

Table 1. Categories of health workers by occupation and health sector.

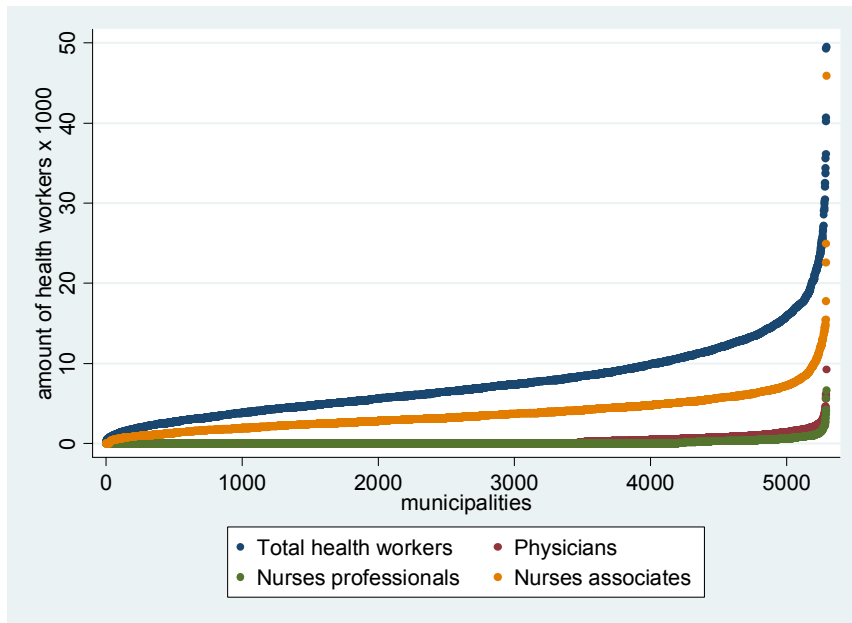
	ISCO code	Categories of Health Workers	Aggregated categories
OCCUPATION	2231	1-Physicians	1-Physicians
	2235	2-Nurses of superior level and equivalents	2-Nurses professionals
	3222	3-Technicians and auxiliaries of nursing	3-Nurses associates
	5151	4-Assistants of nursing, practical midwives and similar	
	3522	5-Health and environmental agents -community health workers-	
	2232	6-Dentist	4-Other health staff
	2234	7-Pharmacists	
	2236	8-Physiotherapists and similar	
	2237	9-Nutritionist	
	2211	10-Biologist and similar	
	2515	11-Psychologist and Psychoanalyst	
	3201	12-Technician in biology	
	3221	13-Technicians in physiotherapy and similar	
	3223	14-Optometrists and opticians	
	3224	15-Technicians in dentistry	
	3241	16-Operators of medical and dentistry equipment	
	3242	17-Lab technicians of clinical analysis	
	3251	18-Technicians in pharmacy	
	5102	19-Supervisors of health services and personal care	
	5152	20-Lab auxiliaries	
	9153	21-Repairman of medical-hospital equipment	
HEALTH SECTOR		1-Public health	5-Other support staff
		2-Private health	
		3-Other health activities	
		4-Other health activities no specified	

Source: IBGE, Demographic Census 2000, Brazil

Table 2. Description of the data

Variables	Source	Number of municipalities	Mean	Std. Dv.
% coverage of antenatal care	DATASUS	4282	79	16
Physicians x1,000	CENSUS	1831	0.86	0.70
Nurses professionals x1,000	CENSUS	1100	0.54	0.50
Nurses associates x1,000	CENSUS	5265	3.73	2.22
Other health staff x1,000	CENSUS	3429	1.73	1.45
Other support staff x1,000	CENSUS	4449	2.83	2.11
Total health workers x1,000	CENSUS	5292	7.61	4.63
Ambulatory units	DATASUS	5260	11.98	28.66
Health expenditure per capita	DATASUS	4912	86	50.57
Gini in income	IPEADATA	5292	0.56	0.06
Average years of education	CENSUS	5292	4.64	1.26
% of urban population	CENSUS	5292	59.6	23.09
salary physicians	CENSUS	1831	3782	2622
salary nurses professionals	CENSUS	1100	1125	601
salary nurses associates	CENSUS	5265	331	199

Figure 1. Distribution of total health workers per 1,000 inhabitants by municipality, Brazil CENSUS 2000



Source: Author's calculation. N=5,292 municipalities

Figure 2. Geographical distribution of total health workers per 1,000 inhabitants by municipality, Brazil CENSUS 2000.

