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Productivity efficiencies in Ukrainian polyclinics: lessons for health system transitions from differential responses to market changes

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Abstract Ukraine's recent elections revealed deep divisions between eastern regions, which favored central economic planning, and western regions, which preferred more free market reforms. This study compares polyclinics in Ukraine to see if the inflexibility of Soviet-style planned economies results in lower economic efficiency in eastern regions. Using data from two geopolitical regions, Data Envelopment Analysis (DEA) scores for polyclinic efficiencies are modeled as a function of demographic and economic determinants. Surprisingly, results indicate that polyclinics in western Ukraine are less efficient. Possible explanations, including case mix intensity, responsiveness to local preferences, physician entrepreneurial behavior and a legacy of inequitable funding, are discussed.

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This study examines efficiencies in Ukraine healthcare institutions focusing on the East–West regional cultural differences. Ukraine's 1991 independence from the Soviet Union has brought a number of dramatic social, political and economic changes. The product of a unique history and position in Europe, Ukraine provides a natural laboratory to examine the impact of cultural differences on economic behavior.

The Ukrainian economy has been growing and adapting since 1991, but in order for this development to continue, health sector reform is needed (World Bank 2001). While most health resources are currently owned and financed by the government, health finance reforms are aimed at restructuring the system through the development of primary care. Rather than continue the current approach of budgeting facilities, World Bank recommends the use of selective contracting in which facility management must provide purchasers with demonstrated value and be held to new performance standards. This study of polyclinic efficiencies in Ukraine aims at improved understanding of potential reactions to these reforms.

Under funding makes change in Ukraine's health system difficult. Health care expenditures of just 2.8% of GDP must more than double to achieve the minimum 5.8% recommended by the WHO. Though Ukraine's nominal expenditures increased from 2.5 billion UAH (Ukrainian hryvna) in 1995 to 5.2 billion UAH in 2001, inflation outpaced this higher spending, resulting in a

real dollar decrease from $33.33 to $20.00 per capita over the same period. Ukraine's health system is also constitutionally constrained from reductions to existing medical institutions, leaving increased productivity and efficiency as the only avenue to achieving their goals (World Bank 2001). Liebenstein's X-Efficiency Theory suggests that managers faced with resource constraints might be more motivated to squeeze out more output from relatively scarcer resources (Liebenstein 1978). Support for this is provided by studies of U.S. nursing homes and hospitals faced with declining resources (Rosko et al. 1995; Rosko 2001). This should be applicable to Ukrainian polyclinics faced with declining real per capita expenditures.

Though Ukraine's Ministry of Health (MOH) owns and operates all polyclinics, budgetary authority and accountability have been pushed down to the oblast (i.e., state or province) level since 1997 (World Bank 2001; Vitrenko and Nagorna 1999). This increased oblast autonomy has come with greater reliance on local taxes, providing oblasts the economic incentive to improve health care delivery efficiencies. The deep-rooted cultural differences between the eastern and western regions of Ukraine may moderate oblast-level reactions to these incentives. Such differences in response to market incentives are consistent with managerial behavior and beliefs observed in other post-socialist transition economies in the region (Aaronson 1997; Aaronson and West 1997).

Culture can influence many types of economic behavior, including production (DiMaggio 1994). Because culture exists at organizational, social class, and national levels, each may play an important role. Hawthorne studies demonstrate that unique cultures can distinguish different organizations, resulting in measurable differences in effectiveness and efficiency (Mayo 1933). Work ethic, motivation and leisure-earnings tradeoffs may be associated with social class. Trans-national cultural differences may be just as important. For example, when compared to Americans, Japanese workers have a greater collective orientation and view work as more important (DiMaggio 1994). Such attitudes impact productivity, such as with Japanese workers who work longer hours, take fewer days off, and strike less (Lincoln and Kalleberg 1990).

