries studied by Carrin and James (2005) (Austria, Belgium, Germany and Luxembourg) took close to 100 years to achieve universal health insurance (UHI). Costa Rica, Japan and Korea, which achieved UHI in 1991, 1958 and 1989 respectively, took considerably less time, though Costa Rica's coverage rate in 1991 was still only 85%, and Japan and Korea were both at an advanced stage of economic development when they reached UHI.

switches between the SHI and tax-financed camps (six “old” OECD countries abandoned SHI in the 1970s and 1980s, notably Denmark, Greece, Iceland, Italy, Portugal and Spain) and the transitions occurred some time ago, so the available data are very limited.

This paper looks instead to a (mostly) different group of countries where transitions have occurred with greater frequency and more recently, namely the countries of (central and eastern) Europe and Central Asia (ECA).⁹ Of the 28 ECA countries, 14 abandoned tax-finance and adopted SHI at some stage between 1990 and 2004 (and 4 other countries had adopted SHI prior to 1990). These countries are also data-rich countries, having inherited and largely maintained the Communist tradition of extensive data-gathering, and falling under the most data-rich regional office of the World Health Organization.¹⁰ One dimension in which the database we have been able to assemble is especially rich is health outcomes; we have been able to assemble extensive information on mortality and disease incidence *by disease*. The fact that a sizeable fraction (perhaps 70-80%) of mortality is not amenable to medical care (cf. Nolte and McKee 2008) probably helps explain why many cross-country regression studies have been unable to find a strong relationship between health spending and health outcomes (cf. e.g. Martin *et al.* 2008). The same fact might—in the absence of disease-specific mortality data—have made it hard for us to credibly establish whether, by increasing health spending or by raising the efficiency of health spending, countries that switched to SHI have been able to improve health

⁹ The countries treated as being in central and eastern Europe and Central Asia (the countries in the World Bank’s ECA region) are listed in Table 1.

¹⁰ The European office of the World Health Organization developed and has maintained a huge database to track progress towards its Health for All initiative. In addition, it is home to the European Observatory on Health Systems and Policies, which has produced detailed overviews of the health systems of the member countries (known as Health Systems in Transition (HiT) profiles), as well as a variety of volumes that discuss health systems and health policies in the region.

outcomes.¹¹ The ECA health financing experiment thus affords a valuable “laboratory” to try to shed light on the question of how SHI systems fare vis-à-vis tax-financed systems in spending, throughput and health outcomes.

To shed light on these issues, we use regression-based generalizations of the differences-in-differences (DID) method, with data from (up to) 28 countries for 14 years (1990-2004). We explore three different approaches to allowing for the possible endogeneity of SHI. The first is a simple individual-specific effects model estimated along the lines of the classic DID model. This allows for the endogeneity of SHI only insofar as the unobservables that are correlated with SHI adoption and with our outcomes are time-invariant. This is the parallel trends assumption that is often considered the Achilles heel of the DID approach (cf. e.g. Blundell and Costa Dias 2000). Because our database spans a relatively long period of time, we can explore two more flexible—and more robust—approaches to controlling for the potential endogeneity of SHI. The first is a random (linear) trend model: this allows for a country-specific unobserved linear time trend whose growth rate could be correlated with SHI status (i.e. whether the country operates a SHI system in the year in question). The second is a differential trend model: this allows SHI and tax-financed systems to have different trends in unobservables that are not necessarily linear but do depend only on SHI status. This is not the first paper to employ the random trend regression model.¹² But it is—to our knowledge—the first to propose and employ a regression version of

¹¹ The view that only amenable mortality responds to health spending may be overly pessimistic. Martin et al. (2008) actually find that health spending impacts favourably on mortality causes previously considered as being unavoidable and unamenable to better care, such as neoplasms and circulatory diseases.

¹² Friedberg (1998) used a random trend model in her analysis of divorce laws in the US, and found that allowing for state-specific trends is crucial to unearthing the impacts of these laws.

the differential trend generalization of the DID model.¹³ We are able, using the two generalizations of the DID approach, to shed light empirically on the validity of the parallel trends assumption. In the event, we find that for most outcomes the data are reasonably consistent with the assumption.

The organization of the paper is as follows. Section 2 provides a brief history of the SHI reforms in the post-Communist ECA region and discusses the hypothesized effects of SHI adoption on health spending, throughput and health outcomes. Section 3 outlines our methods, section 4 our data, and section 5 our empirical results. Section 6 presents our conclusions.

2. Europe and Central Asia's SHI reforms and hypothesized effects

Under Communism, health care in almost all of the ECA countries (the former Yugoslavia was the exception) was financed out of general revenues and out-of-pocket payments.¹⁴ Health care was delivered through a centrally-planned “Semashko” model consisting of a tiered system of health providers, each allocated budgets according to population-based norms, with health workers paid by salary. In the early 1990s, as most countries shifted away from Communism, several looked to SHI to solve several emerging problems and improve the performance of the health sector.

¹³ The differential trend model was first proposed by Bell et al. (1999), but their estimation was undertaken using (triple) differencing rather than via regression analysis. In our case, because the date of ‘treatment’ (i.e. adoption of SHI) varies across countries, differencing would not work.

¹⁴ This section draws heavily on Langebrunner et al. (2008) and the *Health Systems in Transition (HiT)* series, downloadable from <http://www.euro.who.int/observatory/Hits/TopPage>.

2.1 *Transitions to SHI*

Of the 28 ECA countries, 14 introduced payroll taxes earmarked for health care at some stage between 1990 and 2004, and four others had already done so prior to 1990 (Bosnia and Herzegovina, Croatia, Serbia and Montenegro, and Turkey). Early SHI adopters in the 1990s included Estonia, Hungary, Lithuania, Macedonia, and Slovenia; all adopted SHI in the period 1990-92. Some countries adopted much later: Bulgaria, for example, adopted SHI as late as 1999. Often, both the employee and employer are liable, though of course there may be wide difference between who is legally liable for what and who ends up bearing the incidence of the payroll tax, the latter depending on conditions in the labor and product markets. Contributions are mandatory, and in exchange for them the contributing employee is entitled to receive health services under the terms of the SHI scheme. Groups other than formal sector workers usually have some coverage. Contributions are required from the self-employed in all SHI countries, and from pensioners in some. Other groups are financed out of general revenues, but often the contributions are not specified and insufficient funds are provided in respect of these groups, who sometimes have inferior de facto coverage.

SHI does not always raise more than 50% of revenues, though in some countries its importance has increased over time and has gradually grown to 50% or more. This is clear from Figure 1, which also shows the timing of the introduction of earmarked payroll taxes in different countries. In central and eastern Europe, SHI shares of total spending have tended to be higher, and payroll tax rates have tended to be higher there as a result. In the first group of countries, payroll tax rates are normally between 10% and 15% of earnings, while in the countries of the former Soviet Union, they are less than 10%, often considerably so (Langenbrunner *et al.* 2008). It is worth noting that two countries (Latvia and Poland) introduced earmarked taxes for health

care, but the tax base is income not earnings, so from a financing perspective these are not “pure” SHI systems.

2.2 *Hypothesized benefits of the transition to SHI*

The most pressing problem that SHI aimed to tackle was the decline in health spending caused by a decline in government revenues as a share of GDP. This in turn was caused by a variety of factors, including the growth of the private and informal sectors where tax compliance was lower, a shrinking of traditional tax bases such as state-owned enterprises, and pressures for tax cuts from a population experiencing declines in real income. With falling GDP and revenues falling as a share of GDP, health sectors experienced substantial cuts in government spending. For a number of reasons, SHI was seen as a way of protecting spending in the health sector if not facilitating increases in spending: it was thought that people would be more willing to pay SHI contributions than (other) taxes because under SHI the revenues are earmarked for health services and contributions confer entitlements to use them; it was argued that earmarking would help ensure that the health sector did not have to compete with other sectors in government spending allocation decisions; and it was thought that earnings in the economy as a whole would fall less than government revenues and be more stable. Providers were especially enthusiastic about SHI which they saw as a way to increase their incomes.

The reality has been rather different. Contributions in SHI systems have often fallen well below ‘theoretical’ levels because of non-reporting and underreporting of earnings and non-enrollment. In Kazakhstan, for example, only 40% of expected revenues were actually collected (Gottret and Schieber 2006). In Russia, similar problems have been reported, with considerable variation geographically: the Kemerovo region collects 75-78% of the money due to it, while in

Moscow City the rate is even higher (90%); by contrast, in the Volgograd region, only 508 of over 32,000 private enterprises apparently pay into the insurance fund at all (Twigg 1999).¹⁵ The scale of the evasion problem reflects the fact that in most SHI systems, access to health care does not increase with contributions, and may not actually require making any contributions at all: in most Latin American countries, non-contributors are often able to fall back on the health delivery system financed and operated by the health ministry; in the ECA countries, evidence of contributions is rarely required when accessing the health system. Furthermore, as countries have switched to SHI, tax financing has often been reduced by finance ministries, often in line with ‘theoretical’ SHI revenues rather than actual revenues. In Kazakhstan, for example, the finance ministry reduced the allocation of tax revenues to the health sector as SHI contributions were introduced, regarding them as a substitute for tax revenues not a complement (Langenbrunner *et al.* 2008). And in SHI systems, contributions are linked to earnings through a formula and typically subject to ceilings that may change infrequently, with the result that at times of rapid growth SHI revenues may not keep pace with per capita incomes and a tax-financed system might produce higher revenue growth.¹⁶

Tax-financed systems in the ECA countries have had their own problems raising revenues, though in many cases informal out-of-pocket payments have plugged at least part of the gap (Lewis 2007). These problems included the aforementioned growth of the private and informal sectors where tax compliance was lower, and a shrinking of traditional tax bases such as

¹⁵ In Colombia, evasion in the contributory regime (which covers formal sector workers as well as informal workers not classified as poor) has been estimated to cost US\$836 million in forgone revenues (2.75% of GDP) (Escobar and Panopolou 2003). Nearly three-quarters of this was due to underreporting, the rest being due to nonpayment. In the Philippines, evasion also appears to be a major issue, particularly among small shops and businesses, with one estimate suggesting that 70% of those who should be contributing are not doing so (Jowett and Hsiao 2007).

¹⁶ See, for example, Lu and Hsiao (2003) on Taiwan’s experience in this regard.

state-owned enterprises. *A priori*, it is not obvious, then, whether SHI systems have fared better or worse in terms of protecting health spending levels than tax-financed systems.

It was not just the idea that SHI would allow health spending to be better protected that attracted the ECA countries to SHI. It was also felt that SHI would permit a more efficient health system. It was thought that SHI would allow for a loosening of the grip of finance and health ministries over the finance and delivery of health care, the vision being that payroll tax contributions could flow automatically to a SHI agency that would sit at arms' length from both the finance and health ministry and that would develop a capacity to engage in strategic purchasing. The SHI agency, it was argued, would implement provider payment reform, engage in selective contracting, and would foster competition between public and private sector providers for SHI contracts. This would make government (and private) providers more accountable for their performance. Autonomization of providers was seen as a logical part of this process, which was seen as necessary for better performance and greater accountability.

Again, the reality has been somewhat different. SHI countries now typically have a SHI agency, but so too do Poland and Latvia that rely on income taxes or general revenues rather than payroll taxes. These agencies are indeed typically independent of the ministry of health and have responsibility for administering the SHI scheme or at least some functions, such as collecting contributions, setting or recommending contribution rates and ceilings, pooling contributions, etc. Where it exists, the SHI agency pays providers, but some funds still flow from the health ministry (allocations for capital spending, for example, but also sometimes other items of spending too). Where there is a SHI agency, it typically has explicit contracts with providers, though this has not always been the case, and has become common only in recent years.

Moreover, the contracting is not always selective, although this too has become more common recently. Often there is no contracting with the private sector, and where it does occur, it is typically in primary care.

Most SHI countries have indeed shifted from budgets as a way of paying hospitals (the biggest spenders in a health sector) to either fee-for-service (FFS) or a patient-based payment method (PBP), such as diagnosis-related groups (DRGs). Figure 2 shows the timing of the various hospital payment reforms, where we have used the *HiTs* series to classify a country's predominant hospital payment method in a given year as falling into one of three categories: (i) fixed budgets/block grants (the prevailing method under the Communist Semashko system), (ii) fee-for-service/payment by bed days, or (iii) patient-based systems (mainly DRG-based) (cf. Ellis and Miller 2008). Of the 18 countries that adopted SHI, 12 switched from the use of budgets, though in four cases the switch occurred with a lag and in one case the switch occurred prior to SHI adoption. Some switched to FFS and stuck with it, while others switched subsequently to a PBP. A few switched immediately to PBP.

The switch to SHI has in practice, then, led to some changes in the purchasing and delivery of health care, and may therefore have led to improvements in the efficiency of the health system. It seems plausible that any such improvements will have been reflected to higher rates of throughput and lower rates of mortality and morbidity, even in the absence of any impact of SHI on spending levels.

There are, however, a couple of caveats. First, not all of the changes in purchasing and provider payments hinged on a switch to SHI: for example, some ECA countries that did not adopt SHI (namely Latvia and Poland) switched away from budgets anyway. It is of some

interest, therefore, to know how far any impact of SHI adoption is due to the shift to payroll finance and the setting up of a SHI agency, rather than to provider payment reforms which could have occurred (and in the cases of Latvia and Poland did occur) even without the adoption of SHI. The lag between SHI adoption and provider payment reform, the fact that different countries opted for different payment methods and sometimes switched a second time after SHI adoption, and the fact that some non-SHI countries also switched from budgets during our period all help create an opportunity to shed light on this question.

Second, the fact that the changes mentioned above occurred does not necessarily mean that the efficiency of the system necessarily increased. A SHI agency is likely to add a new layer of bureaucracy and cost to the health system: in several countries, the demarcation of responsibilities between the SHI agency and the pre-existing government health departments was blurred; and in most countries, risk pools were fragmented which meant economies of scale in health insurance administration were sacrificed (Kutzin *et al.* 2008). The purchasing and provider-payment reforms are also likely to have been costly to design and implement. Furthermore, putting aside the possibility of higher administrative costs in a SHI system, it is by no means automatic that the purchasing and provider-payment reforms seen in these systems will necessarily have led to lower health care costs and better health outcomes. Budgets and salaries do, of course, have their limitations; but FFS and PBP have their drawbacks too (Ellis and Miller 2008). And while selective contracting is widely advocated, the evidence on its impact is thin. A goal of this paper, then, is to establish whether the hoped-for benefits associated with the purchasing and provider-payment reforms in the ECA countries that switched to SHI actually materialized.

3. Methods

Let y_{it} be the health sector outcome of interest in country i at time t . In the empirical analysis below, the outcomes studied include health spending, throughputs and health outcomes. Let X_{it} be a vector of covariates thought to potentially influence both outcomes and the SHI adoption decision, and SHI_{it} be a dummy variable taking on a value of 1 if country i has a SHI health financing system at time t . Consider the model:

$$(1) \quad y_{it} = X_{it}\gamma + \delta SHI_{it} + e_{it},$$

where the e_{it} capture unobservable variables and noise. Our interest is in the coefficient δ which gives the impact of SHI on the outcome y_{it} . Estimating eqn (1) by pooled OLS would run the risk that the estimate of δ would be biased because of a correlation between SHI_{it} and e_{it} , i.e. SHI status might be endogenous. Countries with unobserved characteristics that lead to higher-than-expected levels of, say, health spending may deliberately choose not to adopt SHI in the belief that it might be less easy to control spending in a SHI system.