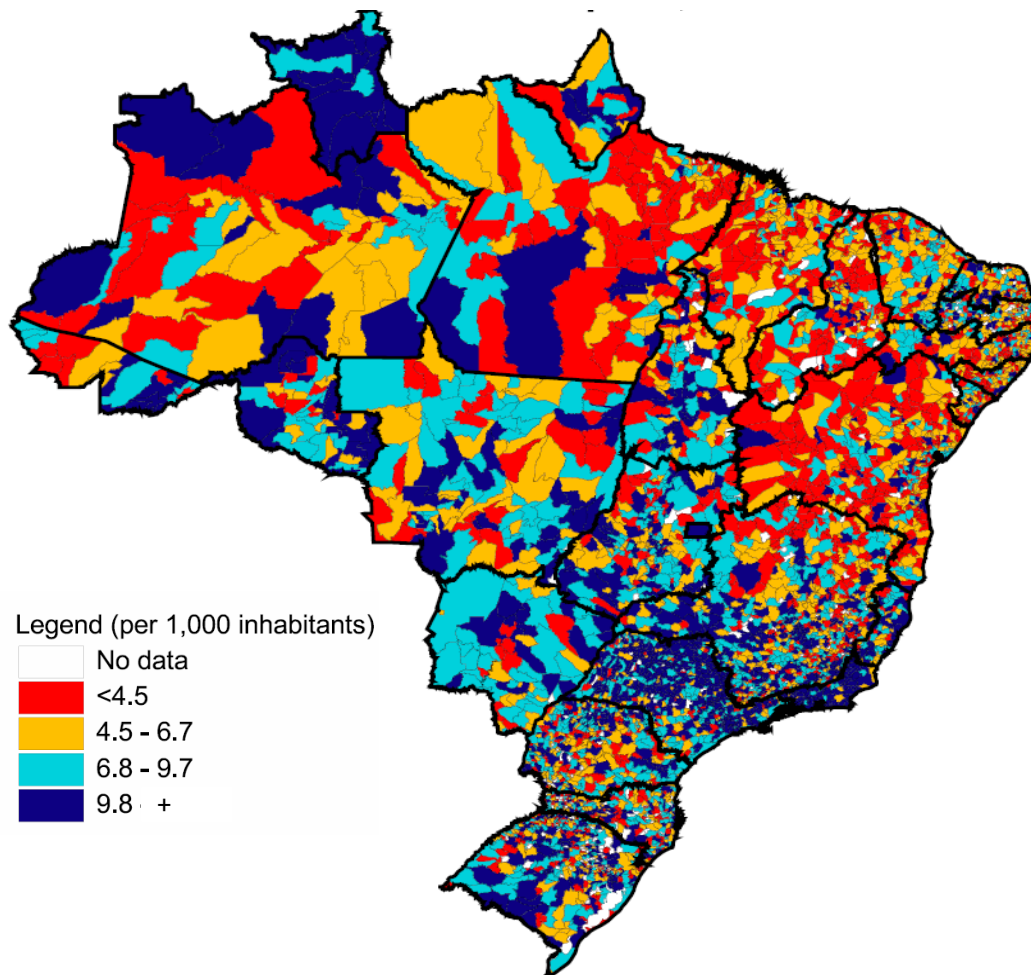
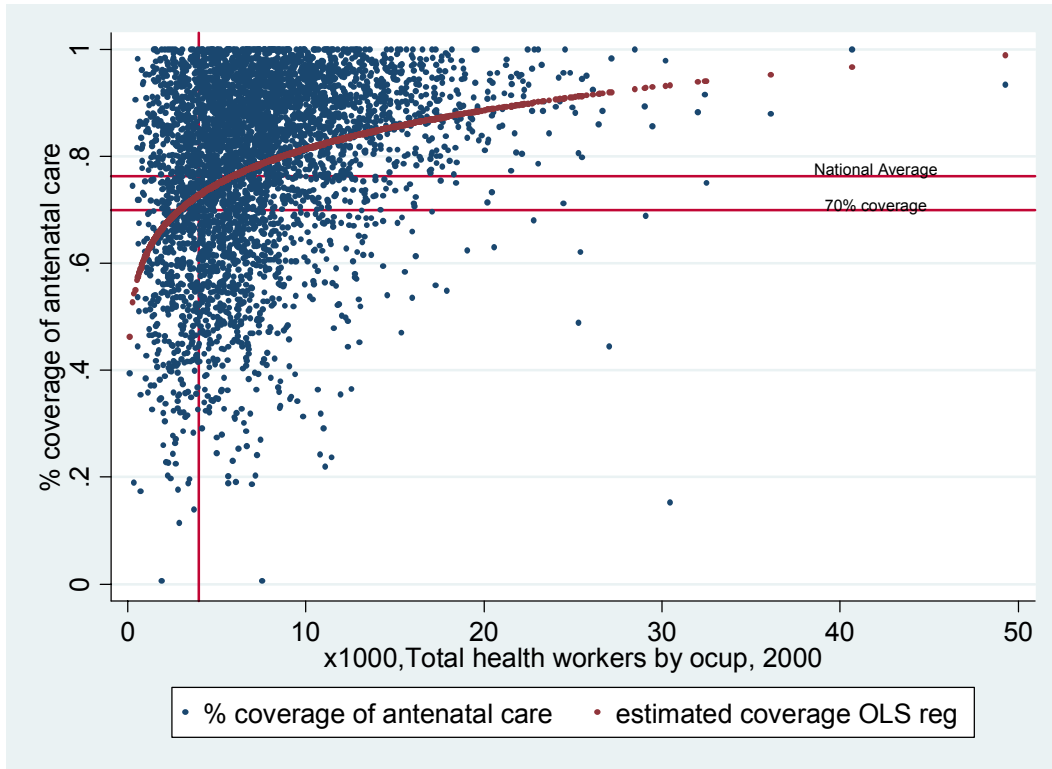