The relationship between culture and economic behavior is complex and supporting evidence is sometimes tenuous (DiMaggio 1994). Notwithstanding, Ukraine's recent economic and political changes present a valuable natural experiment on the affect of culture on performance. Our study focuses on regional variations in culture and their impact on the efficiency of polyclinics in the eastern and western regions of Ukraine.

1 Background

1.1 History—foundation of cultural distinctions between east and west

The western and eastern regions of Ukraine have often 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 (Ryabchuk 2003). Western Ukraine was historically part of Central Europe and developed along similar lines as its neighbors. Lviv was a regional capital of the Polish-Lithuanian Commonwealth (14–18th centuries), the Austro-Hungarian Empire (18th century to 1918) and the Republic of Poland (1918–1939), and an academic center 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. Ukrainian language, culture and religion were tolerated under both Poland and Austria. The Soviets, however, suppressed Ukrainian language and religion in favor of the Russian language, state socialism and Russian Orthodoxy (Subtelny 1994).

Western Ukrainians have been more independent-minded and more willing to discard the Soviet past (Solchanyk 2001). 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) 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 some dramatic 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). Such differences in social milieu and health status indicators can influence both healthcare need and use among the diverse populations.

Political differences are just as dramatic. Western Ukrainians are predominantly anti-communist, anti-soviet, and believe Russia is its main threat while Europe and North America are its main allies. They also favor private ownership, economic reforms, the revival of Ukrainian language and culture, democratization and membership in the EU and NATO. Holding largely contrary views, eastern Ukrainians prefer closer ties with Russia, the re-establishment of a soviet-style economy, and granting Russian "second state language" status. These east–west differences were clear in the 2004 presidential and the 2006

Table 1 Regional comparison of incidence rates for social and health problems

Variable	% 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

This table shows incidence rates for two Ukraine oblasts. The Luhansk figures include just the Donbas region because it is more comparable with Lviv in terms of both population and industrialization-urbanization. (*Source:* Ryabchuk 2003)

parliamentary elections, where voters in western Ukraine backed pro-western opposition candidate Yushchenko, while those in the east backed the Russian-leaning Yanukovich. Though many saw Yushchenko's victory as a sign that Ukraine "will be far more open to western ideas of political and economic reform" (BBC 2004), more time will be needed for the divide between east and west to close. To the extent that these cultural and political differences can impact management styles and strategies, this study looks for east–west variance in polyclinic efficiency measures.

1.2 Prior research

The scarcity of health care resources in Ukraine makes it particularly important that they be used as effectively and efficiently as possible. In this section, we first discuss how efficiency can be measured, then proceed to review prior research that suggests the direction of east–west efficiency differences.

Though the effectiveness of health care spending is difficult to assess, many studies have dealt with the efficiency of resource use in hospital inpatient as well as ambulatory care. In their overview of efficiency studies for hospitals in several settings, Hollingsworth (2003) highlight the use of Data Envelopment Analysis (DEA). Guiffrida and Gravelle (2001) compared approaches to the measurement of efficiency of primary care in the UK's National Health Service. While there were merits in other econometric methods of efficiency estimation, they found that DEA provided reasonable results when applied to primary care. DEA has been applied to Ukrainian hospitals by Pilyavsky et al. (2003), Pilyavsky et al. (2002), and Pilyavsky et al. (2006). DEA is a non-parametric method used to estimate frontier functions. Some studies use input oriented specifications, focusing on the attainment of a given output level with minimum input use. Under such an orientation, a hospital that used more inputs to produce the same amount of output as its peers would be viewed as less efficient. Alternatively, an output based model defines efficiency as the maximization of outputs for a fixed level of inputs.

Studies of post-Soviet macro economies provide additional information that may affect western versus eastern Ukraine. In his analysis of economic transitions in Eastern Europe, Tomer (2002) 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". The author suggests that this very consensus may have aided efforts to overcome the 'failures of communism'. Western Ukraine, with historical ties to Europe, Poland in particular, shares a similar sentiment and sense of urgency. If history foretells future performance, the same desire to bond with Europe seen recently in Poland should result in similar patterns emerging in western Ukraine.

