EAST – WEST: DOES IT MAKE A DIFFERENCE TO HOSPITAL EFFICIENCIES IN UKRAINE?

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ABSTRACT

Ukraine's history has given it a split personality, as was observed in the recent presidential elections. Eastern regions were heavily influenced by Russo-Soviet rule, while Western regions have more of a European outlook. This study compares recent trends in hospital efficiency in Ukraine to see if this split personality manifests itself in differential rates of improvement. Given the inflexibility of Soviet-style planned economies, it is hypothesized that Western regions will show greater improvement in economic efficiency. Data for this study comes from three oblasts (i.e., geopolitical regions), one in the West and two in the East, spanning from 1997 to 2001. Data Envelopment Analysis (DEA) was used to estimate technical efficiency for the hospitals. The DEA scores were then analyzed with the Malmquist Productivity Function, which provides a measure of productivity change, and a distribution test to measure efficiency change across units and over time. Results indicate that hospitals in the West improved efficiencies, while those in the East declined or did not change. These Western areas, following a more Western form of governance may be quicker to pick up on new techniques to increase healthcare delivery efficiencies. This may stem from a longer history away from the Soviet/Eastern style of a planned and controlled economy.

Introduction

This study looks behind simple technological efficiencies to determine the association between cultural differences and variations in efficiency exhibited by healthcare institutions in Ukraine. Ukraine provides a natural laboratory for examining changing managerial behaviors in light of environmental changes. Ukraine has undergone extraordinary change since becoming independent from the Soviet Union in 1991. However, more importantly, Ukraine's history and position in Europe provide an opportunity to examine differences in effect of health policy that can be related to cultural biases with respect to economic behavior.

The World Bank [1] has identified health sector reform in Ukraine as necessary to economic development. Currently most health resources are owned and financed by the Government of Ukraine, but is currently in the process of implementing health finance reform and looking to restructure the system through the development of primary care. One of the strategies recommended by the World Bank is to abandon the current approach of budgeting hospital services to one of selective contracting. In this scenario, hospital management must be able to respond by demonstrating value to the purchaser – and be held to new performance standards. This study examined the response at the hospital level to economic incentives that were implemented between 1997 and 1999.

Ukraine has an under-funded health system that makes change more difficult. In 2000 health care expenditures amounted to 2.8% of GDP compared to a minimum 5.8% recommended by the WHO. Actual expenditures increased from 2.5 billion UAH (Ukrainian hryvna) in 1995 to 5.2 billion UAH in 2001, which amounts to an increase from 49.1 to 105.6 UAH in per capita spending. However, when adjusting for Ukrainian high rates of inflation the per capita spending actually decreased in real dollars from $33.33 in 1995 to $20 in 2001. Coupled with the

Ukrainian constitutional constraint forbidding reductions to the existing network of medical institutions [1], the reduction in real spending can only be accommodated by improved productivity and efficiency.

While the Ministry of Health (MOH) owns and operates all hospitals in theory, between 1997 and 1999, budgetary authority and accountability was shifted downward from the central MOH to the oblast (i.e. state or canton unit of government) level of administration [1] [2]. Oblast health administrators were given greater discretion in local budgets and relied more directly on contributions from local tax authorities. Given national economic constraints and population health needs, health authorities at the local level faced incentives to improve efficiency to better serve health needs of constituents within budgetary constraints. We contend that cultural differences between the eastern and western regions of Ukraine mediated the response in terms of changes in hospital efficiency. This hypothetical difference in managerial response to market incentives is consistent with observations of managerial behavior and beliefs about management observed in other post-socialist transition economies in the region [3] [4].

DiMaggio [5] suggests that culture can influence different types of economic behavior including production. Further, there are different levels of culture: including organizational, social class, and national. Each level can affect economic behavior. For example, the belief that firms' effectiveness varies as a function of their organizational culture goes back to the Hawthorne studies [6]. Traits associated with class cultures may affect economic behaviors such as work motivation and leisure-earnings tradeoffs. Finally, trans-national cultural differences may affect economic performance. For a common example, compared to Americans, Japanese may have a greater collective orientation and view work as more important [5]. Indeed, compared to U.S. workers, Japanese work longer hours, are absent less often, and strike less frequently [7].