3.1 The differences-in-differences model

The simplest way to allow for such a correlation is to let:

$$(2) \quad e_{it} = \alpha_i + \theta_t + \varepsilon_{it},$$

where θ_t is a period-specific intercept, α_i is a country-specific effect which captures time-invariant unobservables that are potentially correlated with SHI status, and ε_{it} is an idiosyncratic error term (iid over i and t). Substituting eqn (2) in eqn (1) gives

$$(3) \quad y_{it} = X_{it}\gamma + \delta SHI_{it} + \alpha_i + \theta_t + \varepsilon_{it}.$$

In the special case where the X_{it} are omitted, eqn (3) collapses to the standard difference-in-differences (DID) estimator (cf. e.g. Wooldridge 2002 p.284). Eqn (3) can be estimated as a fixed effects model, or via first differences. In the latter case, the estimating equation can be expressed as

$$(4) \quad \Delta y_{it} = \Delta X_{it} \gamma + \delta \Delta SHI_{it} + \xi_t + \Delta \varepsilon_{it},$$

which can be consistently estimated by pooled OLS if the endogeneity of SHI adoption is adequately captured by the error term specified in eqn (2).

Care needs to be taken to get accurate standard errors in this type of analysis. Bertrand et al. (2004) have shown that many outcome variables used in published policy impact analyses generate positive serial correlation in the ε_{it} . If ignored, and the model is estimated as a fixed-effects specification, this positive serial correlation results in standard errors that are too small, and t-statistics that are too large—possibly dramatically so. In such a case, first differences may be preferred. Of course, if the ε_{it} in eqn (3) are serially uncorrelated, the error term in the first-differenced version may well be subject to negative serial correlation, in which case the standard errors would be overestimated. An obvious strategy is to report standard errors that are robust to any type of serial correlation (and heteroskedasticity), whether one uses fixed effects or first differences. This is what we do below in all our models. The Monte Carlo results reported by Bertrand et al. (2004) suggest that with a sample of 28 countries the rate of rejection of the null hypothesis of no impact ought to be close to the right one.¹⁷

This generalized DID estimator assumes a parallel or common trend: the θ_t do not depend on the value of SHI_{it} , and therefore the ‘treated’ health systems (i.e. those that switch to

¹⁷ We also experimented with (block) bootstrapped standard errors, and obtained broadly similar results.

SHI) and the ‘untreated’ ones exhibit the same trend. In reality, there may be time-varying unobservables that are correlated with both y_{it} and SHI status. We explore two approaches to relaxing the parallel trend assumption (PTA).

3.2 *The random trend model*

The first is through the somewhat misleadingly named ‘random trend’ (RT) model (cf. e.g. Wooldridge 2002 p.316). The assumption in eqn (2) is replaced by the assumption

$$(5) \quad e_{it} = \alpha_i + \theta_t + k_i t + \varepsilon_{it}.$$

This allows for the possibility that different countries have different trends, as reflected in different values of k_i . Substituting eqn (5) in eqn (1) gives

$$(6) \quad y_{it} = X_{it} \gamma + \delta SHI_{it} + \alpha_i + \theta_t + k_i t + \varepsilon_{it}.$$

One way of estimating this model is differencing eqn (6) to get

$$(7) \quad \Delta y_{it} = \Delta X_{it} \gamma + \delta \Delta SHI_{it} + \xi_t + k_i + \Delta \varepsilon_{it}.$$

and using a fixed effects estimator on this differenced equation.¹⁸ If the k_i are jointly insignificant, eqn (7) collapses to eqn (4), which would provide some evidence in support of the PTA. However, directly testing this hypothesis through a least-squares dummy variables approach in the present context is unfeasible due to the incidental parameters problem.¹⁹ Even if

¹⁸ Alternatively we could use the first differences estimator once again, this time applied to eqn (7) so as to eliminate the k_i , and estimate the resulting model by pooled OLS. However, this procedure would mean losing an additional period of time for estimation purposes, which is why we have opted for the fixed effects estimator in the case of the random trend model.

¹⁹ Testing the joint insignificance of the k_i for the 28 countries of our sample would mean testing 27 model constraints of the form $k_i = 0$. Since our data are clustered at the country level, there would not be enough degrees of freedom for performing such F tests after the inclusion of the country dummies in addition to the original regressors in the model unless some of these constraints are dropped, thus reducing the appeal of this test in our context. The same problem would arise if we would test for the equality of k_i (that is, $k_i = k$, all i) in eqn (7) via a least-squares dummy variable estimator.

the k_i were jointly significant in eqn (7), the PTA would still be a reasonable assumption if the k_i are uncorrelated with SHI_{it} . This can be tested through a single-variable, generalized version of the Hausman test of fixed versus random effects which takes into account the clustered nature of our data and is implemented by estimating an auxiliary quasi-demeaned regression (cf. Wooldridge 2002 p.290). For each health sector outcome, we implement this test by estimating an augmented version of eqn (7) using a random effects estimator—adding the within-country panel means of the original covariates which vary over i and t as regressors—and testing the null hypothesis of insignificance of the additional SHI term (with cluster-robust standard errors). Non-rejection of this hypothesis would suggest that the k_i are uncorrelated with SHI_{it} and thus provide evidence in favor of the PTA.²⁰

3.3 *The differential trend model*

The RT model is less restrictive than the standard DID model (the latter is nested in the former), but two objections might be raised against it: the assumed trend is linear; and the trend is specific to the country and assumed not to be modified by the treatment (i.e. the introduction of SHI). The second approach we employ to relaxing the PTA is a regression operationalization of the ‘differential trend’ (DT) model of Bell et al. (1999). They assume:

²⁰ This approach is equivalent to estimating the auxiliary quasi-demeaned regression suggested by Wooldridge (2002) using a pooled OLS estimator and performing a Wald test on the subset of regressors of interest. We can use a chi-square test statistic since, if only one parameter is tested (as in our case), the F statistic is asymptotically equivalent to a chi-square with one degree of freedom under the null hypothesis. We also implemented an alternative version of the Hausman test by directly testing for the equality of the SHI dummy coefficients obtained from estimating eqn (7) using random and fixed effects estimators with cluster-robust standard errors. Under the null hypothesis of no difference between the coefficients, the test statistic is asymptotically distributed as a chi-square (with one degree of freedom in our case); non-rejection of the null would suggest that the k_i are uncorrelated with SHI_{it} in eqn (7) and provide support to the PTA in our data. The results obtained from this alternative generalized Hausman test (not shown) were extremely similar to the ones obtained from our main approach, both in terms of the number of rejections of the null hypothesis and the specific outcomes for which rejections were found.

$$(8) \quad e_{it} = \begin{cases} \alpha_i + k_s m_t + \varepsilon_{it} & \text{if } SHI_{it} = 1 \\ \alpha_i + k_n m_t + \varepsilon_{it} & \text{if } SHI_{it} = 0 \end{cases},$$

where m_t is an unobserved trend, the influence of which on y_{it} is allowed to differ between SHI and non-SHI systems. Incorporating this assumption into eqn (1) gives:

$$(9) \quad y_{it} = X_{it} \gamma + \delta SHI_{it} + \alpha_i + k_n m_t + (k_s - k_n) m_t SHI_{it} + \varepsilon_{it},$$

which can be estimated as a fixed-effects model including year dummies ($YEAR$) and year dummies interacted with the SHI dummy:

$$(10) \quad y_{it} = X_{it} \gamma + \delta SHI_{it} + \alpha_i + \sum_{\tau=2}^T \beta_{\tau} YEAR_{\tau} + \sum_{\tau=2}^T \varphi_{\tau} YEAR_{\tau} SHI_{it} + \varepsilon_{it}.$$

In this model the impact of SHI varies over time, but one can estimate the average impact of SHI over time:

$$(11) \quad MEAN \ SHI \ IMPACT = \hat{\delta} + \sum_{\tau=2}^T \hat{\varphi}_{\tau} / T - 2.$$

The PTA assumption in this model implies $k_s = k_n$. This can be tested indirectly by testing the nonlinear restriction:

$$(12) \quad \frac{\sum_t m_t (k_s - k_n)}{\sum_t m_t k_n} = \frac{(k_s - k_n) \sum_t m_t}{k_n \sum_t m_t} = \frac{\sum_{\tau=2}^T \varphi_{\tau}}{\sum_{\tau=2}^T \beta_{\tau}} = 0.$$

An alternative to the fixed-effects model would be a first-differenced model:

$$(13) \quad \Delta y_{it} = \Delta X_{it} \gamma + \delta \Delta SHI_{it} + k_n \Delta m_t + (k_s - k_n) \Delta(m_t SHI_{it}) + \Delta \varepsilon_{it}.$$

In the estimation, the Δm_t would be replaced by first differences of year dummies and the $\Delta(m_t SHI_{it})$ would be replaced by first differences of interactions between year dummies and the SHI status dummy:

$$(14) \quad \Delta y_{it} = \Delta X_{it} \gamma + \delta \Delta SHI_{it} + \sum_{\tau=2}^T \beta_{\tau} \Delta YEAR_{\tau} + \sum_{\tau=2}^T \phi_{\tau} \Delta (YEAR_{\tau} SHI_{it}) + \Delta \varepsilon_{it}.$$

This model can be estimated by pooled OLS. The estimates from this first-differenced model could also be used to compute an average SHI impact via eqn (11) and to test the PTA via eqn (12).

3.4 *Testing for reverse causality*

Although our DID, RT and DT models all allow for some correlation between SHI and the original error term e_{it} , they entail specific assumptions and may not adequately capture the endogeneity of SHI. An informal yet intuitive test of reverse causality based on that proposed by Gruber and Hanratty (1995) in a similar modeling exercise is to include in each of our three models a lead dummy variable indicating whether SHI will be adopted the following year. If causality goes from SHI to the outcome variable, the coefficient on the lead dummy will be zero. A nonzero coefficient would point towards causality running the other way or some other type of endogeneity that cannot be captured by the model in question.

4. **Data**

We use annual data on SHI status and health sector outcomes for the 28 ECA countries, from 1990 to 2004. Our dataset has been constructed using a variety of sources; the description in this section begins with our independent variable of interest, SHI status, and then continues for the dependent and other independent variables included the health models. In our sample, data are generally available for most country-year combinations.²¹

²¹ In the case of Bosnia-Herzegovina, the period between 1992 and 1996 has been excluded from the analysis due to the lack of data for many dependent variables and the complete disorganization of the health system—which obviously included the SHI scheme—during the war period.

4.1 *Social health insurance status*

We define our SHI dummy SHI_{it} as taking a value of one if in country i at time t earmarked payroll taxes for health care were collected from formal-sector workers and there was a SHI agency in place. The required information was obtained mainly from the *Health Systems in Transition (HiT)* document series published by the European Observatory on Health Systems and Policies, a partnership between the European Office of the World Health Organization (WHO) and governmental, national and international agencies. World Bank reports and consultations with its staff working in the ECA region were also used in order to obtain data on countries for which HiTs have not yet been published, and to double-check the information assembled through the HiTs.²²

Our derivation of the SHI status indicator is shown in Table 1. Our strict definition means that we end up classifying as non-SHI some country-year combinations that are often—we believe, erroneously—classified as SHI (such as Latvia and Poland). Furthermore, we classify Romania as SHI only after 1998; despite the fact that payroll taxes were used somewhat before then, it was not until 1998 that SHI was fully set up with a SHI agency and with payroll contributions making up the majority of health care revenues. We explore the sensitivity of our results to not classifying these as SHI countries, by re-running our models with the three of them classified as SHI for the years indicated in Table 1. Figure 3 depicts the pattern of SHI adoption over time in the countries of our sample. Our SHI status dummy is equal to 1 in about half (218 observations) of the 442 country-year combinations for which we have non-missing values of the indicator.

²² Our classification is consistent with that of Langenbrunner *et al.* (2008).

4.2 Outcome variables

Our outcome measures include: per capita health spending (total, public and private) and the share of spending going on salaries; population health status; hospital activity rates and capacity utilization; and quality-of-care indicators. Our variable definitions and sources are briefly described below and the descriptive statistics for them—for the full sample and disaggregated by SHI status—are presented in Table 2.²³

We measure per capita health spending as total health care expenditures per capita expressed in constant 2000 dollars adjusted for purchasing power parity (deflated using the United States GDP deflator), to allow comparisons in real values between countries and over time (Gerdtham and Jonsson 1992). The source for these figures is the World Bank's *World Development Indicators (WB-WDI)* database. The WB-WDI database is the primary World Bank database for development data, obtained from recognized international sources. It contains an expanded set of the economic, health and other time series indicators published in the Bank's *World Development Reports*. Average health spending for the period 1990-2004 was US\$403 PPP per capita. The Czech Republic, Hungary and Slovenia are the countries with highest spending levels (each with an average of at least US\$857 PPP per capita between 1990-2004 and at least US\$1,225 PPP per capita in the last year), whereas Azerbaijan, Kyrgyz Republic, Tajikistan and Uzbekistan have the lowest spending levels in our sample (at most US\$132 PPP per capita on average for 1990-2004 and US\$163 PPP per capita in the last year). On average, government health spending accounted for almost 70% of a country's total health spending over the period of analysis and 60% in the year 2003; Armenia and Tajikistan exhibited the smallest

²³ The complete list of definitions and sources for our health outcome variables can be found in Table A1 in the Appendix.

shares of government health spending in 2003—less than 21%—whilst in Czech Republic and Slovak Republic that share was higher than 88% in the same year.

We also include among our indicators health sector salaries as a percent of total health spending. Data on this—like the data on many of the remaining health sector outcome indicators—are taken from the World Health Organization’s *Health for All Database (WHO-HFA)*. This database, maintained by the European Office (Copenhagen) of the WHO, contains data for all European countries plus the former USSR republics in Central Asia on about 600 health indicators, including annual information on morbidity and disability; hospital discharges; and health care resources, utilization and expenditure. The original sources of information are mainly WHO itself, country statistical offices and other international organizations. In our attempt of getting a comprehensive, general picture of the (potential) SHI impact on population health conditions, we include dependent variables related to life expectancy, group-specific mortality rates, disease-specific standardized death rates and incidence rates and measures of utilization of services such as caesarean sections and immunization. We used the same database for obtaining data on hospital indicators, which include measures of average length of stay, bed occupancy, number of hospital beds (from the WB-WDI database), admissions and disease-specific discharges. We also include in our analysis a few indicators of avoidable deaths—such as standardized death rates for appendicitis and hernia and intestinal obstruction—as proxies for the average quality of hospital care. Finally, alternative infant mortality and under-five mortality rates were obtained from WB-WDI and the *TransMONEE 2006 Database*, a UNICEF database which contains data for ECA countries except Turkey on 146 economic and social indicators divided into ten different topics and ranging from 1989 to 2004.

Simple comparisons of the average outcomes presented in Table 2 indicate that SHI countries tend to spend more on health care, both in the public and private sectors, and a higher fraction of the government health spending seems to be absorbed by salaries. On the other hand, there is some indication that mortality and disease incidence rates are generally lower in SHI countries, whilst no clear pattern emerges for immunization rates. As far as hospital indicators are concerned, total length of stay, in-patient admissions and beds tend all to be lower in SHI countries; most of our diagnosis-specific hospital discharges indicators are higher for SHI countries, and there is no clear pattern concerning our quality-of-care proxy measures. Visual comparisons of the evolution of SHI adoption in our sample vis-à-vis two health outcomes, average total health expenditures per capita and WHO's average infant mortality rate (Figure 4 and Figure 5), show somewhat clear patterns: average health spending slightly decreased during the first period of growing SHI adoption by ECA countries (1990-93) but experienced a sustained increase during and after the second period of SHI growth (1995-98, when SHI prevalence reached more than 50% in our sample), while the average infant mortality rate tended to remain stable around 22 per thousand births during the first period but continuously decreased during and after the second period, when SHI prevalence reached half of the countries. Determining whether the differences and patterns described above are due to SHI adoption (that is, a *causal* effect) or whether they merely reflect pre-existing differences—observable and/or unobservable—between countries that eventually adopted SHI and those that did not (a *selection* effect) is the main task of our empirical work.²⁴

²⁴ Moreover, the comparisons of descriptive statistics between SHI and non-SHI countries presented in Table 2 cannot be strictly interpreted as a preliminary assessment of SHI effects, because eventual SHI adoptions occurred on a staggered basis in our sample.