Rapid adoption of economic reform has been demonstrated in other studies of Ukraine (Tedstrom 2002), lending further support to "a widely held notion that the western part of Ukraine is restructuring more quickly than the rest of the country". In this study of Ukrainian economic trends from 1990–1995, western regions appear to be 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."

1.3 Hypothesis

This study tests for east–west differences in the efficiency of polyclinics in Ukraine. The null hypothesis is that there are no efficiency differences between western and eastern Ukrainian polyclinics. Alternatively, given the longer historical association with less-planned, more capitalist markets in western Ukraine, it is expected that polyclinics in the west show higher efficiencies relative to those in the east. Such findings would be consistent with Liebenstein's X-Efficiency Theory that suggests that resource scarcity

may pressure managers to improve performance. This type of finding would also suggest that a western orientation may help managers perform better under resource constraints. The next section describes the data used to test this hypothesis. The following section describes the method used, including DEA model specification and a description of other potential determinants of polyclinic efficiency. A fourth section presents our results and a final section concludes.

2 Data

Ukraine is divided geopolitically into 25 oblasts, each consisting of approximately 20 rayons, or communities. Each rayon typically has a central community hospital that provides medical care mainly to the village population, which comprises more than a third of the nation's population (16.1 of 49.5 million). These hospitals include adult and children's polyclinics which 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 and their associated polyclinics provide direct patient care, manage public health programs, and oversee some of the health policies in their rayon.

This study focused on the rayon polyclinics in two oblasts: Zaporizha (20) in the east and Lviv (19) in the western part of Ukraine. This research design provides a sharper contrast than a design that included observations from central Ukraine, and should provide more clarity in the examination of east–west differences. Data were gathered for years 1997–2001 for a total of 195 observations, making the rayon-year the unit of analysis.

3 Methods

We estimate the efficiency of the polyclinics in our sample by employing DEA (Färe et al. 1994) and bootstrapping techniques as suggested by Simar and Wilson (2006). It is well recognized that while DEA provides many benefits in gauging the efficiency of decision making units, especially in the public or not-for-profit sector (where neither cost-minimization nor profit-maximization can be assumed), but it has a serious drawback. Specifically, point estimation defies statistical modeling, especially in any type of two-stage approach (i.e., regressing efficiency scores on exogenous variables). Since the readership of this journal is familiar with DEA, we proceed in this section to describe the bootstrapping approach.

The input–output correspondence in which we are interested consists of translating physician and nurse labor inputs into polyclinic services. For the Ukrainian polyclinics, this output consists of outpatient visits on-site and sick visits (house calls). We adopt the output orientation model of maximizing outputs given inputs. We further impose variable returns to scale since we are interested in the short-run efficiency rather than the long-run efficiency of these polyclinics. One reason we do not impose constant returns to scale is that the polyclinic operates as part of an associated hospital, subject to control by the regional (rayon) health authority, which has discretion over the space (capital) allotted for polyclinic use. There are also several environmental factors which are not included in the production process but which can affect the efficiency score derived using DEA. These include the location of the polyclinics (eastern Ukraine versus western Ukraine), the population characteristics, the budget allocated to health, and the wage rates; all of which are exogenous. Following the suggestions by Simar and Wilson (2007) and utilizing the FEAR software (Wilson, Unpublished working paper, 2005) we employ the general DEA bootstrap model to the observations in the sample in order to derive the corrected scores which take into account possible errors that would have been previously considered inefficiency.[1] It has been demonstrated by Simar and Wilson (2007) that without the semi-parametric approach, using only the point estimate of the efficiency score may lead to biased results in any second stage analysis. Thus, the bootstrapping approach is the only possible way to estimate the inference around the DEA score so that we may validly estimate a second stage regression equation (Wilson, Unpublished working paper, 2005).