The relationship between culture and economic behavior is very complex and consequently, the evidence to support this relationship is ambiguous [5]. Nevertheless, we feel that the recent history in Ukraine presents a valuable natural experiment on the affect of culture on performance. In this study, we restrict our attention to regional variations in culture and how they might be related to changes in the efficiency of hospitals in the eastern and western regions of Ukraine.

Background

History – Foundation of Cultural Distinctions between East and West

Throughout its long history the western and eastern regions of the Ukrainian territory have been divided even though they share a common ethnic, linguistic, and cultural heritage. Differences between the extreme eastern and western Ukraine cities, such as Donetsk and Lviv, are as profound as if they belonged to two different cultures [8]. Western Ukraine (Galicia) was historically part and parcel of Central Europe and developed in much the same way as did that region. Lviv was a regional capital of the Polish-Lithuanian Commonwealth (14^{th} to 18^{th} centuries), the Austro-Hungarian Empire (18^{th} century to 1918) and the Republic of Poland (1918 to 1939), and a seat of learning throughout. Western Ukraine was ceded to the Soviet Union from Poland at the end of World War II and integrated into the Soviet Socialist Republic of Ukraine. Under both Poland and Austria, Ukrainian language, culture and religion were tolerated. The Soviets, following the Czarist traditions of the previous 3 centuries, suppressed Ukrainian language and religion in favor of the Russian language, state socialism and Russian Orthodoxy [9].

Western Ukrainians have been more independent-minded and more willing to discard the Soviet past [10]. In contrast, Kyiv and the Eastern Ukrainian territories were largely dominated by Russia from the mid-17th Century up until independence in 1991, and have been less inclined to forego their relationship with Russia. Solchanyk (2001) [10] summarizes the fealties of the post-Soviet mentality by referring to the camps as “Independists" and "Samostiiniki” or “Little Russians”. The former are predominantly from Western Ukraine, while the latter predominate in Eastern Ukraine. The statistical data in Table 1 identifies the striking differences between the "two Ukraines". Incidence rates of crime, broken families, drug abuse and sexually transmitted disease are all higher in Luhansk (in the East) than in Lviv (in the West). (The smaller Donbas region of Luhansk, rather than Donetsk, is taken here, as it is more comparable with Lviv in terms of both population and industrialization-urbanization) [8].

Political differences are no less striking. Opinion polls clearly show that western Ukrainians are predominantly anti-communist and anti-soviet; they believe Russia is Ukraine's main threat while Europe and North America are its main allies; they favor private ownership and radical economic reforms, the revival of Ukrainian language and culture, democratization and, of course, Ukraine's eventual membership in the EU and NATO. Easterners tend toward an opposite viewpoint. They prefer Ukraine to join the Russia/Belarus union, re-establish a soviet-style economy, give more authoritarian power to the president and grant Russian language the constitutional status of "second state language" in Ukraine. These East-West differences were clear in 2004 presidential elections, where voters in western Ukraine backed pro-western opposition candidate Yushchenko, while those in the east backed the Soviet-leaning Yanukovich. While not universal, Western Ukrainians are more likely to exert the right of self-determination (through self-responsibility), a critical foundation of rational economic decision-making. An analysis by Reynolds [11] was recorded December 27th on the BBC on the day following the runoff election stated that "There will be voices in the EU calling for swift action to consolidate Ukraine's new position, which will be far more open to western ideas of political and economic reform." However, the eastern oblasts continued to vote heavily for Yanukovich who won 44.2% of the popular vote. Thus, despite a victory for Mr. Yushchenko, Ukraine will need to grapple with the divide between east and west for some time to come. This study provides evidence of how this divide effects healthcare organizational management and strategies as observed through changes in hospital efficiency measures.

Prior Research

As health care resources are extremely constrained in Ukraine, it is of particular importance that these scarce resources be used as effectively and efficiently as possible. In this section, we first discuss the tool that will be employed to measure efficiency, and then review prior research that suggests the direction of east-west differences in terms of efficiency.