4.3 *Covariates in the estimating equation (the X-vector)*

We are not attempting to estimate a complete model of our health sector and labor market outcomes, but rather to estimate the impact of SHI adoption. The criterion for including a variable in our X_{it} vector is whether its omission would bias our estimate of δ , our SHI impact parameter. We want to include in X_{it} therefore variables that are correlated with both our outcomes and SHI adoption.

Although evidence on the determinants of SHI adoption is scarce, it has been indicated that SHI schemes emerged first in countries with higher initial (i.e. pre-transition) per capita income levels, whilst tax-based funding prevailed in countries with lower initial per capita income (Preker et al. 2002). This positive correlation between income levels and SHI status is also present in our data; thus, we include GDP per capita in our X_{it} vector²⁵. We also include among the X_{it} the share of the population aged 65 or above, and the urban population as a fraction of the total.

These three variables comprise the X_{it} vector in our basic model. We also estimate a second model where we control for the ways hospitals are paid, in order to establish how far any SHI impacts in our basic model are attributable to provider-payment reforms. In this second model, we add to the X_{it} vector dummy variables for FFS and PBP (“fixed budgets/block grants” is the reference category).²⁶

²⁵ The precise definition and source are indicated, along with those for other variables included in the X_{it} vector, in table A2 in the Appendix.

²⁶ Table A3 in the Appendix presents the detailed timing of changes in predominant hospital payment methods for the countries in our sample. As can be seen, SHI adoption and a change in the predominant hospital payment method have occurred in the same year for some countries, e.g. Bulgaria, Czech Republic, Estonia, Kyrgyz Republic and Macedonia.

5. Results

We begin this section with the results of our specification tests, and then present the estimates of the models.

5.1 *Specification tests*

Table 3 reports the results of our PTA tests for the first-differenced versions of our RT and DT models, i.e. eqns (7) and (14), and our reverse-causality tests for our DID model (eqn (4)) and our first-differenced RT and DT models. In the RT model, the generalized Hausman test of the null hypothesis that the k_i are uncorrelated with SHI_{it} is rejected in only 13% of outcomes at the 10% level, suggesting that the PTA assumption is for the most part highly consistent with the data. This is reinforced by the results of the nonlinear restriction test in the DT model: the null hypothesis that there is a common trend in unobservables between the SHI adopters and non-adopters is rejected in only 17% of outcomes at the 10% level. For the most part, then, the data seem consistent with the PTA assumption of the basic DID model. The results of the reverse causality test suggest that in all of our three models, reverse causality is also not an issue: the lead SHI dummy is significant at the 10% level in only 3% of outcomes in the DID model, in none of the outcomes in the RT model, and in only 4% of outcomes in the DT model.

5.2 *Basic estimates*

Overall, then, our test results suggest that the simple DID model provides a reasonable approach to modeling the impacts of SHI. Nonetheless we report basic results (i.e. without the provider payment dummies included) for the (first-differenced) RT and DT models as well as the

(first-differenced) DID model; see Table 4. Unsurprisingly, in view of the PTA and reverse-causality test results, the SHI impact estimates are similar across all three models.

The first noteworthy result is the absence of any significant impact of SHI in the vast majority of outcomes. In the DID model SHI has a significant impact (at the 10% level) in only 16% of outcomes. The figures for the RT and DT models are 16% and 22% respectively. The second point to emerge is that while SHI has no impact for the vast majority of outcomes, it does have an impact among some groups of variables, namely the spending variables and the basic set of hospital variables. In all three models, there is evidence that SHI has increased government health spending by between 13% and 15%, equivalent to around \$45 per capita in 2000 prices. Private spending does not seem to have been affected by SHI adoption, by contrast. The overall effect has been to raise total health spending by around 10%.²⁷

Whether the additional spending resulting from a transition to SHI is a good or bad thing cannot be said without seeing what the extra resources buy. A third result that emerges from Table 4 is that SHI may have increased the share of health spending going on wages and salaries, with the impact being of the order of around 11-16%, equivalent to a mean increase in the share of spending going on wages and salaries of around 4-6 percentage points. We must interpret this result with caution, however, due to the reduced number of changes in our SHI dummy used to

²⁷ The impacts on total and government health spending are reduced to about 8% and 12% (respectively) when we switch to the alternative “non-classical” definition of SHI for Latvia, Poland and Romania, where we classify the first two countries as SHI countries despite the fact they do not meet the strict definition of SHI, and Romania as SHI from 1992 onwards even though it was not until 1998 that Romania set up a formal mandatory SHI system. This reduction of impact when the definition is changed provides additional evidence that SHI—interpreted strictly—does indeed increase health spending. Similarly, for all the remaining models estimated in this paper, using the alternative definition of the SHI variable does not alter our qualitative results and only marginally affects the size of our parameter estimates in some instances.

identify the SHI impact in this case. Furthermore, and curiously, there is also no evidence of this impact in the DT model.

The second set of variables where we find a significant impact of SHI is the basic set of hospital variables. In two of our three models (including our preferred DID model), the results in Table 4 suggest that SHI adoption reduced mean length of stay (by about 2.5%), increased the bed-occupancy rate (by around 3% or 2 percentage points), and increased both inpatient admissions in general (by 2-3%) and acute inpatient admissions in particular (by around 4%). It is noteworthy that the percentage impact on admissions is a good deal smaller than the percentage impact on spending. Among the other hospital variables, there is less evidence of SHI adoption having an impact, and the significant effects are confined to just three variables: hospital discharges for patients treated for infectious diseases (an 11-18% increase); discharges for patients treated for cerebrovascular diseases (a 4% increase); and surgical infection rates, though the large estimated negative effect needs to be interpreted with caution due to the limited number of switches of the SHI dummy in the sub-sample used to obtain this particular parameter estimate.

SHI adoption thus seems to have increased (government) health spending and to have increased (albeit by a lesser percentage) inpatient admissions. What is striking about Table 4 in the light of these results is that SHI adoption does not appear to have had any perceptible impact on health outcomes. This is despite the fact that we are not controlling for health spending in our regressions and the fact that we have over 40 different health outcome variables, including detailed cause-specific data on both mortality and disease incidence. In only two outcomes (infant mortality and postneonatal mortality) is there any evidence of a significant impact of SHI

in our preferred DID model, and here the evidence is not altogether compelling: interpreted literally, SHI increased (though not significantly) neonatal and perinatal mortality, significantly reduced postneonatal mortality, and significantly increased infant mortality, but only for one of our three infant mortality variables. It would seem unwise to read too much into these results. The results for the DT model are even more pessimistic, suggesting that SHI led to a significant deterioration in several health outcomes; however, since these are not (with one exception) outcomes where the nonlinear restriction test points to the DT model being preferred to the DID model, it would probably be unwise to read too much into these results as well. Overall, our estimates suggest that SHI adoption resulted in neither health improvements nor adverse effects on population health status.

In general, the results for the fixed-effects versions of the DID and RT models are similar to those obtained for the abovementioned first-differences estimates (see Table A4 in the appendix). According to the fixed-effects results, SHI has significantly increased government health spending and has had no perceptible beneficial effects on population health (the fixed-effect estimates are in fact more pessimistic on this point than the first-differences results). A positive impact on discharges of patients treated for infectious diseases is also evident in the fixed-effects estimates. Where the results differ somewhat are on the impacts of SHI on hospital length of stay, bed occupancy and admissions: there are no significant impacts on any in the fixed-effect results, though the point estimates are actually usually somewhat larger.

5.3 Robustness of estimates to accounting for provider-payment reforms

As noted in section 2, SHI adoption is often (though not always) associated with a change in the way hospitals are paid, from budgets to either FFS or PBP. From an empirical point of

view, it might be argued that our estimates of the impacts of SHI adoption in Table 4 are simply picking up the effects of provider payment reforms rather than the impact of SHI adoption *per se*. Because payment reforms can be effected in non-SHI systems—and were in some of the ECA countries over the study period—it is important to try to isolate the impacts of SHI adoption *per se* from the impacts of concurrent provider-payment reforms.²⁸

Table 5 presents the results for our preferred DID model with the hospital payment dummies included.²⁹ Overall, the latter results offer support to our previous finding that SHI adoption increased per capita health spending. Even after including the payment methods dummies, we find that SHI led to an increase in annual government health care expenditures per capita of around 12% or US\$36 PPP in the “adopter” countries, compared to what would have occurred had these countries not switched to SHI. This estimated effect is only three percentage points smaller than that obtained from our original DID specification (i.e. without the payment dummies) and is significant at the 5% level. Interestingly, while the corresponding coefficients on FFS and PBP exhibit the expected sign, neither is significant. The results suggest, in other words, that SHI adoption *of itself* increases government health spending, while switching from budgets to either FFS or PBP does not *of itself* change government health spending per capita. Interestingly as well our results suggest that *private* spending on health is sensitive to the way hospitals are paid, with FFS being associated with significantly higher spending. The magnitude is sizeable: an increase of 33% or US\$35 PPP per capita.

²⁸ We would like to have expanded the scope of this part of the analysis to cover other potentially relevant changes that may have been associated with SHI adoption, such as changes to the way physicians were paid, the introduction of a gate-keeping function for primary care providers, and so on. We were unable, however, to get the relevant data, year by year. At best, we could obtain typically only snapshots of the initial (i.e. Communist) and current arrangements, with no information on the *timing* of these changes over the decade.

²⁹ We undertook the same reverse-causality test for this model. In only 4% of cases was the coefficient on the lead SHI dummy significant at the 10% level.

As far as hospital indicators are concerned, the results in Table 5 suggest that our initial impact of SHI on mean length of stay reported in Table 4 may have been largely due to contemporaneous provider-payment reforms: the point estimate is reduced considerably in the fuller specification, and is no longer significant. The estimate of the impact on the bed-occupancy rate is slightly increased by the addition of provider-payment dummies and is still borderline significant at the 10% level even in the fuller specification. By contrast, the evidence on the impact of SHI on inpatient admissions survives the inclusion of provider-payment dummies in the model, although the point estimates are reduced, reflecting the positive impact of FFS on inpatient admissions and the fact that this was the most common payment method among SHI adopters who switched provider payment method upon adopting SHI. Our earlier impacts of SHI on infectious disease discharges and surgical infection rates also survive the inclusion of the provider-payment dummies.

As far as health outcomes are concerned, there was little evidence in our original specification of SHI adoption having any impact, and this remains the case even after including provider payment method dummies. The latter have a few significant coefficients but there is no consistent pattern.

Overall, our basic empirical conclusions seem fairly robust to the inclusion of changes in hospital payment methods as potential confounders of SHI impacts. In particular, SHI adoption *per se*—i.e., without any change in payment methods—has apparently led to higher government

health spending and hospital admissions, but has not led to any perceptible improvements in population health indicators.³⁰

6. Discussion and conclusions

The health system reforms the European and Central Asian (ECA) countries implemented during their transition from socialist economies in the 1990s provide a unique opportunity to assess the impacts of social health insurance (SHI) on the health sector. We took advantage of this highly unusual “experiment” in which many ECA countries unequivocally switched from general tax-funded to SHI systems in a relatively short period of time, and on a staggered basis, so as to shed light on a broad set of currently unanswered questions: how does SHI affect national health spending, the way such resources are spent, and population health outcomes? In order to obtain empirical evidence on these issues, we have used regression-based generalizations of the differences-in-differences approach on panel data from 28 ECA countries for the period 1990-2004. In two of our generalizations we relaxed the parallel trends assumption that is seen as a major drawback of the differences-in-differences approach: in one we allow for a country-specific unobserved linear time trend that could be correlated with SHI adoption; and in the other we allow for differential (possibly nonlinear) time trends between SHI adopters and non-adopters.

³⁰ The estimated coefficients on hospital payment methods are of course very interesting by themselves, not least because in practice it has been mostly SHI countries that have abandoned budgets as the predominant arrangement in our sample; however, since an analysis of the influence of provider payment methods on health indicators is not the primary aim of this paper, we only briefly comment on these results here and leave a more detailed investigation of the subject for a future study. As it can be seen in Table 5, in addition to the substantial, positive effect of fee-for-service on total and private health care spending per capita, this arrangement is also found to increase the number of inpatient admissions and hospital discharges, suggesting that providers are given the incentives for using resources more intensely under such payment method. Also noteworthy is the finding that neither fee-for-service nor SHI *per se* induce hospital downsizing in terms of the normally excessive beds supply inherited from the Communist system, though switching from budgets to patient-based payment methods seems to provide some incentive for it.

Our tests suggest that the parallel trends assumption is not, in fact, inconsistent with our data. We also find that whichever model we use there is no evidence of reverse causality—SHI adoption being caused by changes in our outcomes. Our estimated SHI impacts are also similar for our three models. Our tests and parameter constancy provide some reassurance that we have identified causal relationships between SHI adoption and health sector outcomes.

Our estimates suggest that SHI adoption *per se* increased government health expenditure per capita. We also obtain some evidence that part of the extra financial resources available in the health sector due to SHI adoption have served to increase the fraction of salaries as percentage of government health spending in SHI countries. This result provides quantitative evidence in support of claims about the process of transition to SHI in some ECA countries being favored and accelerated by pressure from health professionals, who expected to have their income levels driven up by the introduction of a SHI system.³¹ Our results also suggest that SHI has impacted on how physical resources are used, by reducing average hospital length of stay and increasing bed occupancy rates and hospital admissions. Despite this, our analysis of several mortality and morbidity indicators showed that transition to SHI has *not* caused general improvements in health outcomes for ECA countries. This is despite the fact that we have been able to analyze SHI impacts on over 40 health outcome measures, including cause-specific mortality and morbidity indicators.³² It might be argued that the absence of any beneficial impacts of SHI adoption—with its associated increase in health spending—on general mortality is not surprising, since for many mortality causes it is not reasonable to expect death to be

³¹ See, for instance, the individual *HiTs* for the Czech Republic and the Russian Federation.

³² Studies with similar objectives to ours (though not specifically on SHI) have usually been constrained by lack of data on mortality and (especially) morbidity outcomes, thus potentially missing important health benefits arising from public health insurance arrangements. See, for instance, Finkelstein and McKnight (2008), who were only able to investigate Medicare impacts on elderly mortality but could not examine any potential effects on morbidity indicators.

averted by timely or higher quality health care after the condition develops (e.g. many types of malignant neoplasms, heart and circulatory diseases). However, the wide range of mortality measures examined here means that we are not restricted to examining only such “unavoidable” deaths; rather, we have been able to show that SHI adoption did not cause any general improvements in mortality from causes that should not occur in the presence of timely and effective/better quality health care, a concept known as “amenable mortality” which has been used elsewhere to assess the quality of health care systems (Nolte and McKee 2008). Compared to tax-funded health systems, SHI systems do not seem to have reduced amenable mortality when this is measured by a variety of mortality indicators containing an important “avoidable” or preventive component for most age ranges, such as standardized death rates by tuberculosis, female breast cancer, cerebrovascular diseases, diabetes, ischemic heart disease, alcohol-related causes and the maternal mortality ratio; the same general conclusion arises as far as children-specific amenable mortality is concerned (judged by measures such as death rates by diarrhea and acute respiratory infections). Thus, in this study, we have been able to perform an investigation of the broad population health impacts that could in theory be brought about by a different organization of a national health system—i.e., the adoption of social insurance—taking into account both morbidity and amenable mortality indicators.