Since we are primarily interested in the environmental factors that may explain deviations in efficiency between eastern and western Ukrainian polyclinics, we use maximum likelihood methods and truncated regression techniques in order to regress the "corrected" efficiency scores on our independent variables.

4 Results

4.1 Descriptive results

In order to characterize the sample polyclinics and their operating environment, we begin by presenting descriptive statistics that are relevant in health care services. Table 2 shows that, in terms of inputs, Lviv has more physicians and nurses than Zaporizhia. Outputs consist of polyclinic visits and home visits provided by polyclinic staff.

[1] Details of the FEAR program and the bootstrapping techniques are available from Wilson (Unpublished working paper, 2005) and Simar and Wilson (2007).

Table 2 Descriptive statistics by oblast, 1997–2001

Variable	Zaporizhia	Lviv
Number of physicians	30 (15)	51 (12)
Number of nurses	42 (26)	47 (14)
Polyclinic visits	90,494 (59,848)	101,1390 (42,199)
Home visits	8,923 (9,043)	12,554 (6,306)
Home Visits as a proportion of polyclinic visits	8.90 (4.92)	12.76 (4.55)
Nurses per physician	1.41 (0.31)	0.94 (0.17)
Physicians per 10,000 lives	8.08 (2.81)	7.05 (1.76)
Physician wage	2,923 (536)	2,337 (444)
Average rayon wage	1,663 (259)	1,584 (594)
Nurses per 10,000 lives	11.40 (4.74)	6.49 (1.76)
Nurse wage	1,553 (434)	1,500 (319)
Health budget per capita	51.55 (16.21)	40.69 (12.63)
Percent elderly	27 (5)	24 (3)
Percent disabled	0.4 (0.2)	0.5 (0.1)

This table shows rayon averages by oblast, with standard deviations in parentheses, for various key indicators. Averages and standard deviations include the entire 1997–2001 study period

We include these two outputs rather than other qualitative environmental factors since the former can be managed endogenously and are therefore under management control, whereas the latter cannot. Lviv's output polyclinic and home visits are also higher than Zaporizhia. Looking at the ratio of home visits to polyclinic visits, Lviv provides a greater proportion of services in the patient's home. Though home visits require significant travel time, the DEA model will simply recognize these as an output requiring a greater share of inputs. The first potentially unusual finding is that Lviv employs fewer nurses per physician, suggesting a possible oversupply of physicians or lower physician wages. Yet the number of physicians per 10,000 lives in Lviv is much lower than in Zaporizhia, putting suspected oversupply in doubt. Looking to average wage for all workers as a possible 'leveler' of lifestyle afforded by Lviv's physician wage does not help explain these observations either, as Lviv's ratio is below that observed in Zaporozhia.

If the case cannot be made that Lviv is experiencing an oversupply of physicians, an undersupply of nurses might be the cause of low ratios of nurses per physician. Lviv's number of nurses per 10,000 lives is much lower than rates in Zaporizhia. Though this undersupply can not be easily explained by nurse wage discrepancies, which are rather minor, it might instead be a result of lower funding for health services. Lviv's health budget per capita is 20% lower than Zaporizhia's. Another possible explanation for Lviv's staffing patterns comes from their apparent advantage in case mix. With a lower combined percent of elderly and disabled, Lviv's staffing may actually be appropriate for their population, but it does make the higher proportion of home visits unexpected.

The lopsided staffing ratios shed light on some of the unique aspects of healthcare in Ukraine. If labor mobility theory holds true, physician and nurse wage rates, allowing for regional differences in base wage rates, would be fairly level across the country. Nurse wages are fairly level across study oblasts, so the large differences in nurses per physician and nurses per 10,000 lives ratios would best be interpreted as fundamental differences in production processes between eastern and western oblasts. If all oblasts shared that same production process, markets would respond to imbalances by bidding up nurse wages in the west to attract more nurses from the east, but this does not appear to be happening.