The effectiveness of health care spending is difficult to assess accurately. A number of studies, however, have dealt with the efficiency of resource use in hospital inpatient as well as ambulatory care. Hollingsworth et al. [12] provide an overview on efficiency studies for hospitals, and an efficiency study for Central Region Hospitals of the Lviv Region of Ukraine was covered in Pilyavsky et al. [13, 14]. The review by Hollingsworth et al. [12] focused on Data Envelopment Analysis (DEA) and Pilyavsky et al. [13, 14] also used this technique. DEA is a non-parametric method used to estimate frontier functions. Most studies used input oriented specifications, wherein the focus is on the minimum input usage for given output levels. Any hospital utilizing more inputs to produce the same amount of outputs as compared to its peers would be deemed inefficient. Alternatively, an output based model is used to demonstrate possible increases in outputs given fixed levels of inputs. The choice of model depends on the objective to be assessed.

Beyond assessing the economic performance of hospital behavior, prior studies of post Soviet macro economies provide additional information that may affect Western versus Eastern Ukraine. In his socio-economic analysis of economic transitions in Eastern Europe, Tomer [15] finds strong evidence of East-West differences, observing that "among the Polish people there was a high degree of consensus that they wanted a return to Europe, to markets and to an economy like Western Europe". This consensus, the author suggests, might have contributed to the quick adaptation in an economy that was fighting to overcome the 'failures of communism'. The Western Ukrainians are noted to share this sentiment in that they favor closer ties to Europe. If prior history is a predictor of future performance, the same desire to bond with Europe seen recently in Poland should result in similar patterns emerging in Western Ukraine.

One study of the economic transitions in Ukraine [16] finds similar rapidity in adoption, lending further support to "a widely held notion that the western part of Ukraine is restructuring more quickly than the rest of the country". This study analyzes economic trends in Ukraine from 1990-1995 and notes that western regions in Ukraine are privatizing faster. The author notes:

> "one possible explanation that fits with Ukraine's history and sociological complexion is that regional and local elites are less likely to oppose privatization and that local populations in western Ukraine are more inclined toward market capitalism due to their linkages with Central European economies and the relative distance they kept from Moscow during much of the Soviet era".

Hypothesis:

This study will test for East-West differences in the efficiency of hospitals. The null hypothesis to be tested is that there are no efficiency differences between Western and Eastern Ukrainian hospitals either cross-sectionally or through time. Alternatively, given the strong support for Western-style capitalism in Western Ukraine, it is expected that hospitals in the West will improve efficiencies relative to those in the East. The next section describes the data available for the analysis. The following section describes the method used, specifically the output-oriented specification of the DEA model as well as the calculation of the Malmquist indices. A fourth section presents our results and a final section concludes.

Data

Ukraine is divided geopolitically into 25 oblasts, each consisting of approximately 20 rayons i.e., communities. Generally, each rayon has one central rayon hospital (community hospital) that provides medical care mainly to the village and rural population of that rayon. The population living in non-city rayons comprises more than a third of the nation's population (16.1 of 49.5 million). These hospitals provide both inpatient care and ambulatory care through affiliated adult and children's polyclinics. Services provide in the rayons are identical with regard to their function in the health system, share the same departmental structure, and provide more than one fourth of all beds in Ukraine. Community hospitals provide direct pa tient care, administer public health programs, and formulate some types of health policies in their rayon.

This study focused on the rayon hospitals in three oblasts: Dnipropetrovsk (22 hospitals), Zaporizha (20) and Lviv (19). The first two oblasts are in the east while Lviv is in the western part of Ukraine. Data were gathered for the years 1997-2001 for a total of 305 observations (5 years times 61 observations per year).

Descriptive Statistics

An initial review of the data in Table 2 shows the number of beds and utilization statistics by oblast for each of the study years. While Eastern oblasts showed little decline in admissions (6.3%) despite large decreases in beds (18.3%), the Western oblast showed the opposite, increasing admissions rapidly (17.8%) on just a small increase in beds (4.1%). Similar relations were found in other production inputs. While this is a much generalized view, it provides further support for hypothesis expectations.

Methods

To measure hospital performance we used Data Envelopment Analysis (DEA) to estimate technical efficiency for 61 central rayon hospitals located in our 3 reference oblasts. DEA scores were computed using beds, physicians and nurses as inputs, and medical admissions and surgical admissions as the two outputs. Ideally, we would adjust the outputs to control case-mix variations. Unfortunately, the data required for this were not available. However, proxy measures for case mix including average length of stay and percent of admissions for surgery indicate little variation across the sample and across the time period of the study (see Table 3). Thus, case-mix does not appear to be a confounding factor.