Our results are mostly robust to the inclusion of dummy variables capturing shifts in provider payment methods alongside the SHI status dummy; they are therefore pure SHI effects, not provider-payment reform effects. For example, the higher government spending caused by a transition to SHI is not a spurious result attributable to the fact that some countries switched to fee-for-service (FFS) when they adopted SHI. We are able to estimate separate provider payment effects because SHI adoption did not always lead to provider payment reform and even when it

did sometimes do so with a lag, because some non-SHI countries reformed the way they paid hospitals as well, and because some SHI countries switched provider payment methods more than once (some, for example, switched to FFS only to change to a patient-based payment method (PBP) later on). Typically, where we find an impact of provider payments on our outcomes we do not find an impact of SHI adoption, and vice versa. For example, private health spending is affected (positively) by a switch to FFS but not by SHI adoption, while government spending is (positively) affected by SHI adoption but not by how hospitals are paid. An exception is inpatient admissions, which respond positively to both SHI adoption (a 2% increase) and a switch to FFS (a 3% increase). The impact of SHI adoption on inpatient admissions was thus greater in countries where SHI adoption was associated with a switch to FFS than in countries where SHI adoption did not coincide with a provider payment reform.

The question arises: Why did health outcomes not improve as a result of SHI adoption even though it led of itself to higher government health spending and higher inpatient admissions? One part of the explanation is that the percentage increase in admissions was much smaller than the percentage increase in spending (2-3% compared to 13-15%). Much of the extra spending therefore resulted in more costly admissions and/or extra spending elsewhere in the health system. Part of the story seems to be the higher salary share of costs as a result of SHI adoption. But it also seems likely that costs were incurred undertaking new activities (e.g. collecting contributions, writing contracts with providers) or that existing activities became more costly (e.g. more tests being administered on in-patients, more expensive drugs being given, etc.). It is also possible that SHI adoption may have resulted in less comprehensive and less well integrated public health and prevention programs (cf. e.g. Allin et al. 2004), and that the extra admissions and extra costs caused by the transition to SHI were incurred in treating additional

patients who would not have otherwise become sick. The fact that SHI adoption appears to have led to increased numbers of infectious disease hospital discharges is consistent with this story. Gaps in coverage may also be part of the explanation. Some groups seem to have fallen through the coverage net, such as the Roma population (cf. e.g. Rechel and McKee 2003), and there is anecdotal evidence that some formal sector workers wait to enroll until they get sick. Because of lack of coverage, these groups may use primary care less than they would have otherwise done, increasing the likelihood that illness is left untreated until serious enough to warrant hospitalization. Some of the extra hospital caseload associated with SHI may therefore simply be due to people waiting until they get so sick that they require hospitalization.

Of course, our results do not necessarily imply that SHI adoption everywhere must necessarily raise health spending without improving health outcomes. These results are likely to hinge in part on the fact that SHI was introduced with costly institutional reforms but ones that did little to stimulate the performance of the health system. Nonetheless, the largely negative results in the paper ought to serve as a warning to those contemplating shifting from general revenue finance to SHI.

Table 1: Definitions of SHI status in the dataset

Country	Year of SHI adoption	SHI dummy	Comments
Albania	1995	=1 1995 onwards =0 beforehand	
Armenia	Never	=0 throughout	
Azerbaijan	Never	=0 throughout	
Belarus	Never	=0 throughout	
Bosnia and Herzegovina	Prior to 1990	=1 for 1991 Missing 1992-96 =1 1997 onwards	SHI in place prior and (in theory) during the to 1992-95 war, but war period excluded from analysis
Bulgaria	1999	=1 1999 onwards =0 beforehand	
Croatia	Prior to 1990	=1 1990 onwards	
Czech Republic	1993	=1 1993 onwards =0 beforehand	
Estonia	1992	=1 1992 onwards =0 beforehand	
Georgia	1995	=1 1995 onwards =0 beforehand	
Hungary	1990	=1 1990 onwards	
Kazakhstan	1996	=1 1996-1998 =0 otherwise	Abandoned SHI in 1998
Kyrgyz Republic	1997	=1 1997 onwards =0 beforehand	
Latvia	Never	Option 1: =0 throughout Option 2: =1 1997 onwards, 0 otherwise	Latvia set up SHI agency before 1997 but it was funded through general revenues. Since 1997, 28.4% of income taxes are earmarked for health
Lithuania	1991	=1 1991 onwards =0 otherwise	
Macedonia, FYR	1991	=1 1991 onwards =0 1990	
Moldova	Never	=0 throughout	
Poland	Never	Option 1: =0 throughout Option 2: =1 1999 onwards, 0 otherwise	Health system funded not through payroll tax but earmarked income tax
Romania	1998	Option 1: =1 1998 onwards, 0 otherwise Option 2: missing 1990-91 =1 1992 onwards	Earmarked payroll taxes were established in 1992 (2% of payroll)
Russian Federation	1993	=1 1993 onwards =0 beforehand	
Serbia and Montenegro	Prior to 1990	=1 throughout	
Slovak Republic	1995	=1 1995 onwards =0 beforehand	
Slovenia	1992	=1 1992 onwards =0 beforehand	
Tajikistan	Never	=0 throughout	
Turkey	Prior to 1990	=1 throughout	Two out of the three main insurance funds collect payroll-based earmarked contributions for health and cover approximately 87% of the population
Turkmenistan	Never	=0 throughout	WHR has social security spending ranging from 6.1-9.9%.
Ukraine	Never	=0 throughout	
Uzbekistan	Never	=0 throughout	

Table 2: Descriptive statistics for health sector outcome variables

	Full sample			SHI = 1			SHI = 0		
	Mean	SD	Obs	Mean	SD	Obs	Mean	SD	Obs
Health expenditures - Total	402.83	296.92	359	536.16	325.16	186	259.47	172.88	173
Health expenditures - Government	295.87	249.61	324	404.22	281.52	167	180.62	136.89	157
Health expenditures - Private	101.26	71.77	324	123.91	72.54	167	77.16	62.69	157
Salaries (%)	39.41	12.63	168	40.24	16.62	69	38.82	8.95	98
Physicians	2.97	0.93	343	2.72	1.01	158	3.20	0.79	184
Life expectancy	70.49	2.91	380	71.52	3.03	181	69.55	2.45	198
Life expectancy (male)	66.41	3.51	377	67.53	3.76	178	65.39	2.92	198
Life expectancy (female)	74.64	2.65	377	75.64	2.61	178	73.73	2.36	198
Under-5 MR (TransMONEE)	21.59	13.07	383	15.95	8.19	179	26.58	14.51	203
Under-5 MR (WHO)	21.12	13.05	366	15.37	7.73	167	25.99	14.61	198
Infant MR (WB)	20.22	19.66	231	13.25	11.10	127	28.95	24.25	102
Infant MR (TransMONEE)	17.10	9.48	399	13.24	6.57	181	20.40	10.42	212
Infant MR (WHO)	16.95	9.57	379	14.31	9.29	179	19.29	9.25	198
Perinatal MR	12.40	4.74	352	10.91	5.25	161	13.64	3.87	191
Neonatal MR	7.78	3.00	296	7.35	3.34	154	8.24	2.51	141
Postneonatal MR	7.31	6.29	295	4.89	3.18	154	9.99	7.66	140
Maternal MR	28.46	21.78	383	23.05	23.01	178	33.27	19.51	204
Maternal MR (3-year)	28.65	18.88	349	21.94	17.12	156	34.16	18.55	192
Caesarean sections	92.77	50.10	331	118.53	43.52	154	70.35	44.43	177
SDR all causes	1145.92	184.92	366	1081.83	182.81	167	1200.68	169.12	198
SDR infeccious diseases	17.16	15.31	363	11.81	10.25	167	21.77	17.37	195
SDR tuberculosis	9.84	8.02	361	7.57	8.23	167	11.80	7.33	193
SDR diarrhea (under 5)	31.38	67.31	354	11.82	22.38	166	48.92	86.59	187
SDR ARI (under 5)	105.48	145.38	342	46.61	66.83	167	162.47	175.26	174
SDR heart disease	302.88	129.88	363	239.05	109.83	167	358.58	119.68	195
SDR liver diseases	29.41	21.36	321	26.16	18.02	151	32.39	23.66	169
SDR diabetes	14.92	8.59	363	14.35	6.91	167	15.39	9.81	195
SDR circulatory diseases	623.62	125.33	363	576.83	120.03	167	664.11	115.85	195
SDR cerebrovascular diseases	175.36	53.23	363	171.89	55.21	167	178.57	51.46	195
SDR neoplasms	172.78	47.55	363	190.83	45.72	167	157.40	43.72	195
SDR female breast cancer	21.58	6.68	363	24.52	5.70	167	19.11	6.46	195
SDR respiratory diseases	68.31	34.93	363	54.13	27.91	167	80.59	35.80	195
SDR bronchitis	30.99	19.57	350	25.36	19.93	161	35.85	17.99	188
SDR digestive diseases	48.09	22.90	363	44.73	20.10	167	51.03	24.76	195
SDR alcohol causes	134.83	57.24	321	123.72	57.61	155	145.75	54.78	165
SDR smoking causes	542.38	167.07	321	466.26	131.64	155	615.31	164.40	165
Tuberculosis incidence rate	52.88	31.90	416	50.41	33.97	201	54.98	29.76	213
Hepatitis incidence rate	141.31	170.91	320	67.66	83.37	148	205.37	199.84	171
Hepatitis B incidence rate	17.23	19.29	384	10.38	9.61	178	23.24	23.26	205
Measles incidence rate	13.31	26.96	415	10.33	23.45	200	16.17	29.76	213
Mumps incidence rate	54.72	76.49	390	37.95	58.73	182	69.63	86.83	207
Syphilis incidence rate	31.77	52.15	381	28.21	55.82	180	35.14	48.61	200
Congenital syph incidence rate	0.16	0.30	218	0.23	0.40	88	0.11	0.18	129

	Full sample			SHI = 1			SHI = 0		
	Mean	SD	Obs	Mean	SD	Obs	Mean	SD	Obs
Pertussis incidence rate	4.05	5.62	413	4.33	6.78	199	3.78	4.27	213
Diphtheria incidence rate	1.31	5.19	415	0.67	2.94	200	1.93	6.61	213
Tetanus incidence rate	0.09	0.11	407	0.11	0.12	196	0.07	0.09	210
Cancer incidence rate	245.01	147.37	335	318.21	159.21	138	193.72	113.47	197
Tuberculosis immunization rate	92.70	11.32	420	93.10	10.39	201	93.24	9.93	213
DPT immunization rate	91.59	9.75	420	91.90	7.67	201	91.87	10.31	213
Polio immunization rate	92.06	8.81	420	91.94	7.76	201	92.82	8.69	213
Mumps immunization rate	82.25	22.69	227	88.63	16.39	127	74.59	26.50	99
Rubella immunization rate	88.00	19.23	190	90.05	15.52	124	85.29	22.78	65
Length of stay (total)	12.75	3.04	398	11.23	2.93	193	14.19	2.39	204
Bed occupancy rate	72.80	14.78	278	74.85	9.82	149	70.36	18.78	128
Hospital beds	8.10	2.91	342	6.72	2.59	155	9.28	2.64	186
In-patient admissions	16.18	5.99	397	15.51	6.02	194	16.86	5.90	202
Acute care admissions	15.16	5.39	277	15.17	5.5	150	15.20	5.26	126
Hospital discharges - infectious	826.10	444.11	353	658.64	352.78	170	981.66	464.08	183
Hosp discharges - cancers	809.34	588.59	346	1068.85	643.08	163	578.19	417.81	183
Hosp discharges - heart	669.00	468.43	343	684.00	425.49	163	655.41	504.97	180
Hosp discharges - circulatory	1904.45	1099.73	354	2092.45	1152.72	170	1730.76	1021.10	184
Hosp discharges - cerebrov	339.11	240.51	350	394.82	243.94	168	287.68	226.04	182
Hosp discharges - respiratory	2088.68	1014.24	351	1737.75	778.42	170	2418.28	1098.08	181
Hosp discharges - digestive	1623.59	626.99	354	1544.75	579.86	170	1696.44	660.83	184
Hosp discharges - musculo	776.92	508.15	354	809.35	536.77	170	746.96	479.71	184
SDR appendicitis	0.30	0.18	347	0.23	0.14	158	0.36	0.19	188
SDR hernia & intestinal	2.23	0.75	350	2.34	0.74	161	2.14	0.74	188
SDR adverse effects	0.20	0.33	183	0.19	0.33	116	0.19	0.28	66
Surgical infection rate	1.09	1.22	74	0.92	0.82	42	1.30	1.59	32

Note: Mean, standard deviation (SD) and number of observations (Obs) for the full sample and for the sub-samples of observations with the SHI dummy equals to one (SHI=1) and zero (SHI=0).

Table 3 : Specification tests for first-differenced models: reverse causality and parallel trend assumption (PTA)

		<i>DID model</i>		<i>Random linear trend model</i>				<i>Differential trend model</i>			
		Reverse causality test		PTA test		Reverse causality test		PTA test		Reverse causality test	
		Lead SHI dummy test on eqn (4)		Generalized Hausman test on eqn (7)		Lead SHI dummy test on eqn (7)		Non-linear restriction test on eqn (14)		Lead SHI dummy test on eqn (14)	
Dependent variable		Coef	p-value	chi-square	p-value	Coef	p-value	F	p-value	Coef	p-value
<i>Health spending</i>	Health expenditures - Total	4.73	0.768	0.77	0.380	7.61	0.672	0.07	0.788	-2.88	0.834
	Health expenditures - Public	0.88	0.954	0.15	0.695	1.48	0.930	0.35	0.559	-5.80	0.689
	Health expenditures - Private	6.31	0.287	2.11	0.147	8.13	0.243	0.03	0.856	3.64	0.597
	Salaries (%)	-1.94	0.773	0.40	0.525	-1.30	0.837	0.59	0.452	-3.74	0.568
	Physicians	-0.02	0.494	0.29	0.592	-0.02	0.460	0.07	0.795	-0.01	0.685
<i>Health outcomes</i>	Life expectancy	0.07	0.795	0.12	0.724	0.11	0.679	3.36	0.079	0.04	0.896
	Life expectancy (male)	-0.03	0.919	0.13	0.721	0.03	0.895	1.37	0.254	-0.08	0.793
	Life expectancy (female)	0.24	0.390	0.05	0.826	0.29	0.336	8.06	0.009	0.23	0.438
	Under-5 MR (TransMONEE)	-0.13	0.875	3.00	0.083	-0.24	0.777	0.26	0.618	0.14	0.874
	Under-5 MR (WHO)	-0.55	0.631	0.14	0.705	-0.59	0.593	0.02	0.900	-0.29	0.811
	Infant MR (WB)	-0.23	0.799	0.20	0.656	-0.12	0.895	2.40	0.153	-0.22	0.781
	Infant MR (TransMONEE)	0.46	0.298	3.88	0.049	0.34	0.469	0.01	0.921	0.62	0.191
	Infant MR (WHO)	-0.15	0.858	0.00	0.964	-0.24	0.766	0.27	0.609	0.03	0.974
	Perinatal MR	0.67	0.121	4.57	0.033	0.45	0.268	0.08	0.781	0.70	0.112
	Neonatal MR	0.21	0.276	1.83	0.176	0.17	0.385	0.26	0.614	0.22	0.343
	Postneonatal MR	-0.68	0.550	0.01	0.936	-0.58	0.594	9.10	0.006	-0.31	0.794
	Maternal MR	-1.12	0.539	0.17	0.677	-0.69	0.702	0.32	0.574	-1.13	0.557
	Maternal MR (3-year)	1.48	0.411	0.23	0.632	1.92	0.292	0.33	0.569	1.64	0.408
	Caesarean sections	-1.49	0.622	0.46	0.499	-2.42	0.449	0.24	0.628	-1.76	0.546
	SDR all causes	-9.34	0.572	0.33	0.569	-12.04	0.487	13.48	0.001	-9.01	0.630
	SDR infeccious diseases	1.65	0.165	0.10	0.752	1.71	0.193	0.01	0.915	2.29	0.130
	SDR tuberculosis	0.78	0.274	0.56	0.453	0.89	0.264	0.67	0.422	0.92	0.310
	SDR diarrhoea (under 5)	0.56	0.931	3.84	0.050	-0.59	0.930	1.01	0.324	2.73	0.699
	SDR ARI (under 5)	-16.41	0.341	0.00	0.985	-15.05	0.348	0.63	0.434	-12.58	0.474
	SDR heart disease	2.61	0.673	1.49	0.222	3.05	0.627	0.09	0.762	3.30	0.603
SDR liver diseases	-0.24	0.840	0.54	0.461	-0.64	0.570	0.34	0.566	0.14	0.921	
SDR diabetes	-0.32	0.553	2.10	0.147	-0.20	0.688	6.53	0.017	-0.41	0.482	