Along the same theme, Zaporozhia has the higher physician wage and the higher ratio of physicians per 10,000 lives, apparently confirming labor mobility. The fact that the wage rate differential still exists might indicate that Zaporozhia demands even more physicians. Being the economically stronger of the two study oblasts, Zaporozhia is better able to afford such rates, as evidenced by their higher health budget per capita. Recognizing that official wages are only a portion of a physician's total income in this country where "tipping is common practice" (Walgate 2002), such an allowance only increases the likelihood of higher physician income in Zaporozhia where larger tips would be enabled by that oblast's higher base wages. Yet if standard production theories regarding reduced productivity of additional workers hold, Zaporozhia's high wage and staffing ratios provide further hint of potentially different production processes in the two oblasts.

Rather than continue its assumed proper functioning, obstacles to labor mobility may offer an alternative explanation to differences in production processes. There are several barriers to the free movement of labor in Ukraine. Language represents the first hurdle, with Ukrainian spoken in the west and Russian preferred in eastern oblasts. Further, polyclinic positions are government jobs, so an applicant from western Ukraine might not be as well received in the east by a bureaucracy that may still hold regional preferences. Finally, recalling the east–west differences in Ukraine, it is possible that the psychological wall between Lviv and its eastern neighbors is relatively impermeable. If healthcare professionals in Lviv prefer to live in a more 'western' area, then the higher wages in Zaporozhia may not be adequate to break down this wall.

Whether the staffing patterns can be explained by labor mobility, labor immobility, or simple differences in production processes, this discussion highlights the

Table 3 DEA and bootstrapping results, 1997–2001

Variable	*N*	Mean	Std. Deviation	Minimum	Maximum
Efficiency score	195	1.61	0.39	1.00	3.02
Efficiency bias corrected	195	1.74	0.41	1.08	3.16
Bias	195	−0.13	0.06	−0.40	−0.04
Est. Standard Error	195	0.004	0.004	0.0003	0.25
Lower bound	195	1.65	0.40	1.03	3.07
Upper bound	195	1.83	0.42	1.13	3.26

This table shows raw and bias-corrected efficiency scores derived from the 1997–2001 study period. DEA Inputs: number of physicians and number of nurses. DEA Outputs: number of polyclinic visits and number of home visits. 1000 iterations were used in the bootstrapping model

contradictions present in Ukrainian healthcare and provides a good frame of reference for other findings discussed below.

4.2 DEA results

To further investigate cursory observations of inputs and outputs described above, we employ the bootstrapping method to estimate efficiency. This allows a deeper assessment of efficiency in terms of the multiple-input, multiple-output framework. The DEA results (with and without bootstrapping) are given in Table 3.

Results in Table 3 show that the DEA score was downward biased, indicating that scores that defined inefficiency were slightly over-estimated. However, the difference between the corrected efficiency score and the DEA-derived efficiency score is not statistically significant. Despite the statistical similarity between the scores, it is not appropriate to use the DEA efficiency score in the second stage analysis (Simar and Wilson 2006). Instead we will use the corrected efficiency score.

4.3 Truncated regression results

We are interested in determining what environmental factors may affect the efficient production of patient care services by polyclinics. Before proceeding to regression results, we present our hypotheses regarding how each independent variable may affect the resulting corrected efficiency score.

One difference may be due to the location of the polyclinic. It has been hypothesized that the eastern region of Ukraine tends to follow a more controlled, centralized economic model and the western region pursues a more market-oriented economic model. Since we are measuring efficiency in the output-based orientation, there may not be any market effect since visits to the polyclinic may be exogenous of market structure and more a case of need. Therefore, we must include variables identifying different population characteristics, including the percent of the population that is elderly and the percent with disabilities. We focus on these two characteristics because the elderly tend to use more medical services and persons with disabilities may require more home visits.