In the following sections we discuss the appropriateness of using the frontier methods in healthcare settings, and then we review the specific assumptions of the general model and conclude with technical notes on the specific Malmquist methods employed.

Frontier Methods

Farrell (1957) [16] first operationalized a frontier method to estimate the efficiency of a decision-making unit (DMU) using a distance function approach which compared an individual DMU's observed level of outputs and inputs with the best practice production frontier. This frontier was derived by those DMUs that could maximize output given inputs (output based model) or minimize inputs given output (input based model) under the usual assumptions of production including: homogeneity of degree 0, strong disposability of inputs and outputs, and ray homotheticity. This measure was formulated into a data envelopment analysis (DEA) model by Charnes et al. (1978) [17] and Färe, Grosskopf, and Lovell [18]. DEA has been the most frequently used frontier technique in studies of health care organizations. The first health care application of DEA was published in 1983, and since then over 100 DEA studies of health care organizations have been published [19]. A competing frontier technique, Stochastic Frontier Analysis (SFA) has also been used to estimate the inefficiency of health care organizations [19]. Each technique has its own strengths and weaknesses; however, a preferred frontier method has not emerged. Coelli et al (1999) [20] suggest that these techniques be evaluated for appropriateness on a case-by-case basis. In the analysis of the efficiency of Ukrainian hospitals, the choice was simplified by the absence of information on input prices, a requirement for SFA. In contrast, data were available for a range of inputs and outputs, the variables needed to conduct a DEA study.

Theoretical Model

Since our objective is to measure the maximum amount of output produced, given input levels, we first model our output reference under assumptions of constant returns to scale and strong disposability of inputs and outputs:

$$P(x \mid C, S) = \{y : y \le zY, x \ge zN, z \in \Re_{+}^{J}\}$$

where the z parameters represent the intensity variables, C denotes constant returns to scale, S represents strong disposability of outputs, and Y and X represent the output and input matrices, respectively of each J^{th} DMU. This follows the methodology pr oposed by Färe, Grosskopf, and Lovell [18]. See this reference for a formal proof. We chose the output based orientation as we are interested in how to value hospitals resources provide and are some hospitals underutilizing their inputs, i.e., given inputs outputs are not maximized. This latter situation would suggest poor managerial decision making and those hospitals may not be ready to engage in selective contracting.

Since we are also interested in relaxing the constant returns to scale in order to get a "short-run" measure of technical efficiency, we add a further constraint to the output reference, namely that $\sum_{j=1}^{J} z = 1$. This permits the concavity of the production process to be defined.

As mentioned above, to derive the best practice frontier and the associated efficiency scores, linear programming techniques are employed. We first specify the linear problem to be solved under constant returns to scale.

$$
\begin{aligned}
&Max\Theta \\
&s.t. zY \geq \Theta y \\
&zX \leq x \\
&z \in \overset{+}{\underset{j}{\Re}},
\end{aligned}
$$

where T is the efficiency measure or radial distance to the frontier, which is greater than or equal to 1. In other words, any measure greater than 1 represents the amount in which all outputs could be radially expanded to the best practice frontier. Since we do not impose any functional form on the model, the data will reveal the frontier. And because it is defined by DMUs in the sample, the measure of efficiency is relative rather than absolute as in the engineering sense. One benefit of this relative measure is that peers are theoretically able to achieve efficiency gains given the technology available.

We can also relax the constant returns to scale constraint by employing the variable returns to scale technology, which is solved for in the following linear programming problem.

$$
\begin{aligned}
&Max\Theta' \\
&s.t. zY \geq \Theta y \\
&zX \leq x \\
&z \in \overset{+}{\underset{j}{\Re}}, \\
&\sum_{j=1}^{J} z = 1
\end{aligned}
$$

According to Fare, Grosskopf, and Lovell [18] these measures can then be used to derive a measure of scale efficiency given as the ratio of 'T/T'. All of this gives us three measures of efficiency: overall efficiency, pure technical efficiency (which is determined under the VRS technology) and scale efficiency.