Dependent variable	<i>DID model</i>		<i>Random linear trend model</i>				<i>Differential trend model</i>			
	Reverse causality test		PTA test		Reverse causality test		PTA test		Reverse causality test	
	Coef	p-value	chi-square	p-value	Coef	p-value	F	p-value	Coef	p-value
	Lead SHI dummy test on eqn (4)		Generalized Hausman test on eqn (7)		Lead SHI dummy test on eqn (7)		Non-linear restriction test on eqn (14)		Lead SHI dummy test on eqn (14)	
SDR circulatory diseases	-10.73	0.225	0.59	0.443	-11.43	0.225	22.61	0.000	-12.61	0.206
SDR cerebrovascular diseases	-4.61	0.133	0.03	0.870	-5.62	0.136	9.31	0.005	-4.25	0.183
SDR neoplasms	2.40	0.378	0.07	0.789	1.96	0.480	0.02	0.890	2.64	0.340
SDR female breast cancer	-0.31	0.526	0.29	0.589	-0.42	0.415	1.28	0.268	-0.26	0.631
SDR respiratory diseases	-5.82	0.177	0.50	0.482	-5.62	0.179	3.74	0.065	-5.86	0.183
SDR bronchitis	-0.55	0.719	0.00	0.972	-1.18	0.514	12.38	0.002	0.25	0.905
SDR digestive diseases	-0.74	0.558	0.42	0.519	-0.95	0.435	0.00	0.962	-0.54	0.716
SDR alcohol causes	-3.05	0.587	0.62	0.432	-4.33	0.413	0.00	0.990	-0.41	0.952
SDR smoking causes	-0.76	0.928	1.08	0.299	-4.06	0.654	0.17	0.680	3.80	0.694
Tuberculosis incidence rate	-2.57	0.499	0.24	0.626	-3.06	0.392	1.25	0.275	-3.44	0.387
Hepatitis incidence rate	15.91	0.541	1.35	0.246	15.90	0.579	12.23	0.002	21.94	0.394
Hepatitis B incidence rate	1.31	0.213	3.56	0.059	0.85	0.429	1.13	0.298	1.79	0.128
Measles incidence rate	13.74	0.231	4.10	0.043	12.55	0.280	0.02	0.887	12.92	0.263
Mumps incidence rate	20.10	0.217	0.51	0.474	20.42	0.229	0.88	0.356	10.96	0.515
Syphilis incidence rate	16.62	0.114	0.18	0.673	17.49	0.121	1.25	0.276	18.44	0.077
Congenital syph incidence rate	0.17	0.108	0.02	0.888	0.17	0.109	0.46	0.506	0.16	0.094
Pertussis incidence rate	0.77	0.560	0.78	0.378	0.71	0.584	0.03	0.869	0.69	0.608
Diphtheria incidence rate	-0.22	0.732	0.13	0.723	-0.28	0.666	0.08	0.779	-0.28	0.669
Tetanus incidence rate	-0.02	0.221	0.12	0.733	-0.03	0.189	0.00	0.961	-0.02	0.201
Cancer incidence rate	-1.32	0.714	5.60	0.018	-0.86	0.824	0.06	0.804	-2.44	0.470
Tuberculosis immunization rate	1.54	0.251	1.20	0.272	1.72	0.205	0.11	0.740	1.16	0.393
DPT immunization rate	-0.03	0.984	1.46	0.227	0.29	0.845	0.06	0.808	-0.78	0.700
Polio immunization rate	2.45	0.421	0.83	0.363	2.69	0.389	0.31	0.583	1.69	0.612
Mumps immunization rate	-5.07	0.473	0.37	0.542	-7.34	0.249	0.58	0.457	-3.81	0.610
Rubella immunization rate	-0.63	0.798	1.58	0.209	-0.67	0.891	0.20	0.658	-1.70	0.644
<i>Hospitals</i> Length of stay (total)	0.15	0.247	1.56	0.211	0.19	0.178	0.07	0.798	0.13	0.363
<i>Hospitals</i> Bed occupancy rate	-0.49	0.800	0.43	0.513	-0.54	0.759	0.16	0.689	-0.16	0.941
<i>Hospitals</i> Hospital beds	-0.22	0.372	1.63	0.202	-0.26	0.313	0.89	0.354	-0.20	0.418
<i>Hospitals</i> Inpatient admissions	-0.11	0.440	0.33	0.565	-0.14	0.453	0.01	0.926	-0.06	0.702

Dependent variable	<i>DID model</i>		<i>Random linear trend model</i>				<i>Differential trend model</i>			
	Reverse causality test		PTA test		Reverse causality test		PTA test		Reverse causality test	
	Lead SHI dummy test on eqn (4)		Generalized Hausman test on eqn (7)		Lead SHI dummy test on eqn (7)		Non-linear restriction test on eqn (14)		Lead SHI dummy test on eqn (14)	
	Coef	p-value	chi-square	p-value	Coef	p-value	F	p-value	Coef	p-value
Acute care admissions	-0.04	0.842	0.14	0.706	-0.07	0.723	0.55	0.465	0.10	0.601
Hospital discharges - infectious	18.41	0.536	1.11	0.292	18.70	0.532	2.61	0.119	31.00	0.316
Hosp discharges - cancers	-10.23	0.479	0.35	0.554	-8.40	0.369	0.12	0.730	-5.88	0.608
Hosp discharges - heart	19.03	0.257	0.76	0.382	25.99	0.125	3.35	0.079	17.24	0.325
Hosp discharges - circulatory	-11.45	0.604	0.01	0.917	-4.88	0.738	0.65	0.426	-13.46	0.608
Hosp discharges - cerebrov	-0.50	0.923	0.31	0.575	0.86	0.811	1.32	0.262	-1.12	0.836
Hosp discharges - respiratory	-74.04	0.055	0.02	0.884	-73.60	0.106	0.01	0.905	-63.07	0.132
Hosp discharges - digestive	5.65	0.817	0.24	0.625	-1.88	0.935	0.12	0.732	15.51	0.521
Hosp discharges - musculo	-12.39	0.225	0.24	0.625	-9.53	0.341	0.69	0.413	-7.49	0.480
SDR appendicitis	0.00	0.984	3.27	0.071	0.00	0.873	0.07	0.800	-0.01	0.719
SDR hernia & intestinal	0.00	0.989	3.05	0.081	-0.03	0.779	3.23	0.085	0.02	0.855
SDR adverse effects	0.39	0.262	1.14	0.285	0.39	0.269	0.02	0.891	0.40	0.246
Surgical infection rate	0.34	0.045	0.15	0.694	0.10	0.599	0.86	0.381	0.77	0.094

Table 4: Results for first-differenced models

		<i>DID model</i>			<i>Random linear trend model</i>			<i>Differential trend model</i>			
		Eqn (4) estimated by OLS			Eqn (7) estimated by fixed effects			Eqn (14) estimated by OLS			
Dependent variable		Coef	p-value	SHI impact	Coef	p-value	SHI impact	Coef	p-value	SHI impact	# shifts
<i>Health spending</i>	Health expenditures - Total	45.87	0.114	11.3%	47.47	0.098	11.7%	40.04	0.080	9.8%	11
	Health expenditures - Public	45.57	0.036	15.0%	45.20	0.037	14.9%	40.44	0.017	13.3%	11
	Health expenditures - Private	0.61	0.965	0.6%	2.31	0.859	2.2%	0.73	0.956	0.7%	11
	Salaries (%)	4.35	0.012	11.1%	6.34	0.009	16.2%	0.41	0.895	1.0%	3
	Physicians	0.04	0.322	1.3%	0.03	0.410	1.0%	0.06	0.329	1.9%	13
<i>Health outcomes</i>	Life expectancy	-0.21	0.370	-0.3%	-0.24	0.297	-0.3%	-0.09	0.768	-0.1%	13
	Life expectancy (male)	-0.24	0.371	-0.4%	-0.27	0.316	-0.4%	-0.10	0.798	-0.2%	13
	Life expectancy (female)	-0.15	0.374	-0.2%	-0.17	0.286	-0.2%	-0.04	0.866	-0.1%	13
	Under-5 MR (TransMONEE)	0.10	0.911	0.5%	-0.12	0.896	-0.6%	1.96	0.152	9.3%	14
	Under-5 MR (WHO)	0.92	0.195	4.5%	0.81	0.241	3.9%	1.72	0.074	8.4%	13
	Infant MR (WB)	1.03	0.068	9.2%	0.99	0.074	8.9%	1.07	0.104	9.6%	7
	Infant MR (TransMONEE)	0.25	0.667	1.5%	0.10	0.859	0.6%	1.03	0.164	6.1%	14
	Infant MR (WHO)	0.40	0.429	2.4%	0.37	0.446	2.3%	0.90	0.142	5.5%	14
	Perinatal MR	0.39	0.244	3.2%	0.19	0.598	1.6%	0.68	0.022	5.6%	13
	Neonatal MR	0.56	0.158	7.5%	0.43	0.348	5.7%	0.64	0.012	8.4%	10
	Postneonatal MR	-0.46	0.099	-6.5%	-0.55	0.056	-7.8%	0.03	0.942	0.4%	10
	Maternal MR	2.59	0.225	9.1%	2.80	0.206	9.9%	6.03	0.006	21.2%	13
	Maternal MR (3-year)	1.31	0.198	4.5%	1.46	0.199	5.0%	2.14	0.101	7.3%	13
	Caesarean sections	-0.27	0.761	-0.3%	-0.90	0.370	-0.9%	5.41	0.041	5.6%	10
	SDR all causes	5.96	0.777	0.5%	9.37	0.659	0.8%	-17.76	0.553	-1.5%	13
	SDR infectious diseases	1.38	0.447	7.8%	1.45	0.446	8.2%	3.16	0.259	17.9%	13
	SDR tuberculosis	1.63	0.282	15.7%	1.83	0.245	17.7%	2.24	0.430	21.7%	13
	SDR diarrhoea (under 5)	4.09	0.442	13.4%	2.74	0.625	8.9%	10.16	0.119	33.2%	13
	SDR ARI (under 5)	1.63	0.747	1.6%	2.25	0.683	2.2%	18.60	0.089	18.1%	12
	SDR heart disease	-0.36	0.953	-0.1%	1.93	0.735	0.6%	-6.19	0.586	-2.0%	13
	SDR liver diseases	-0.53	0.659	-1.7%	-0.25	0.828	-0.8%	-1.67	0.329	-5.4%	10
	SDR diabetes	0.66	0.615	4.4%	0.89	0.509	6.0%	-0.51	0.582	-3.5%	13
	SDR circulatory diseases	-2.00	0.889	-0.3%	1.79	0.903	0.3%	-25.86	0.227	-4.1%	13
	SDR cerebrovascular diseases	0.88	0.856	0.5%	1.16	0.816	0.7%	-3.53	0.613	-2.0%	13

Dependent variable	<i>DID model</i>			<i>Random linear trend model</i>			<i>Differential trend model</i>			# shifts	
	Eqn (4) estimated by OLS			Eqn (7) estimated by fixed effects			Eqn (14) estimated by OLS				
	Coef	p-value	SHI impact	Coef	p-value	SHI impact	Coef	p-value	SHI impact		
SDR neoplasms	2.23	0.320	1.3%	2.00	0.380	1.2%	0.78	0.737	0.4%	13	
SDR female breast cancer	0.06	0.883	0.3%	0.09	0.844	0.4%	-0.02	0.972	-0.1%	13	
SDR respiratory diseases	2.03	0.283	2.9%	2.23	0.276	3.2%	4.84	0.108	7.0%	13	
SDR bronchitis	3.68	0.300	11.8%	3.62	0.334	11.6%	8.51	0.104	27.3%	13	
SDR digestive diseases	-0.32	0.773	-0.6%	-0.06	0.953	-0.1%	-1.39	0.461	-2.8%	13	
SDR alcohol causes	-1.27	0.731	-0.9%	-0.87	0.802	-0.6%	-7.36	0.169	-5.3%	11	
SDR smoking causes	1.65	0.905	0.3%	1.02	0.943	0.2%	-6.53	0.749	-1.2%	11	
Tuberculosis incidence rate	-2.63	0.342	-4.8%	-2.29	0.430	-4.2%	-10.14	0.010	-18.6%	14	
Hepatitis incidence rate	34.08	0.203	26.4%	29.43	0.281	22.8%	82.56	0.038	63.8%	14	
Hepatitis B incidence rate	1.69	0.127	10.4%	0.85	0.440	5.2%	3.06	0.115	18.7%	12	
Measles incidence rate	-5.09	0.507	-43.1%	-6.53	0.395	-55.3%	-7.05	0.528	-59.7%	14	
Mumps incidence rate	4.68	0.603	8.1%	4.26	0.663	7.4%	6.35	0.684	11.0%	14	
Syphilis incidence rate	7.38	0.457	20.1%	7.69	0.474	20.9%	21.28	0.107	57.9%	14	
Congenital syph incidence rate	-0.01	0.704	-5.3%	-0.02	0.482	-10.9%	-0.01	0.821	-7.0%	7	
Pertussis incidence rate	1.05	0.333	25.8%	0.95	0.402	23.4%	0.40	0.592	9.8%	14	
Diphtheria incidence rate	-0.05	0.936	-3.7%	-0.13	0.850	-8.9%	0.57	0.480	38.0%	14	
Tetanus incidence rate	0.02	0.287	20.8%	0.02	0.264	21.9%	0.02	0.213	23.8%	14	
Cancer incidence rate	2.37	0.447	1.0%	-0.02	0.994	0.0%	10.57	0.029	4.3%	14	
Tuberculosis immunization rate	0.92	0.520	1.0%	0.84	0.559	0.9%	0.56	0.727	0.6%	14	
DPT immunization rate	-0.40	0.738	-0.4%	-0.25	0.846	-0.3%	0.82	0.257	0.9%	14	
Polio immunization rate	1.25	0.381	1.3%	1.36	0.360	1.5%	0.73	0.491	0.8%	14	
Mumps immunization rate	9.69	0.155	11.6%	8.32	0.248	10.0%	9.40	0.143	11.3%	10	
Rubella immunization rate	13.90	0.212	15.3%	8.98	0.233	9.9%	21.49	0.117	23.6%	6	
<i>Hospitals</i>	Length of stay (total)	-0.32	0.063	-2.6%	-0.30	0.081	-2.4%	0.00	0.987	0.0%	14
	Bed occupancy rate	1.91	0.085	2.6%	2.19	0.039	3.0%	0.11	0.944	0.1%	9
	Hospital beds	-0.17	0.371	-2.1%	-0.23	0.238	-2.8%	-0.02	0.923	-0.3%	13
	Inpatient admissions	0.44	0.015	2.7%	0.37	0.061	2.3%	0.40	0.224	2.4%	14
	Acute care admissions	0.63	0.004	4.2%	0.57	0.014	3.7%	0.99	0.121	6.5%	10
	Hospital discharges - infectious	90.63	0.060	11.0%	81.85	0.108	9.9%	149.70	0.009	18.1%	13
	Hosp discharges - cancers	25.18	0.160	3.0%	21.68	0.238	2.6%	43.26	0.162	5.2%	13
	Hosp discharges - heart	11.65	0.279	1.7%	16.43	0.145	2.4%	-43.43	0.170	-6.4%	13