The preferences for health care services may be revealed by the proportion of the total oblast budget that is allocated to health. We hypothesize that more resources allocated to the health care sector may result in more resources being employed without increasing the amount of services provided. However, the services that are provided may be of a higher quality, including more time with the physician or nurse. Wages for inputs are included since they are exogenously determined and may impact the hiring practices of the polyclinics, especially when considered along with health care budget allocations.

To allow for the possibility that hospital care can substitute for some polyclinic services, we include a variable that defines the distance to the central hospital as an implicit price for this substitute. We hypothesize that the further the hospital, the higher the price of this substitute, resulting in a more efficient polyclinic. In Ukraine, families are still responsible for personal care even when a family member is admitted, so travel costs are felt by both the patient and their family. We further control for the distance by also including a variable defining the size of the market area, effectively making it a relative measure.

Finally, since our data were collected over five consecutive years from 1997 to 2001, categorical variables were created for years 1998–2001 with the year 1997 serving as the referent category.[2] This time variable acts as a control for any temporal changes, holding the other exogenous variables constant. Even though we have panel data, we wish to focus on the inefficiencies of the polyclinics rather than impose the same temporal effects on efficiency (Deily and McKay 2006). The regression results are presented in Table 4. When reviewing these results, keep in mind that efficiency scores have a lower bound of 1.0 for the most efficient clinics, so a positive regression coefficient is associated with increased inefficiency.

Differences in the corrected efficiency score may be partly explained by findings summarized in Table 4. Polyclinics located in Lviv have higher inefficiency scores when compared to those located in Zaporizhia (the omitted category). Patient population characteristics also account

[2] Additional regressions were run to assess the possibility of any time-oblast interactions. None were found.

Table 4 Truncated regression results, 1997–2001

Variable	Coefficient	Std. Error	Z	$p > \|z\|$
Lviv	0.37***	0.07	4.99	0.00
Percent elderly	1.83***	0.70	2.61	0.00
Percent disabled	91.32***	19.67	4.64	0.00
Health budget	1.60**	0.50	3.17	0.00
Distance to hospital	−0.01	0.0001	−1.24	0.21
Market area	0.0002***	0.00004	3.06	0.00
1998	−0.04	0.08	−0.58	0.56
1999	0.15*	0.08	1.88	0.06
2000	0.13	0.08	1.51	0.12
2001	−0.02	0.08	−0.25	0.81
Constant	1.35***	0.02	19.74	0.000

This table shows the results of a regression that measures the influence of various economic and demographic characteristics on the corrected efficiency score. The unit of measure for this regression is the rayon-year (recall that each oblast is composed of a number of rayons, just as US states are composed of counties). $N = 195$

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Wald $\chi^2 = 54.84$

for some of the difference, with greater proportions of elderly and disabled associated with higher inefficiency scores. Polyclinics enjoying a higher budget also had higher inefficiency scores. This finding makes sense, since polyclinics may be using more money from the budget to hire more staff, which can result in better quality, but also less efficiency. Although further information regarding quality of care was not available for this study, this finding indicates that it may prove to be an important determinant. An explanation for this association between higher inefficiency scores and higher budgets may be provided by Liebenstein's X-Efficiency Theory (Liebenstein 1978). Specifically, managers of polyclinics with fewer resources might be more motivated to squeeze out more output from their relatively scarcer inputs. Support for this is provided by studies of U.S. nursing homes and hospitals (Rosko et al. 1995; Rosko 2001). Alternatively, and in keeping with our central theme of cultural influences on management decisions, maintenance of high rates of home visits may be indicative of market responsiveness. That is, patients expect to receive and continue to receive home visits even though such services require more physician and nurse time.