Since it was first introduced [17], DEA has experienced a substantial degree of evolution. Most germane to our study has been the extension of DEA to a two-stage approach that facilitated the analysis of the influence of environmental factors on relative efficiency. A variety of multivariate approaches have been used in which the DEA-derived efficiency score served as the dependent variable in the second stage. These approaches have used OLS directly, or OLS after transforming the DEA score using log, logistic, or log-normal transformations. The use of Tobit became the favored approached owing to the censored (at 1) distribution of the DEA-based relative efficiency estimate. However, recently this approach has been found to result in inconsistent estimates [21]. Accordingly, our analysis will focus on the changes in mean relative efficiency scores with secondary analysis considering temporal and spatial variances in the estimates. Since the DEA estimates do not follow a normal distribution, we apply a variety of non-parametric statistical measures in order to determine if the distribution of the rankings of efficiency scores is the same, as well as control for external factors deemed relevant.

Malmquist Index [22]

Beyond using cross-sectional data with the DEA, a related approach as defined by Caves et al. [23] is the Malmquist Index. Fare, Grosskopf, and Lovell [18] adapted this approach to reflect the geometric mean of the Malmquist index, which can be used to measure productivity changes over time. This measure is also directly related to the DEA output measure as it is the reciprocal of the output distance function defined as:

$$\left[D_0^t\left(x^t, y^t \middle| C, S\right)\right]^{-1} = F_0^t\left(x^t, y^t \middle| C, S\right) = \max\left\{\Theta : \Theta y^t \in P^t\left(x^t \middle| C, S\right)\right\}$$

Note that the maximization problem is the same used above to assess cross-sectional data except in this case we simply add a time dimension. By using this technique, we can formally define the Malmquist index and its decomposition into economic change and technical change:

$$M_0^{t+1} = \left(x^{t+1}, y^{t+1}, x^t, y^t \middle| C, S\right) = \left[\frac{F_0^t\left(x^t, y^t \middle| C, S\right)}{F_0^t\left(x^{t+1}, y^{t+1} \middle| C, S\right)} * \frac{F_0^{t+1}\left(x^t, y^t \middle| C, S\right)}{F^{t+1}\left(x^{t+1}, y^{t+1} \middle| C, S\right)}\right]^{1/2}.$$

The first expression in the brackets represents economic change indicating the distance (i.e., inefficiency measure) from the frontier using the current technology with the DMU's input and output use in the next time period. The second expression in the brackets indicates technological change, or the move to a new frontier, which is demonstrated as using the next time period's frontier with the current time period's input-output correspondence divided by the next time period technology. In other words, by using newer inputs and outputs does the DMU move closer to the existing frontier (economic efficiency), and by using the newer technology does the DMU move to a different frontier. Values greater than 1 represent an improvement over time, equal to 1 denote no change, and less than 1 indicate reduction in productivity. The same linear programming models are employed as specified above, but by adding the relevant time reference to the inputs and outputs.

Results

Table 4 presents descriptive statistics of the outputs and inputs used in the DEA models to gauge efficiency among Ukrainian hospitals. As can be seen, these hospitals typically treat more medical cases than surgeries with an average of 237 beds and an average nurse to physician ratio of 3.19.

Table 5 presents overall efficiency results for the entire sample. The results suggest that output could be increased by an average of 20% to 29% depending upon whether the overall efficiency (CRS) or technical efficiency (VRS) technology is employed. Turning next to scale, only 8% of overall inefficiency can be attributed to scale inefficiency. Correlation analysis (see Table 6) revealed an inverse relationship between technical and scale efficiency. This implies that hospitals that are technically efficient are the "wrong size"; conversely, hospitals that are the "correct size" tend to be technically inefficient.

Table 7 presents mean efficiency scores grouped by oblast. Overall it appears that Dnipropetrovsk contains, on average, the relatively most efficient hospitals and Zaporizha contains the relatively the most inefficient hospitals. Lviv hospitals were in an intermediate position. The relative efficiency differences are the greatest when the CRS model was used. Using the F-Test and the Kruskal-Wallis Test for statistical significance, we found that efficiency scores using the both the CRS and VRS technologies were statistically different at the $p > 0.01$ level, but there was no statistically significant difference among the scale efficiency scores.