Dependent variable	<i>DID model</i>			<i>Random linear trend model</i>			<i>Differential trend model</i>			
	Eqn (4) estimated by OLS			Eqn (7) estimated by fixed effects			Eqn (14) estimated by OLS			# shifts
	Coef	p-value	SHI impact	Coef	p-value	SHI impact	Coef	p-value	SHI impact	
Hosp discharges - circulatory	37.40	0.125	1.9%	32.16	0.244	1.7%	-9.72	0.860	-0.5%	13
Hosp discharges - cerebrov	12.45	0.073	3.6%	12.65	0.073	3.6%	0.71	0.967	0.2%	13
Hosp discharges - respiratory	96.49	0.121	4.7%	86.83	0.224	4.2%	21.69	0.771	1.0%	13
Hosp discharges - digestive	20.08	0.263	1.2%	7.36	0.699	0.5%	4.03	0.915	0.2%	13
Hosp discharges - musculo	17.74	0.107	2.2%	12.93	0.227	1.6%	53.92	0.051	6.8%	13
SDR appendicitis	-0.04	0.436	-14.1%	-0.05	0.405	-15.6%	0.00	0.954	0.8%	13
SDR hernia & intestinal	-0.16	0.172	-7.1%	-0.18	0.111	-8.3%	-0.08	0.643	-3.7%	13
SDR adverse effects	0.00	0.931	2.1%	0.00	0.983	-0.6%	0.12	0.073	54.2%	6
Surgical infection rate	-1.32	0.013	-142.7%	-1.38	0.006	-148.8%	-1.47	0.017	-159.1%	3

Notes: The first model in the table (DID) is a generalization of the difference-in-differences approach implemented by including covariates in the corresponding estimating equation. Results refer to the coefficient (Coef) and p-values from two-sided *t*-tests with cluster-robust standard errors. SHI impact (%) calculated over the average outcome in the corresponding estimating sub-sample. In the last column, number of shifts refers to the number of transitions between tax-funded and SHI systems in the sub-sample used to estimate the corresponding coefficients.

Table 5: DID results with hospital payment method dummies included

Dependent variable	SHI dummy			Hospital Payment Methods					
	Coef	p-value	Impact	Fee-for-service			Patient-based		
				Coef	p-value	Impact	Coef	p-value	Impact
<i>Health spending</i>									
Health expenditures - Total	21.25	0.360	5.3%	62.50	0.027	15.4%	11.14	0.531	2.8%
Health expenditures - Public	36.32	0.038	12.1%	30.04	0.158	10.0%	-9.26	0.743	-3.1%
Health expenditures - Private	-15.90	0.323	-15.0%	34.73	0.018	32.8%	21.95	0.262	20.7%
Salaries (%)	6.87	0.074	17.2%	0.04	0.979	0.1%	-3.93	0.374	-9.8%
Physicians	0.05	0.205	1.7%	-0.03	0.623	-0.9%	0.01	0.817	0.3%
<i>Health outcomes</i>									
Life expectancy	-0.36	0.141	-0.5%	0.34	0.241	0.5%	0.27	0.305	0.4%
Life expectancy (male)	-0.42	0.154	-0.6%	0.43	0.261	0.6%	0.27	0.379	0.4%
Life expectancy (female)	-0.26	0.135	-0.3%	0.18	0.289	0.2%	0.26	0.206	0.3%
Under-5 MR (TransMONEE)	0.00	0.998	0.0%	0.12	0.893	0.6%	0.43	0.472	2.0%
Under-5 MR (WHO)	0.67	0.367	3.2%	0.49	0.599	2.3%	0.72	0.388	3.5%
Infant MR (WB)	1.02	0.183	9.1%	0.03	0.958	0.2%	0.02	0.980	0.2%
Infant MR (TransMONEE)	0.25	0.692	1.5%	-0.17	0.768	-1.0%	0.34	0.505	2.0%
Infant MR (WHO)	0.25	0.704	1.5%	0.10	0.874	0.6%	0.72	0.376	4.4%
Perinatal MR	0.35	0.437	2.8%	0.07	0.881	0.6%	0.08	0.916	0.6%
Neonatal MR	0.31	0.583	4.0%	0.53	0.304	7.0%	0.55	0.437	7.2%
Postneonatal MR	-0.54	0.074	-7.6%	-0.29	0.299	-4.0%	0.45	0.193	6.4%
Maternal MR	2.39	0.351	8.3%	-0.10	0.977	-0.4%	1.07	0.722	3.7%
Maternal MR (3-year)	1.34	0.277	4.6%	-1.06	0.358	-3.6%	1.05	0.553	3.6%
Caesarean sections	-1.17	0.320	-1.2%	-2.21	0.317	-2.3%	4.95	0.127	5.2%
SDR all causes	20.26	0.352	1.8%	-24.89	0.224	-2.2%	-32.74	0.142	-2.8%
SDR infeccious diseases	1.15	0.552	6.4%	0.15	0.921	0.8%	0.87	0.495	4.8%
SDR tuberculosis	1.68	0.279	16.0%	-0.37	0.630	-3.5%	0.19	0.799	1.8%
SDR diarrhoea (under 5)	3.23	0.454	10.1%	3.90	0.551	12.2%	-0.33	0.921	-1.0%
SDR ARI (under 5)	1.34	0.815	1.3%	-4.65	0.564	-4.4%	6.50	0.507	6.1%
SDR heart disease	4.46	0.529	1.5%	-5.13	0.583	-1.7%	-14.42	0.233	-4.7%
SDR liver diseases	-0.38	0.766	-1.2%	-1.67	0.113	-5.3%	1.23	0.386	3.9%
SDR diabetes	1.33	0.189	8.7%	-3.39	0.000	-22.3%	0.47	0.786	3.1%
SDR circulatory diseases	9.69	0.496	1.5%	-8.84	0.503	-1.4%	-40.39	0.028	-6.4%
SDR cerebrovascular diseases	4.95	0.321	2.8%	-3.05	0.582	-1.7%	-14.46	0.027	-8.2%

Dependent variable	SHI dummy			Hospital Payment Methods						
	Coef	p-value	Impact	Fee-for-service			Patient-based			
				Coef	p-value	Impact	Coef	p-value	Impact	
SDR neoplasms	2.47	0.338	1.4%	0.84	0.735	0.5%	-1.75	0.272	-1.0%	
SDR female breast cancer	0.24	0.566	1.1%	-0.25	0.501	-1.1%	-0.50	0.227	-2.3%	
SDR respiratory diseases	3.12	0.200	4.5%	-3.84	0.181	-5.6%	-0.72	0.732	-1.0%	
SDR bronchitis	5.37	0.237	17.5%	-4.55	0.094	-14.8%	-2.55	0.320	-8.3%	
SDR digestive diseases	-0.29	0.785	-0.6%	-1.15	0.317	-2.3%	1.16	0.417	2.3%	
SDR alcohol causes	0.18	0.975	0.1%	-6.00	0.504	-4.4%	2.39	0.748	1.7%	
SDR smoking causes	10.03	0.544	1.8%	-5.28	0.693	-1.0%	-23.72	0.049	-4.3%	
Tuberculosis incidence rate	-5.28	0.191	-9.7%	4.35	0.086	8.0%	7.28	0.186	13.3%	
Hepatitis incidence rate	20.89	0.417	15.9%	18.49	0.466	14.0%	28.42	0.163	21.6%	
Hepatitis B incidence rate	1.19	0.329	7.2%	0.97	0.297	5.9%	1.10	0.385	6.6%	
Measles incidence rate	-3.83	0.656	-32.0%	-3.61	0.493	-30.2%	0.28	0.956	2.3%	
Mumps incidence rate	14.07	0.467	25.4%	0.78	0.963	1.4%	-40.73	0.405	-73.6%	
Syphilis incidence rate	5.73	0.496	16.7%	-2.45	0.687	-7.2%	15.13	0.167	44.2%	
Congenital syph incidence rate	-0.02	0.549	-11.6%	0.07	0.088	39.3%	-0.07	0.210	-41.7%	
Pertussis incidence rate	1.58	0.243	38.7%	-0.93	0.526	-22.7%	-1.36	0.081	-33.3%	
Diphtheria incidence rate	-0.02	0.985	-1.1%	-0.29	0.735	-19.3%	0.19	0.819	12.6%	
Tetanus incidence rate	0.01	0.516	11.5%	0.02	0.048	29.0%	0.00	0.963	1.3%	
Cancer incidence rate	-0.29	0.934	-0.1%	3.96	0.140	1.6%	7.03	0.139	2.9%	
Tuberculosis immunization rate	-1.03	0.575	-1.1%	2.79	0.224	3.0%	5.84	0.168	6.2%	
DPT immunization rate	-1.79	0.406	-1.9%	2.25	0.381	2.4%	3.92	0.373	4.2%	
Polio immunization rate	0.99	0.546	1.1%	1.23	0.486	1.3%	-0.27	0.848	-0.3%	
Mumps immunization rate	5.50	0.356	6.7%	8.37	0.159	10.1%	4.03	0.588	4.9%	
Rubella immunization rate	12.14	0.223	13.4%	5.22	0.315	5.8%	1.19	0.839	1.3%	
<i>Hospitals</i>	Length of stay (total)	-0.18	0.342	-1.4%	-0.24	0.280	-1.9%	-0.34	0.210	-2.7%
	Bed occupancy rate	2.01	0.118	2.8%	0.82	0.558	1.1%	-1.43	0.401	-2.0%
	Hospital beds	-0.04	0.825	-0.5%	-0.14	0.415	-1.8%	-0.39	0.036	-5.0%
	Inpatient admissions	0.27	0.076	1.7%	0.54	0.004	3.4%	0.14	0.591	0.9%
	Acute care admissions	0.47	0.022	3.1%	0.39	0.101	2.6%	0.06	0.860	0.4%
	Hospital discharges - infectious	75.28	0.051	9.2%	37.51	0.496	4.6%	30.74	0.227	3.8%
	Hosp discharges - cancers	24.20	0.251	3.0%	34.76	0.301	4.3%	-27.28	0.356	-3.4%
	Hosp discharges - heart	0.05	0.996	0.0%	33.43	0.151	5.3%	22.84	0.178	3.6%

Dependent variable	SHI dummy			Hospital Payment Methods					
	Coef	p-value	Impact	Fee-for-service			Patient-based		
				Coef	p-value	Impact	Coef	p-value	Impact
Hosp discharges - circulatory	-28.93	0.624	-1.6%	131.21	0.066	7.1%	175.06	0.248	9.4%
Hosp discharges - cerebrov	8.20	0.128	2.5%	19.10	0.108	5.8%	2.82	0.714	0.9%
Hosp discharges - respiratory	58.86	0.293	3.0%	154.28	0.058	7.8%	33.07	0.688	1.7%
Hosp discharges - digestive	-1.76	0.921	-0.1%	86.98	0.128	5.5%	10.75	0.719	0.7%
Hosp discharges - musculo	7.63	0.546	1.0%	48.24	0.084	6.4%	-3.48	0.885	-0.5%
SDR appendicitis	-0.04	0.427	-14.5%	-0.04	0.456	-13.1%	0.05	0.389	18.5%
SDR hernia & intestinal	-0.14	0.293	-6.1%	-0.19	0.079	-8.6%	0.10	0.450	4.8%
SDR adverse effects	0.00	0.979	-0.8%	-0.11	0.097	-53.4%	0.07	0.248	35.2%
Surgical infection rate	-1.62	0.006	-175.3%	0.30	0.003	32.3%			

Notes: The results correspond to the estimation of a generalized difference-in-differences model implemented by including covariates as specified in eqn (4) in the text. Results refer to the coefficient (Coef) and p-values from two-sided *t*-tests with cluster-robust standard errors for the SHI status, fee-for-service (FFS) and patient-based payment (PBP) methods dummies. The estimated impact (%) of each dummy on a given health outcome has been calculated over the average outcome in the corresponding estimating sub-sample. The coefficient of the PBP dummy could not be estimated for the surgical infection rate due to the lack of transitions from/to PBP in that particular estimating sub-sample.

Figure 1: SHI as a share of total health spending, 1990-2003

country	90	91	92	93	94	95	96	97	98	99	00	01	02	03
Albania														
Armenia														
Azerbaijan														
Belarus														
Bosnia and Herzegovina	M	M	M	M	M	M	M	M						
Bulgaria														
Croatia														
Czech Republic														
Estonia			M	M	M									
Georgia														
Hungary	M		M		M									
Kazakhstan														
Kyrgyz Republic														
Latvia														
Lithuania		M	M	M										
Macedonia, FYR		M	M	M	M									
Moldova														
Poland														
Romania														
Russian Federation														
Serbia and Montenegro	M	M	M	M	M	M	M							
Slovak Republic														
Slovenia			M	M										
Tajikistan														
Turkey	M	M												
Turkmenistan														
Ukraine														
Uzbekistan														

M	Missing data
	SHI share = 0%
	0% < SHI share < 50%
	50% < SHI share

Source: HiTs and World Health Reports, various years

Figure 2: Hospital payment methods, 1990-2004

country	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04
Albania															
Armenia															
Azerbaijan															
Belarus															
Bosnia and Herzegovina															
Bulgaria															
Croatia															
Czech Republic															
Estonia															
Georgia															
Hungary															
Kazakhstan															
Kyrgyz Republic															
Latvia															
Lithuania															
Macedonia, FYR															
Moldova															
Poland															
Romania															
Russian Federation															
Serbia and Montenegro															
Slovak Republic															
Slovenia															
Tajikistan															
Turkey															
Turkmenistan															
Ukraine															
Uzbekistan															



Source: HiTs

Figure 3: SHI classification, 1990-2004

country	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04
Albania															
Armenia															
Azerbaijan															
Belarus															
Bosnia and Herzegovina															
Bulgaria															
Croatia															
Czech Republic															
Estonia															
Georgia															
Hungary															
Kazakhstan															
Kyrgyz Republic															
Latvia															
Lithuania															
Macedonia, FYR															
Moldova															
Poland															
Romania															
Russian Federation															
Serbia and Montenegro															
Slovak Republic															
Slovenia															
Tajikistan															
Turkey															
Turkmenistan															
Ukraine															
Uzbekistan															

 SHI system

Source: HiTs

Figure 4: The evolution of SHI adoption and average health expenditure per capita in ECA countries (1990-2004)