The distance from a hospital did not affect estimated efficiency, so travel time may not be an issue. The significance of market area suggests that polyclinics operating in larger geographical markets had higher inefficiency scores. Only one of the 4- year coefficients was significant, and only marginally so ($p < 0.10$), revealing no clear trend over time

5 Discussion

Though history may have placed eastern and western Ukraine under the same flag, the two regions have very different characters. The eastern regions have more of a communist orientation, and seem more at-ease with planned economies. But western regions are more associated with western-style capitalism. We test the impact of these differences through a study of operating efficiencies at polyclinics in the two regions. Our hypothesis was based on the premise that the free market tendencies in western oblasts would result in higher efficiencies than their eastern counterparts, based on Liebenstein X-Efficiency Theory. This is tested through a model forecasting DEA efficiency scores as a function of oblast health budgets, remoteness from central hospitals, population characteristics and an east–west indicator. Consistent with stereotypes of bureaucratic bloat, we find that higher budgets decrease efficiency. Larger market areas with older and more disabled populations led to relatively higher levels of inefficiency. With regard to our central hypothesis, however, we find polyclinics in western Ukraine to be less efficient.

These counterintuitive findings are perplexing at first. Though Lviv does have to do more (more polyclinic and home visits) with less (fewer physicians and nurses per capita, lower budget per capita), these variables are all already in the model. The explanation may lay in variables that were not in the model. Elderly and disabled population measures were employed as proxies for case mix intensity because data on better indicators were not available. Table 5 displays per capita service use and seems, at first blush, to confirm findings of greater inefficiencies in the west. Per capita use of hospital and polyclinic services are much lower in Lviv. With fewer services per capita, it is reasonable to suspect that those patients are sicker when

Table 5 Alternative indicators

Variable	Zaporizhia	Lviv
Hospital days per capita	1.67 (0.79)	1.18 (0.46)
Polyclinic visits per capita	2.29 (0.79)	1.33 (0.46)
Home visits per capita	0.23 (0.13)	0.17 (0.08)
Home visits as a proportion of polyclinic visits	8.90 (4.92)	12.76 (4.55)
Health budget per capita	51.55 (16.21)	40.69 (12.63)
1997 per capita health budget net of physician and nurse salary	30 (12)	22 (9)
2001 per capita health budget net of physician and nurse salary	37 (19)	32 (14)

This table shows rayon averages by oblast, with standard deviations in parentheses, for various alternative indicators. Averages and standard deviations include the entire 1997–2001 study period

they do need services. This can result from less time for preventative care. Or, it can result from patients choosing to avoid implicit costs of longer waits unless they are very ill. Regardless of cause, Lviv polyclinics may be facing a more difficult case mix.

Lviv's higher proportion of home visits as a percent of polyclinic visits (repeated in Table 5) may be related to the suspected higher case mix. If patients have to wait for appointments, a rational economic response could be to simply allow ailments to get so bad that a home visit is needed. Though the 1997 through 2001 period has seen this proportion decrease, Lviv healthcare professionals are still burdened by a high proportion of this time-consuming service. Whether Lviv's preference for home visits is the result of rational decision making or local habit, it highlights several implications of employing DEA techniques. First, DEA assumes outputs are uniform across regions, but the 'inefficiency' of Lviv may just mean that doctors are spending more time with patients. In effect, DEA scores may be penalizing those who are being more responsive to market demands. Further, by focusing on outputs as services and not health indicators, DEA does not assess response to need. Lviv's much lower rates of services per person hint at such unmet needs. This is particularly surprising in a centrally planned system, but less so if allowance is made for regional favoritism. Lviv's health budget per capita (repeated in Table 5) is about 20% below that of Zaporizhia, indicating that Lviv may be suffering from a legacy of neglect.