Now our attention shifts to changes in relative inefficiency between oblasts over time. As Table 8 shows, Dnipropetrovsk exhibited a relatively flat pattern for CRS-based inefficiency scores, starting with average inefficiency of 1.27 in 1997 and ending with a score of 1.25 in 2001. In contrast, hospitals in Lviv consistently decreased their relative inefficiency over time, starting at 1.37 in 1997 and ending with an average score of 1.19 in 2001. This finding indicates that more hospitals in this western Oblast moved "closer" to the grand frontier. Conversely, our results suggest that hospitals in Zaporizha became more inefficient but the pattern was erratic. Similar results were found for the VRS efficiency scores; however a different pattern emerged when the scale efficiency score was analyzed. Specifically, no discernable pattern was found.

Unlike, the results for CRS and VRS-based inefficiency estimates, the F-statistic for the overall level of significance of the scale efficiency results was very small (0.88) and statistically insignificant ($p > 0.81$).

Finally, we used the Malmquist approach to more formally analyze changes in efficiency and productivity over time for our sample Ukrainian hospitals. Unlike the DEA scores that measure an undesirable attribute (i.e., inefficiency) which are cross-sectional by nature, the Malmquist Index reflects a desirable attribute (i.e., productivity). Hence, larger values for the Malmquist Index reflect improvement. The estimated Malmquist Index (Table 9) decreased from the first time period until the last period. The efficiency change improved until the last period, when it fell sharply. And technical change decreased, then improved dramatically in the last time period. The relative index scores -- Malmquist, efficiency change, and technical change were all statistically significantly different (using the F-test and Kruskal-Wallis test at the pr > 0.01 level)

We also assess the Malmquist measure by time and oblast as well economic and technological change. The results are partitioned by time and oblast for the entire sample because the small size of the sample precluded this analysis at the oblast level. These findings are presented in Table 10.

What is striking from these results is that for hospitals in all three oblasts, large changes in economic efficiency were met with a digression in technological change and vice versa until the 2000-2001 time period. Further all these indices scores were statistically significant indicating that the changes occurring were not only a function of time, but also Oblast, indicating regional differences.

Discussion

Before discussing the results it is important to note that available data limited this study to three oblasts. While fairly representative of their regions, future studies would benefit from a broader sample of oblasts. The results show that all hospitals increased efficiency, but that hospitals operating in Lviv demonstrated the greatest amount of economic change. These hospitals average efficiency scores improved over the time period from 1.37 in 1997 to 1.19 in 2001, while Dnipropetrovsk remained stable (1.27 to 1.25) and Zaporizha deteriorated from 1.28 to 1.37 (CRS efficiency scores). The VRS scores showed the same dynamic. Distributions were significantly different. There was no difference in scale over time for each region.

In effect, all Oblasts benefited from a rising tide, but Lviv demonstrated the larger increases in productive performance. Lviv's improvements were most noticeable in terms of technological change relative to the other Oblast hospitals and time. These findings are consistent with the hypothesis that Lviv, having a greater Western influence, may be quicker to adopt new healthcare delivery efficiencies. This may stem from a longer history of a less-planned and less-controlled economy, or it may indicate that Western Ukrainian healthcare managers were more open to the methods introduced through a deluge of technical assistance from the European Union and the United States following Ukrainian independence.

However, the fluctuations in the efficiency and technological components of the Malmquist measures suggest that growth is not steady and may be more vulnerable to macro-economic development than may be the case for high income countries. Unfortunately, we lack any type of net revenue data which may provide further understanding to hospitals' investment possibilities as well as more information as to where technology is procured. We also have only scant and anecdotal evidence of the extent of technology transfer that resulted from substantial European and American assistance to the Ukrainian health sector following independence.

Further, it appears that the hospitals in all three oblasts demonstrated a high degree of improvement in technological change, but the lower levels of economic change suggest that the hospitals are "further away" from this new frontier, i.e., there is not the additional output change from one year to the next. International donations and technical assistance can partly explain this observation in light of declining real per capita health expenditures during this period of time. In future studies, we will follow-up on these hospitals in order to ascertain whether services "caught up" with the new technology.