Figure 3. Shortfall of total health workers in the municipalities of Brazil, reproduction of Chen L et al 2004



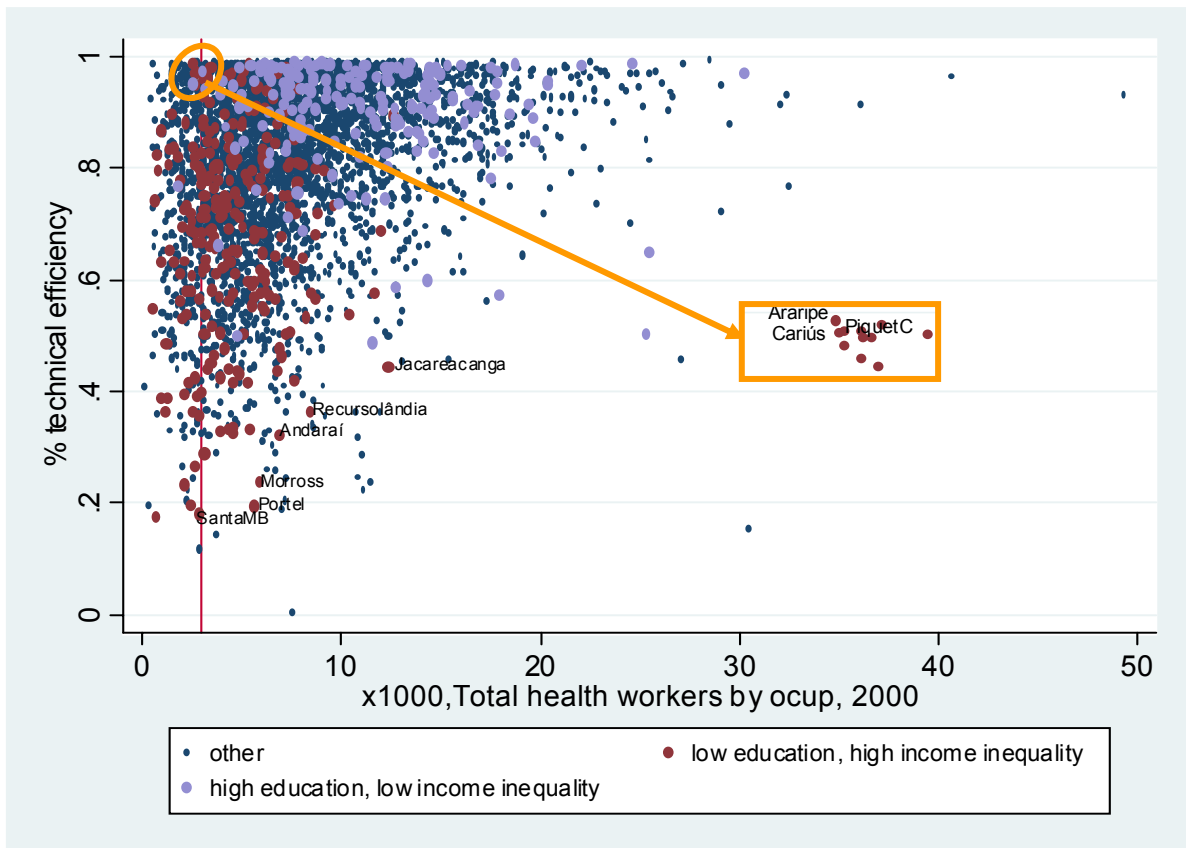
Note: The regression model is: $\ln c_i = -0.49 + (0.12^*)(\ln THW_i)$ where the symbol * represents significant coefficients with a $p < 0.05$. N=4,282 municipalities.
Source: Author's calculation

Table 3. Stochastic Frontier Model for Coverage of Antenatal Care in Brazil with Total Health Workers, CENSUS 2000