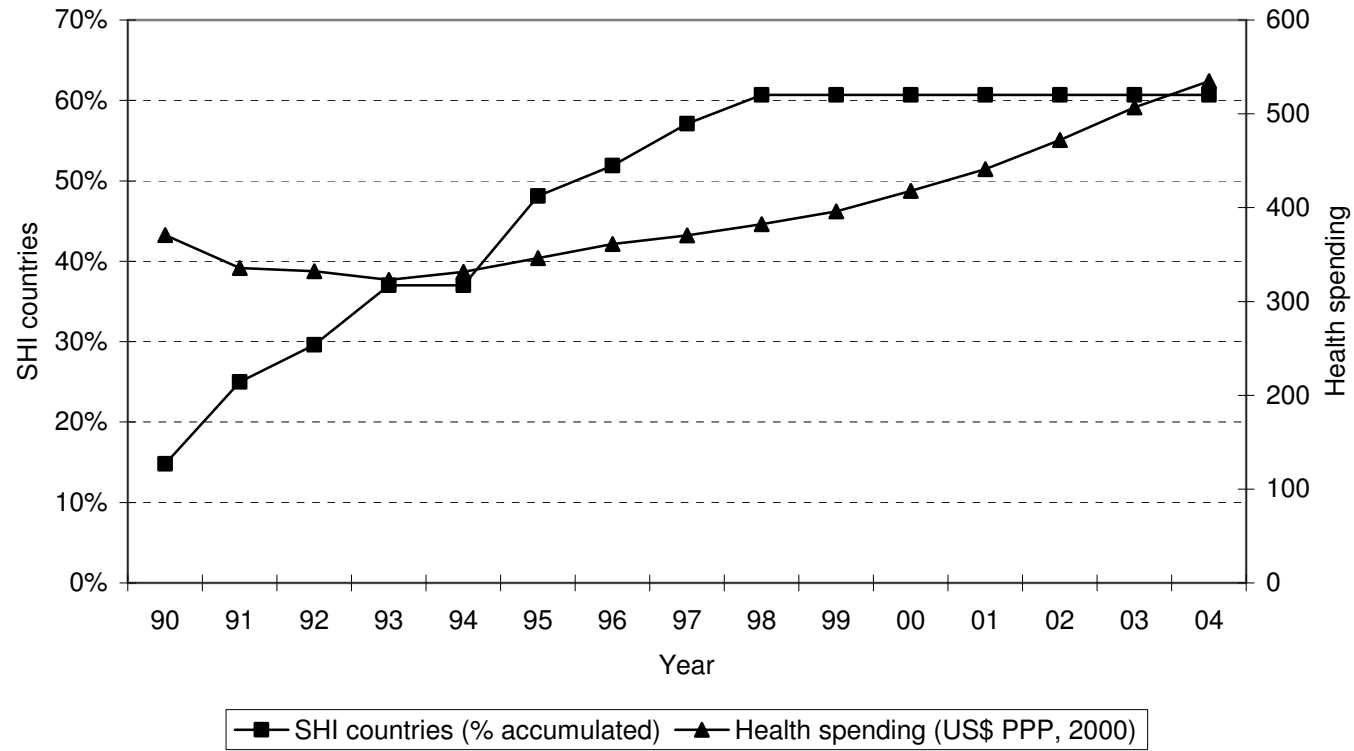
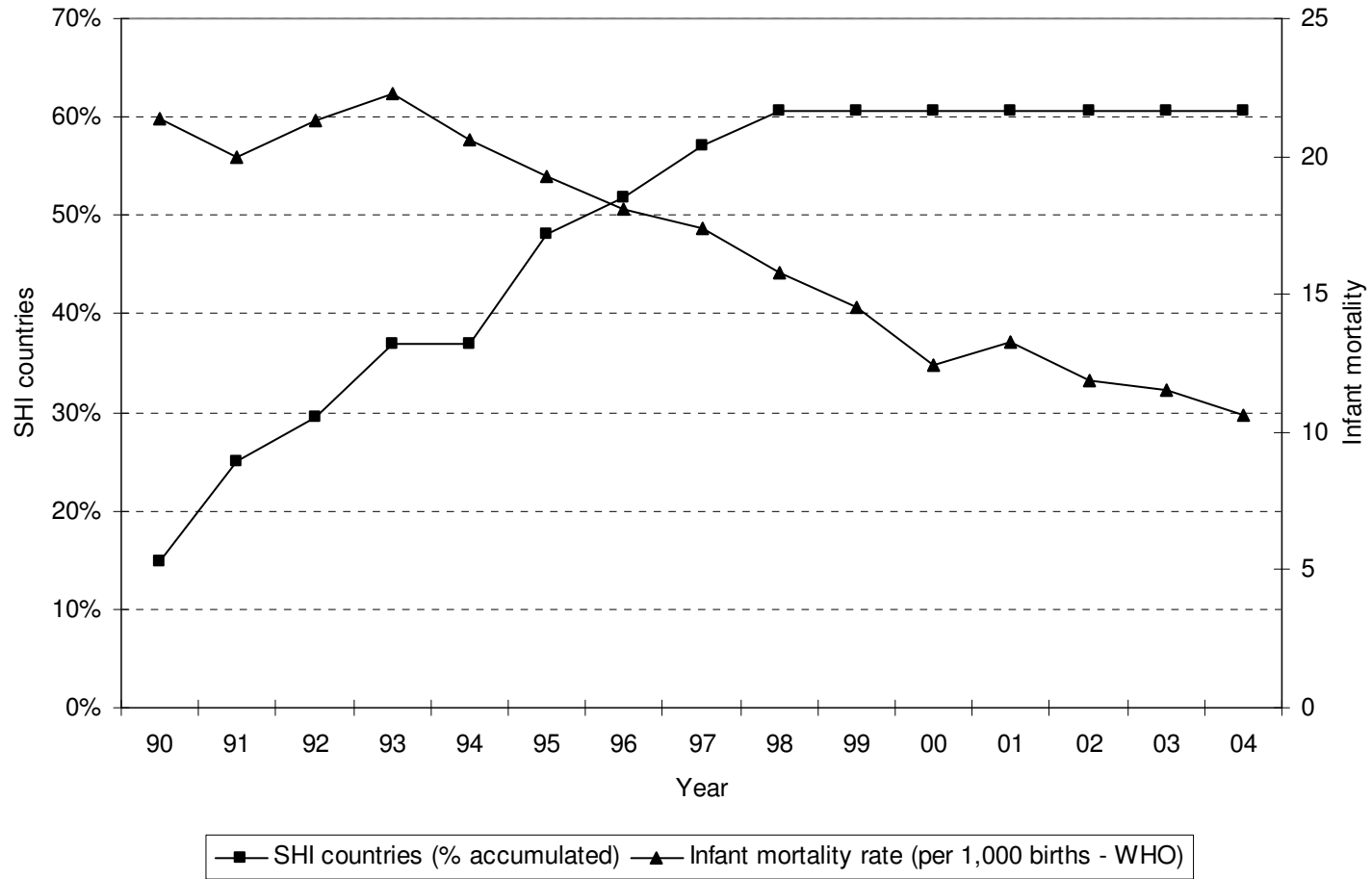


Figure 5: The evolution of SHI adoption and average infant mortality rate in ECA countries (1990-2004)



APPENDIX

Table A1: Health sector outcome variables: definitions and sources

Variable	Definition	Source
Total health expenditure per capita (constant 2000 international US\$)	Sum of General Government and of Private Expenditure on Health. Estimates for this indicator were produced by WHO. Data are in constant 2000 international dollars (deflated using the US GDP deflator).	Own calculations, based on the following sources: 1990-1997: WDI 2002 database (Serbia and Montenegro = Yugoslavia, Fed.). From 1998 onwards: WHO estimates, HFA-DB.
Government health expenditure per capita (constant 2000 international US\$)	General Government Expenditure on Health. Estimates for this indicator were produced by WHO. Data are in constant 2000 international dollars (deflated using the US GDP deflator).	See above.
Private health expenditure per capita (constant 2000 international US\$)	Private Expenditure on Health. Estimates for this indicator were produced by WHO. Data are in constant 2000 international dollars (deflated using the US GDP deflator).	See above.
Salaries as percentage of total government health expenditure	Includes salaries, bonuses to fixed rate wages and salaries, and overtime payments to employees in the publicly financed health sector.	WHO, HFA-DB.
Physicians (per 1,000 people)	Physicians are defined as graduates of any facility or school of medicine who are working in the country in any medical field (practice, teaching, research).	WDI Database - DDP, based on data from World Health Organization, OECD, TransMONEE, supplemented by country data.
Life expectancy at birth, in years	Calculated by WHO/EURO for all countries which report detailed mortality data to WHO, using Wiesler's method.	WHO, HFA-DB.
Life expectancy at birth, in years, male	Calculated by WHO/EURO for all countries which report detailed mortality data to WHO, using Wiesler's method.	WHO, HFA-DB.
Life expectancy at birth, in years, female	Calculated by WHO/EURO for all countries which report detailed mortality data to WHO, using Wiesler's method.	WHO, HFA-DB.
Mortality rate, under-5 (per 1,000) – TransMONEE	Probability of dying before age 5 years per 1000 live births, calculated as the number of deaths per 1000 live births until 5 years of age.	TransMONEE 2006 Database, UNICEF IRC, Florence.
Mortality rate, under-5 (per 1,000) – WHO	See above.	WHO, HFA-DB.
Mortality rate, infant (per 1,000 live births) - World Bank	Number of infants dying before reaching one year of age, per 1,000 live births in a given year. Harmonized estimates of the World Health Organization, UNICEF, and the World Bank, based mainly on household surveys, censuses, and vital registration, supplemented by World Bank estimates based on household surveys and vital registration.	WDI-DDP database.

Variable	Definition	Source
Mortality rate, infant (per 1,000 live births) – TransMONEE	Number of infants dying before reaching one year of age, per 1,000 live births in a given year.	TransMONEE 2006 Database, UNICEF IRC, Florence.
Mortality rate, infant (per 1,000 live births) - WHO	See above.	WHO, HFA-DB.
Perinatal mortality rate (per 1,000 births)	Weight specific (1000 g +) fetal deaths and early neonatal deaths per 1000 births (live births+stillbirths)	WHO, HFA-DB.
Neonatal mortality rate (per 1,000 live births)	Number of deaths in infants under 28 days of age in a year, per 1000 live births in that year (ICD-10).	WHO, HFA-DB.
Postneonatal mortality rate (per 1,000 live births)	Number of deaths in infants between 4 weeks and a year of age in a year, per 1000 live births in that year (ICD-10).	WHO, HFA-DB.
Maternal mortality rate (per 100,000 live births)	Maternal deaths per 100,000 live births. A maternal death is death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes.	WHO, HFA-DB.
Maternal mortality rate (per 100,000 live births) - moving average (3 years)	Moving average (3 years) of maternal deaths per 100,000 live births.	WHO, HFA-DB.
Caesarean sections (per 1,000 live births)	Number of caesarean sections per 1000 live births.	WHO, HFA-DB.
Death rate, all causes (per 100,000)	Standardized death rate, all causes, all ages, per 100,000.	WHO, HFA-DB.
Death rate, infectious diseases (per 100,000)	Standardized death rate, infectious and parasitic diseases, all ages, per 100,000.	WHO, HFA-DB.
Death rate, tuberculosis (per 100,000)	Standardized death rate, tuberculosis, all ages, per 100,000.	WHO, HFA-DB.
Death rate, diarrhoeal diseases, under five years (per 100,000)	Standardized death rate, diarrhoeal diseases, under 5 years per 100,000.	WHO, HFA-DB.
Death rate, ARI, under five years (per 100,000)	Standardized death rate, acute respiratory infections, under 5 years per 100,000.	WHO, HFA-DB.
Death rate, ischaemic heart disease (per 100,000)	Standardized death rate, ischaemic heart disease, all ages per 100,000.	WHO, HFA-DB.
Death rate, liver diseases (per 100,000)	Standardized death rate, chronic liver disease and cirrhosis, all ages per 100,000.	WHO, HFA-DB.
Death rate, diabetes (per 100,000)	Standardized death rate, diabetes, all ages, per 100,000.	WHO, HFA-DB.
Death rate, circulatory diseases (per 100,000)	Standardized death rate, diseases of circulatory system, all ages, per 100,000.	WHO, HFA-DB.
Death rate, cerebrovascular diseases (per 100,000)	Standardized death rate, cerebrovascular diseases, all ages, per 100,000.	WHO, HFA-DB.
Death rate, neoplasms (per 100,000)	Standardized death rate, malignant neoplasms, all ages, per 100,000.	WHO, HFA-DB.
Death rate, breast cancer (per 100,000)	Standardized death rate, malignant neoplasm female breast, all ages, per 100,000.	WHO, HFA-DB.

Variable	Definition	Source
Death rate, respiratory diseases (per 100,000)	Standardized death rate, diseases of the respiratory system, all ages, per 100,000.	WHO, HFA-DB.
Death rate, bronchitis/emphysema/asthma (per 100,000)	Standardized death rate, bronchitis/emphysema/asthma, all ages, per 100,000.	WHO, HFA-DB.
Death rate, digestive diseases (per 100,000)	Standardized death rate, diseases of the digestive system, all ages, per 100,000.	WHO, HFA-DB.
Death rate, alcohol causes (per 100,000)	Standardized death rate, selected alcohol related causes, per 100,000. The mortality from combined, selected causes of death which are known from literature to be related to alcohol consumption. Includes: cancer of oesophagus and larynx; alcohol dependence syndrom; chronic liver disease and cirrhosis; all external causes.	WHO, HFA-DB.
Death rate, smoking causes (per 100,000)	Standardized death rate, selected smoking related causes, per 100,000. The mortality from combined, selected causes of death which are known from literature to be related to smoking. Includes: cancers of mouth and pharynx, larynx, traxea, bronchus, lung and oesophagus; ischaemic heart disease; cerebrovascular diseases; chronic obstructive pulmonary disease.	WHO, HFA-DB.
Tuberculosis incidence rate (per 100,000)	Tuberculosis incidence per 100,000. Number of newly diagnosed tuberculosis cases, all forms (ICD-9:010-018; ICD-10: A15-A19) during the given calendar year.	WHO, HFA-DB.
Hepatitis incidence rate (per 100,000)	Viral hepatitis incidence per 100,000.	WHO, HFA-DB.
Hepatitis B incidence rate (per 100,000)	Viral hepatitis B incidence per 100,000.	WHO, HFA-DB.
Measles incidence rate (per 100,000)	Measles incidence per 100,000.	WHO, HFA-DB.
Mumps incidence rate (per 100,000)	Mumps incidence per 100,000.	WHO, HFA-DB.
Syphilis incidence rate (per 100,000)	Syphilis incidence per 100,000.	WHO, HFA-DB.
Congenital syphilis incidence rate (per 100,000)	Congenital syphilis incidence per 100,000.	WHO, HFA-DB.
Pertussis incidence rate (per 100,000)	Pertussis incidence per 100,000.	WHO, HFA-DB.
Diphtheria incidence rate (per 100,000)	Diphtheria incidence per 100,000.	WHO, HFA-DB.
Tetanus incidence rate (per 100,000)	Tetanus incidence per 100,000.	WHO, HFA-DB.
Cancer incidence rate (per 100,000)	Cancer incidence per 100,000. Number of patients with newly diagnosed cancer during given calendar year.	WHO, HFA-DB.
Immunization rate, tuberculosis, infants (%)	Percentage of infants reaching their first birthday in the given calendar year who have been fully vaccinated against tuberculosis (BCG, 1 dose).	WHO, HFA-DB.