As an alternate explanation, physicians in Lviv may have an incentive to act in ways that reduce efficiency. We see that in Lviv home visits as a proportion of total polyclinic visits are considerably higher than in Zaporizhia. Home visits by their nature consume more time and are less efficient. The case mix data do not indicate that home visits are more warranted in Lviv than elsewhere. Physicians, while they are public employees, have the ability to act in ways similar to private practice physicians. The World Bank has identified "under the table" or informal payment to physicians as a problem that results in economic distortions of the health system (Lekhan et al. 2004; Preker et al. 2002; Lewis 2002; Lewis 2000). The problem of physician informal payments is emblematic of larger scale informal privatization occurring in Ukraine that is hard to measure, distorts official economic measures and inhibits real economic progress (Banaian 1999). Although this practice is illegal in Ukraine and elsewhere in the former Soviet sphere of influence, it has been observed to be widespread in all of the countries in the region, including the most western countries of Poland, Hungary, and the Czech and Slovak Republics. While official spending has apparently been declining in countries of the former Soviet Union, a World Bank study (Lekhan et al. 2004; Preker et al. 2002; Lewis 2000) found that when an estimate of extra-market out-of-pocket payment to physicians was added to national healthcare spending, levels of spending among transition economies mimicked western European levels. While this system of informal payment may lead to higher use rates, it may also provide incentive to physicians to substitute services that bring higher "informal" payments. The substitution of home visits, longer polyclinic visits and more therapy services may lower efficiency but increase physician revenue. Thus, decreased productivity may result from physician responsiveness to market incentives in the guise of patient demand for higher quality services. If this is the case, price may be acting as a market clearing mechanism. That is, higher prices paid by patients in Lviv may partially explain the lower polyclinic utilization rate, as well as the substitution of home for polyclinic visits.

There is additional evidence that Lviv may be still living with the aftermath of a long period of under-funding from a communist government which might show favoritism to pro-Soviet eastern oblasts. Though explicit figures for capital budgets were not available for this study, Table 5 provides a crude estimate by deducting physician and nurse wages from total health budgets. Though dramatically lower in 1997, Lviv is approaching parity in estimated funds available for capital by 2001. Starting with what appears to be less capital, it is not surprising that Lviv's polyclinics were found less efficient.

If the explanation of physician response to market changes in Lviv is true, then why did the same phenomenon not appear in the polyclinics operating in Zaporizhia? This explanation is clearly consistent with previously discussed assumptions regarding the cultural and historic differences that exist between east and west Ukraine. These differences are reflected in managerial and economic behavior, resulting in greater market responsiveness in western Ukraine which may have manifested itself in physician behavior designed to maximize personal income and not to increase polyclinic efficiency. That is, western influences on managerial behavior may have been manifested by greater entrepreneurial behavior and not necessarily in behavior directed at improving overall system performance.

Further study is needed to determine if our findings of greater inefficiency in western Ukraine polyclinics are correct, or if other explanations prevail. A larger sample of more oblasts would give greater weight to findings. With only one oblast in the west and one in the east, this study lacked the depth needed to detect intra-region variations. Such a larger sample could also help determine if public health indices are better in the west because of higher spending on prevention and education, or if less spending is needed in the west because of healthier lifestyles. Greater detail on service utilization, including intensity indicators, would help determine if some of Lviv's inefficiency stems

from a response to market demands for more physician time. Capital investment data would also help fine tune efficiency measures and might provide further explanation of apparent disparities in staffing mix decisions. The discussion of possible differences in treatment intensity also raises the need for better case mix indexing in future studies. Yet another important factor to consider is Lviv's choice of role models. Though difficult to quantify, it may be worth the effort. If their efforts resemble the free market capitalism of the U.S., Lviv may be inadvertently choosing a model that costs more and attains less than more socially-oriented systems of Western Europe. This last point should not be overlooked because future studies may confirm our initial findings, showing that there may be some things that the west can learn from the east. It should not be surprising that Ukraine, so full of paradoxes itself, should yield counterintuitive findings. Our study is one step in better understanding the difficulties of improving healthcare delivery in this developing nation.

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