We also find that the efficiency score changes were statistically significantly different for all three Oblast's hospitals but interestingly, we cannot reject the null hypothesis, but rather find that in some time frames the Lviv hospitals outperformed their eastern counterparts and in other years the reverse was true. However, the rising and falling trends for all three oblasts appear to occur at the same time, but to different degrees. The greatest overall productivity advance was observed in Dnipropetrovsk during the 2000-2001 observation period. Lviv's and Zaporizha's hospitals appear to have the greatest gains technologically. The greater technological gains in Lviv and Zaporizha may be due to the larger budgets per capita in these two oblasts compared to Dnipropetrovsk. In 2001 the oblast health budget per capita in Dnipropetrovsk was only $2.85 per capita compared to $4.04 in Zaporizha and $5.14 in Lviv [24]. The more important finding is that Lviv demonstrated the larger increases in productive performance. This is the likely result of managerial actions that in turn resulted in the improved performance. This strengthens our conclusion that Western Ukrainian health entities have a greater likelihood of responding to economic and financial incentives in a proactive and positive manner.

This study provides support for the notion that economic studies should be placed in societal context. Fukyama (1995) [25] observes "as Adam Smith well understood, economic life is deeply embedded in social life, and it cannot be understood apart from the customs, morals and habits of the society in which it occurs. In short it cannot be divorced from culture." Placed in this light, the dramatic East-West differences found in this study are both a blessing and a curse. While cultural attitudes can change at no economic cost, they tend to be slow to change, making Ukraine's rise both less expensive but more difficult.

Table 1. Region Comparison		
	% of total: Lviv region	% of total: Luhansk region
Population	5.5	5.3
Divorces	3.9	6.1
Children out of wedlock	2.5	5.2
Criminals sentenced	3.6	7.5
Teen-age criminals	4.2	7.1
Alcoholics	3.9	6.9
Drug addicts	2.0	4.4
Syphilis	2.7	7.2
Gonorrhea	2.7	6.7
AIDS	0.5	2.4

Source: (Ryabchuk 2003)

Table 2. Number of Hospital Beds and Utilization by Oblast and Year

Oblast	Year	Admissions	Beds	Patient Days	Ave Length of Stay	Occupancy
Dnipropetrovsk	1997	124,525	5,105	1,697,617	13.6	91.1%
Dnipropetrovsk	1998	123,795	4,765	1,633,835	13.2	93.9%
Dnipropetrovsk	1999	122,241	4,750	1,570,138	12.8	90.6%
Dnipropetrovsk	2000	118,697	4,768	1,537,648	13.0	88.4%
Dnipropetrovsk	2001	120,225	4,738	1,531,256	12.7	88.5%
Zaporizha	1997	101,738	4,312	1,452,517	14.3	92.3%
Zaporizha	1998	102,238	4,268	1,381,015	13.5	88.7%
Zaporizha	1999	99,000	4,273	1,289,834	13.0	82.7%
Zaporizha	2000	96,454	4,008	1,266,958	13.1	86.6%
Zaporizha	2001	91,449	3,951	1,187,383	13.0	82.3%
Lviv	1997	120,291	5,406	1,592,023	13.2	80.7%
Lviv	1998	124,588	5,440	1,635,734	13.1	82.4%
Lviv	1999	128,314	5,452	1,688,428	13.2	84.8%
Lviv	2000	136,411	5,531	1,763,421	12.9	87.3%
Lviv	2001	141,711	5,626	1,818,481	12.8	88.6%

Table 3: Case Mix Proxy Characteristics 1997-2001						
Oblast	Dnipropetrovsk		Lviv		Zaporizhia	
Year	ALOS	Surgeries as % of Admissions	ALOS	Surgeries as % of Admissions	ALOS	Surgeries as % of Admissions
1997	13.6	21.8%	13.2	22.7%	14.3	27.6%
1998	13.2	22.0%	13.1	23.5%	13.5	26.2%
1999	12.8	22.8%	13.2	23.3%	13.0	26.0%
2000	13.0	23.3%	12.9	22.1%	13.1	25.4%
2001	12.7	23.4%	12.8	20.2%	13.0	24.6%