Variable	Definition	Source
Immunization rate, DPT, infants (%)	Percentage of children under 2 immunized against diphtheria, pertussis and tetanus.	TransMONEE 2006 Database, UNICEF IRC, Florence.
Immunization rate, poliomyelitis, infants (%)	Percentage of infants reaching their first birthday in the given calendar year who have been fully vaccinated against poliomyelitis (3 doses).	WHO, HFA-DB.
Immunization rate, mumps, infants (%)	Percentage of infants reaching their second birthday in the given calendar year who have been fully vaccinated against mumps.	WHO, HFA-DB.
Immunization rate, rubella, infants (%)	Percentage of infants reaching their second birthday in the given calendar year who have been fully vaccinated against rubella.	WHO, HFA-DB.
Average length of stay, all hospitals	Total number of occupied hospital bed-days of all hospitals divided by the total number of admissions or discharges in those hospitals. Length of stay (LOS) of one patient = date of discharge - date of admission. If these are the same dates, then LOS is set to one day. Bed-days of newborns are excluded in the calculation.	WHO, HFA-DB.
Bed occupancy rate (%), acute care hospitals only	Average number of days when hospital bed was occupied as percentage of available 365 days. Calculation: utilized bed-days x 100/available bed-days during the calendar year.	WHO, HFA-DB.
Hospital beds (per 1,000 people)	Hospital beds include in-patient beds available in public, private, general, and specialized hospitals and rehabilitation centers. In most cases beds for both acute and chronic care are included.	WDI Database - DDP, based on data from World Health Organization, OECD, TransMONEE, supplemented by country data.
In-patient care admissions (per 100)	Admission is the hospitalization of a patient in an in-patient facility normally involving a stay of at least 24 hours. In the case of death or discharge to another health establishment, the actual stay may be shorter than 24 hours. These cases are registered as a one-day hospitalization. The number of admissions excludes: a transfer from one department to another one at the same hospital; day-cases of day patients; weekend leave when the patient has been released temporarily and the hospital bed is still reserved; cases where treatment is provided by hospital personnel at the patient's home. Newborns are not included.	WHO, HFA-DB.
Acute care hospital admissions (per 100)	Same as above, short stay hospitals only.	WHO, HFA-DB.
Hospital discharges, infectious and parasitic diseases (per 100,000)	Total number of patients discharged from all hospitals during the given calendar year with the principal diagnosis falling into the group of infectious and parasitic diseases (Chapter I of ICD-9/10). Discharge is the conclusion of a period of in-patient care, whether the patient returned to his home, was transferred to another in-patient facility or died.	WHO, HFA-DB.

Variable	Definition	Source
Hospital discharges, all cancers (per 100,000)	Total number of patients discharged from all hospitals during the given calendar year with the principal diagnosis falling into the group of cancers (Chapter II of ICD-9/10).	WHO, HFA-DB.
Hospital discharges, ischaemic heart disease (per 100,000)	Total number of patients discharged from all hospitals during the given calendar year with the principal diagnosis falling into the group of ischaemic heart diseases (ICD-10: I20-I25).	WHO, HFA-DB.
Hospital discharges, circulatory system diseases (per 100,000)	Total number of patients discharged from all hospitals during the given calendar year with the principal diagnosis falling into the group of circulatory system diseases (Chapter IX of ICD-10).	WHO, HFA-DB.
Hospital discharges, cerebrovascular diseases (per 100,000)	Total number of patients discharged from all hospitals during the given calendar year with the principal diagnosis falling into the group of cerebrovascular diseases (ICD-10: I60-I69).	WHO, HFA-DB.
Hospital discharges, respiratory diseases (per 100,000)	Total number of patients discharged from all hospitals during the given calendar year with the principal diagnosis falling into the group of respiratory diseases (Chapter X of ICD-10).	WHO, HFA-DB.
Hospital discharges, digestive system diseases (per 100,000)	Total number of patients discharged from all hospitals during the given calendar year with the principal diagnosis falling into the group of digestive system diseases (Chapter XI of ICD-10).	WHO, HFA-DB.
Hospital discharges, musculoskeletal system and connective tissue diseases (per 100,000)	Total number of patients discharged from all hospitals during the given calendar year with the principal diagnosis falling into the group of musculoskeletal system and connective tissue diseases (Chapter XIII of ICD-10).	WHO, HFA-DB.
Death rate, appendicitis (per 100,000)	Standardized death rate, appendicitis, all ages, per 100,000.	WHO, HFA-DB.
Death rate, hernia and intestinal obstruction (per 100,000)	Standardized death rate, hernia and intestinal obstruction, all ages, per 100,000.	WHO, HFA-DB.
Death rate, adverse effects of therapeutic agents (per 100,000)	Standardized death rate, adverse effects of therapeutic agents, all ages, per 100,000.	WHO, HFA-DB.
Surgical infection rate, all operations (%)	Average rate of in-patient surgical operations in all hospitals with postoperative surgical wound infection during the given calendar year (ICD-10: T81.4)	WHO, HFA-DB.

Table A2: Covariates included in the X -vector: definitions and sources

Variable	Definition	Source
GDP per capita (constant 2000 international dollars)	GDP per capita based on purchasing power parity (PPP). Data are in constant 2000 international dollars (deflated using the US GDP deflator).	WB-WDI Database.
Population ages 65 and above (% of total)	Percentage of the total population that is 65 or older.	WB-WDI Database.
Urban population (% of total)	Urban population is the midyear population of areas defined as urban in each country and reported to the United Nations.	WB-WDI Database.

Table A3: Classification of hospital payment methods in the dataset

Country	SHI adoption	Hospital Payment Methods		Values assumed by the corresponding dummies in the dataset
		Predominant method	Years	
Albania	1995	B		B=1 throughout
Armenia	Never	B		B=1 throughout
Azerbaijan	Never	B		B=1 throughout
Belarus	Never	?		all missing
Bosnia and Herzegovina	Prior to 1990	B		B=1 throughout
Bulgaria	1999	B	Until 1998	B=1 (until 1998)
		PBP	1999 onwards	PBP=1 (1999 onwards)
Croatia	Prior to 1990	B	Until 1992	B=1 (until 1992)
		FFS	1993 onwards	FFS=1 (1993 onwards)
Czech Republic	1993	B	Until 1992	B=1 (until 1992)
		FFS	1993-1997	FFS=1 (1993-1997)
		B	1998 onwards	B=1 (1998 onwards)
Estonia	1992	B	Until 1991	B=1 (until 1991)
		FFS	Until 2003	FFS=1 (1992-2003)
		PBP	2004 onwards	PBP=1 (2004 onwards)
Georgia	1995	B	Until 1995	B=1 (until 1995)
		PBP	1996 onwards	PBP=1 (1996 onwards)
Hungary	1990	B	Until 1992	B=1 (until 1992)
		PBP	1993 onwards	PBP=1 (1993 onwards)
Kazakhstan	1996 (scrapped 1998)	B	Until 1995	B=1 (until 1995)
		PBP	1996 onwards	PBP=1 (1996 onwards)
Kyrgyz Republic	1997	B	Until 1996	B=1 (until 1996)
		FFS	1997 onwards	FFS=1 (1997 onwards)
Latvia	Never	B	Until 1993	B=1 (until 1993)
		FFS	1994-1997	FFS=1 (1994-1997)
		PBP	1998 onwards	PBP=1 (1998 onwards)
Lithuania	1991	B	Until 1993	B=1 (until 1993)
		PBP	1994 onwards	PBP=1 (1994 onwards)
Macedonia, FYR	1991	B	Until 1990	B=1 (until 1990)
		FFS	1991 onwards	FFS (1991 onwards)
Moldova	Never	B		B=1 throughout
Poland	Never	B	Until 1998	B=1 (until 1998)
		PBP	1999 onwards	PBP=1 (1999 onwards)
Romania	1998	B		B=1 throughout
Russian Federation	1993	B		B=1 throughout
Serbia and Montenegro	Prior to 1990	?		all missing
Slovak Republic	1995	B	Until 1993	B=1 (until 1993)
		FFS	1994-1998	FFS=1 (1994-1998)
		B	1999-2001	B=1 (1999-2001)
		PBP	2002 onwards	PBP=1 (2002 onwards)
Slovenia	1992	B	Until 1991	B=1 (until 1991)
		PBP	1992 onwards	PBP=1 (1992 onwards)
Tajikistan	Never	B		B=1 throughout
Turkey	Prior to 1990	B		B=1 throughout
Turkmenistan	Never	B		B=1 throughout
Ukraine	Never	B		B=1 throughout

Country	SHI adoption	Hospital Payment Methods		Values assumed by the corresponding dummies in the dataset
		Predominant method	Years	
Uzbekistan	Never	B		B=1 throughout

Notes: B = fixed budget/block grants; FFS = fee-for-service/payment by bed days; PBP = patient-based payment method. Source: HiTs.

Table A4: Results for fixed-effects models

		<i>DID model</i>			<i>Differential trend model</i>		
		Eqn (3) estimated by fixed effects			Eqn (10) estimated by fixed effects		
	Dependent variable	Coef	p-value	SHI impact	Coef	p-value	SHI impact
<i>Health spending</i>	Health expenditures - Total	42.68	0.110	10.6%	43.30	0.120	10.8%
	Health expenditures - Public	31.51	0.079	10.5%	35.23	0.050	11.7%
	Health expenditures - Private	11.17	0.597	11.0%	8.07	0.700	7.9%
	Salaries (%)	-0.16	0.949	-0.4%	-2.06	0.281	-5.2%
	Physicians	0.04	0.712	1.2%	0.02	0.816	0.7%
<i>Health outcomes</i>	Life expectancy	-0.10	0.760	-0.1%	-0.17	0.585	-0.2%
	Life expectancy (male)	-0.17	0.658	-0.3%	-0.26	0.504	-0.4%
	Life expectancy (female)	0.02	0.918	0.0%	-0.04	0.864	-0.1%
	Under-5 MR (TransMONEE)	0.56	0.755	2.6%	0.70	0.704	3.3%
	Under-5 MR (WHO)	1.37	0.523	6.5%	1.45	0.507	6.9%
	Infant MR (WB)	1.11	0.362	5.6%	1.06	0.301	5.4%
	Infant MR (TransMONEE)	0.79	0.450	4.6%	0.90	0.399	5.3%
	Infant MR (WHO)	0.96	0.428	5.7%	1.14	0.362	6.8%
	Perinatal MR	2.42	0.006	19.6%	2.42	0.007	19.6%
	Neonatal MR	1.23	0.003	16.0%	1.20	0.003	15.6%
	Postneonatal MR	-0.84	0.490	-11.5%	-0.76	0.496	-10.4%
	Maternal MR	3.71	0.451	12.6%	4.35	0.399	14.8%
	Maternal MR (3-year)	2.21	0.635	7.5%	2.08	0.666	7.1%
	Caesarean sections	6.23	0.223	6.6%	6.74	0.183	7.2%
	SDR all causes	-14.45	0.510	-1.3%	-6.99	0.746	-0.6%
	SDR infectious diseases	3.49	0.154	20.0%	3.63	0.132	20.8%
	SDR tuberculosis	1.32	0.452	13.1%	1.60	0.376	15.9%
	SDR diarrhoea (under 5)	22.80	0.059	72.4%	22.34	0.056	70.9%
	SDR ARI (under 5)	-13.66	0.518	-12.9%	-13.95	0.504	-13.1%
	SDR heart disease	-21.46	0.186	-6.9%	-21.57	0.208	-7.0%
	SDR liver diseases	-1.53	0.474	-5.1%	-1.61	0.484	-5.3%
	SDR diabetes	-1.57	0.211	-10.7%	-1.55	0.214	-10.6%
SDR circulatory diseases	-24.24	0.160	-3.9%	-18.72	0.275	-3.0%	
SDR cerebrovascular diseases	-0.87	0.914	-0.5%	-0.08	0.993	0.0%	

Dependent variable	<i>DID model</i>			<i>Differential trend model</i>		
	Eqn (3) estimated by fixed effects			Eqn (10) estimated by fixed effects		
	Coef	p-value	SHI impact	Coef	p-value	SHI impact
SDR neoplasms	5.89	0.098	3.4%	5.11	0.146	3.0%
SDR female breast cancer	-0.02	0.971	-0.1%	-0.05	0.934	-0.2%
SDR respiratory diseases	-4.62	0.194	-6.7%	-4.75	0.203	-6.9%
SDR bronchitis	5.31	0.054	17.0%	5.75	0.052	18.4%
SDR digestive diseases	-1.90	0.358	-3.9%	-1.78	0.419	-3.7%
SDR alcohol causes	-5.09	0.630	-3.7%	-4.29	0.677	-3.1%
SDR smoking causes	-6.12	0.806	-1.1%	-8.87	0.738	-1.6%
Tuberculosis incidence rate	3.31	0.679	6.2%	2.07	0.808	3.9%
Hepatitis incidence rate	45.33	0.058	33.0%	55.21	0.011	40.2%
Hepatitis B incidence rate	6.66	0.094	39.1%	6.36	0.130	37.4%
Measles incidence rate	3.57	0.611	27.6%	4.38	0.568	33.9%
Mumps incidence rate	14.13	0.175	24.8%	13.20	0.111	23.2%
Syphilis incidence rate	14.80	0.259	43.5%	16.39	0.218	48.2%
Congenital syph incidence rate	0.28	0.074	176.3%	0.29	0.065	182.2%
Pertussis incidence rate	1.50	0.098	36.2%	1.52	0.101	36.7%
Diphtheria incidence rate	0.61	0.442	43.3%	0.55	0.495	39.2%
Tetanus incidence rate	0.01	0.728	9.3%	0.01	0.816	6.2%
Cancer incidence rate	-5.25	0.721	-2.1%	-1.13	0.930	-0.5%
Tuberculosis immunization rate	1.80	0.484	1.9%	1.62	0.559	1.7%
DPT immunization rate	0.43	0.824	0.5%	0.37	0.852	0.4%
Polio immunization rate	1.35	0.333	1.5%	1.20	0.396	1.3%
Mumps immunization rate	3.62	0.580	4.4%	3.50	0.622	4.3%
Rubella immunization rate	5.25	0.564	5.9%	10.13	0.356	11.5%
<i>Hospitals</i> Length of stay (total)	-0.53	0.191	-4.2%	-0.51	0.223	-4.0%
Bed occupancy rate	10.81	0.134	14.9%	11.83	0.155	16.3%
Hospital beds	0.05	0.908	0.6%	-0.28	0.517	-3.4%
Inpatient admissions	0.71	0.300	4.3%	0.73	0.331	4.5%
Acute care admissions	0.71	0.325	4.7%	1.24	0.208	8.1%
Hospital discharges - infectious	149.81	0.002	17.9%	151.77	0.002	18.1%
Hosp discharges - cancers	85.58	0.259	10.5%	81.01	0.286	9.9%
Hosp discharges - heart	-24.95	0.590	-3.7%	-31.97	0.515	-4.7%

Dependent variable	<i>DID model</i>			<i>Differential trend model</i>		
	Eqn (3) estimated by fixed effects			Eqn (10) estimated by fixed effects		
	Coef	p-value	SHI impact	Coef	p-value	SHI impact
Hosp discharges - circulatory	31.79	0.759	1.7%	20.58	0.855	1.1%
Hosp discharges - cerebrov	14.69	0.506	4.3%	11.08	0.636	3.2%
Hosp discharges - respiratory	43.34	0.756	2.1%	38.34	0.806	1.8%
Hosp discharges - digestive	64.94	0.394	4.0%	64.00	0.445	3.9%
Hosp discharges - musculo	67.81	0.162	8.6%	73.59	0.127	9.3%
SDR appendicitis	0.00	0.995	-0.1%	0.02	0.716	5.7%
SDR hernia & intestinal	0.03	0.838	1.1%	0.10	0.473	4.4%
SDR adverse effects	0.19	0.039	95.5%	0.20	0.017	101.5%
Surgical infection rate	-1.18	0.131	-125.0%	-0.25	0.675	-27.0%

Notes: The first model in the table (DID) is a generalization of the difference-in-differences approach implemented by including covariates in the corresponding estimating equation. Results refer to the coefficient (Coef) and p-values from two-sided *t*-tests with cluster-robust standard errors. SHI impact (%) calculated over the average outcome in the corresponding estimating sub-sample.

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