Table 4. Descriptive Statistics (N=305)				
Variable	Mean	Std. Deviation	Minimum	Maximum
Outputs				
Number of Medical Admissions	4,404.05	1,621.85	972	10,831
Number of Surgical Admissions	1,350.41	580.48	232	3,184
Inputs				
Number of Beds	237.35	81.46	70	540
Number of Physicians	29.56	15.60	6	91
Number of Nurses	94.41	39.43	19	236

Table 5. Descriptive Statistics: Efficiency Results				
Efficiency Measure	Mean	Std. Deviation	Minimum	Maximum
Overall Efficiency (CRS Technology)	1.29	0.18	1.00	1.99
Technical Efficiency (VRS Technology)	1.20	0.17	1.00	1.92
Scale Efficiency	1.08	0.08	1.00	1.46

Table 6. Spearman Correlation Coefficients for Efficiency Scores

	Overall Efficiency (CRS) (Pr > r)	Technical Efficiency (VRS)	Scale
Overall Efficiency (CRS)	1.00	0.84 (0.0001)	0.19 (0.0007)
Technical Efficiency (VRS)			-0.23 (0.0001)
Scale			

Table 7. Mean Efficiency Score by Oblast

Oblast	Mean CRS	Mean VRS	Mean Scale	Number Efficient (CRS)	Number Efficient (VRS)	Number Efficient (Scale)
Dnipropetrovsk (N=96)	1.25	1.17	1.07	7	10	14
Zaporozha (N=80)	1.34	1.25	1.07	2	6	3
Lviv (N=68)	1.29	1.18	1.09	5	7	5

Table 8. Efficiency Scores by Oblast over Time

Oblast	Year	CRS Efficiency Score	VRS Efficiency Score	Scale Efficiency Score
Dnipropetrovsk (N=22)	1997	1.27	1.18	1.08
	1998	1.22	1.15	1.07
	1999	1.24	1.16	1.07
	2000	1.25	1.19	1.06
	2001	1.25	1.17	1.07
Zaporozha (N=19)	1997	1.28	1.20	1.07
	1998	1.32	1.23	1.07
	1999	1.38	1.30	1.06
	2000	1.34	1.26	1.07
	2001	1.37	1.27	1.08
Lviv (N=17)	1997	1.37	1.28	1.09
	1998	1.33	1.21	1.10
	1999	1.29	1.18	1.10
	2000	1.23	1.13	1.09
	2001	1.19	1.10	1.09
F-Statistic (pr>)		2.51 (0.002)	2.46 (0.003)	0.66 (0.81)

Table 9. Malmquist Index Scores			
Time Frame	Malmquist Score	Efficiency Change	Technical Change
1997-1998	1.01	0.98	1.03
1998-1999	0.99	1.00	0.99
1999-2000	0.94	1.17	0.81
2000-2001	1.09	0.61	1.82

Table 10. Productivity Changes Over Time				
Time Frame	Oblast	Mean Malmquist Score	Mean Efficiency Change	Mean Technological Change
1997-1998	Dnipropetrovsk (N=22)	1.04	1.02	1.01
1998-1999	Dnipropetrovsk (N=22)	0.99	1.00	0.99
1999-2000	Dnipropetrovsk (N=22)	0.96	1.23	0.77
2000-2001	Dnipropetrovsk (N=22)	1.23	0.70	1.79
1997-1998	Zaporozha (N=19)	0.96	0.91	1.05
1998-1999	Zaporozha (N=19)	0.97	0.99	0.98
1999-2000	Zaporozha (N=19)	0.95	1.12	0.84
2000-2001	Zaporozha (N=19)	1.05	0.57	1.86
1997-1998	Lviv (N=17)	1.04	1.01	1.02
1998-1999	Lviv (N=17)	1.03	1.02	1.02
1999-2000	Lviv (N=17)	0.94	1.14	0.82
2000-2001	Lviv (N=17)	0.96	0.52	1.82
Statistical Tests		F=1.95 Pr > F ~ 0.04 Kruskal Wallis = 19.65 $Pr > c^2 = 0.05$	F=29.17 Pr > F <0.0001 Kruskal Wallis = 124.69 $Pr > c^2 < 0.0001$	F=108.13 Pr > F <0.0001 Kruskal Wallis = 197.10 $Pr > c^2 < 0.0001$

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