	Coefficients
In total health workers	0.005* (0.002)
In ambulatory units	-0.013* (0.001)
In health expenditure	0.018* (0.003)
_cons	-0.076* (0.013)
EDUC_cov of inefficiency	-0.984* (0.144)
URBAN_cov of inefficiency	0.006* (0.002)
GINI_cov of inefficiency	5.152* (0.904)
_cons inefficiency	-1.011* (0.463)
/lnsigma2	-0.709* (0.161)
/lgtgamma	7.384* (0.213)
Total variance (sigma2)	0.492 (0.079)
Ratio of ui/vi (gamma)	0.999 (0.000)
Inefficiency (sigma_u2)	0.492 (0.079)
Sigma_v2	0.000 (0.000)

Note: Numbers in parenthesis are the standard errors and the symbol * represents significant coefficients with a $p < 0.05$. N=3920 municipalities.
Source: Author's calculation

Figure 4. Distribution of efficiency across the municipalities of Brazil: a contrast of two extreme socioeconomic groups of municipalities



Source: Author's calculations. N=3,920 municipalities

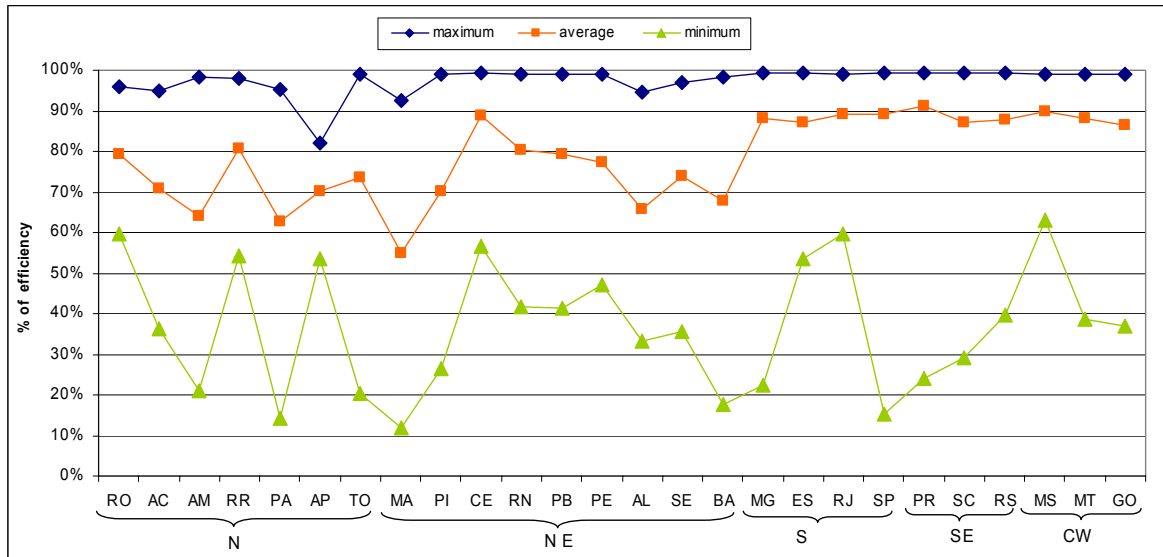
Table 4. Stochastic Frontier Model for Coverage of Antenatal Care in Brazil with Categories of Health Workers, CENSUS 2000

	Model 1	Model 2
Alpha 1	0.003 (0.002)	-0.002 (0.003)
Alpha 2	0.000 (0.003)	-0.003 (0.004)
ln PHYSICIANS (β_1)	0.003 (0.002)	0.005* (0.002)
ln NURSES Prof (β_2)	0.008* (0.003)	0.009* (0.003)
ln NURSES Assoc (β_3)	-0.002 (0.002)	-0.001 (0.002)
ln health expenditure	0.023* (0.003)	0.028* (0.003)
_cons	-0.095* (0.014)	-0.128* (0.015)
EDUC_cov of inefficiency	-0.5631* (0.057)	
URBAN_cov of inefficiency	0.003* (0.001)	-0.032* (0.006)
GINI_cov of inefficiency	3.204* (0.432)	10.340* (2.180)
_cons inefficiency	-0.413* (0.242)	-6.630* (1.057)
/lnsigma2	-1.356* (0.110)	0.420* (0.223)
/ilgtgamma	7.070* (0.258)	7.842* (0.283)
Total variance (sigma2)	0.258 (0.027)	0.656 (0.151)
Ratio of ui/vi (gamma)	0.999 (0.000)	0.999 (0.000)
Inefficiency (sigma_u2)	0.259 (0.028)	0.656 (0.150)
Sigma_v2	0.000 (0.000)	0.000 (0.000)

Note: Numbers in parenthesis are the standard errors and the symbol * represents significant coefficients with a $p < 0.05$. N=3,923 municipalities. The model do not include ambulatory units.

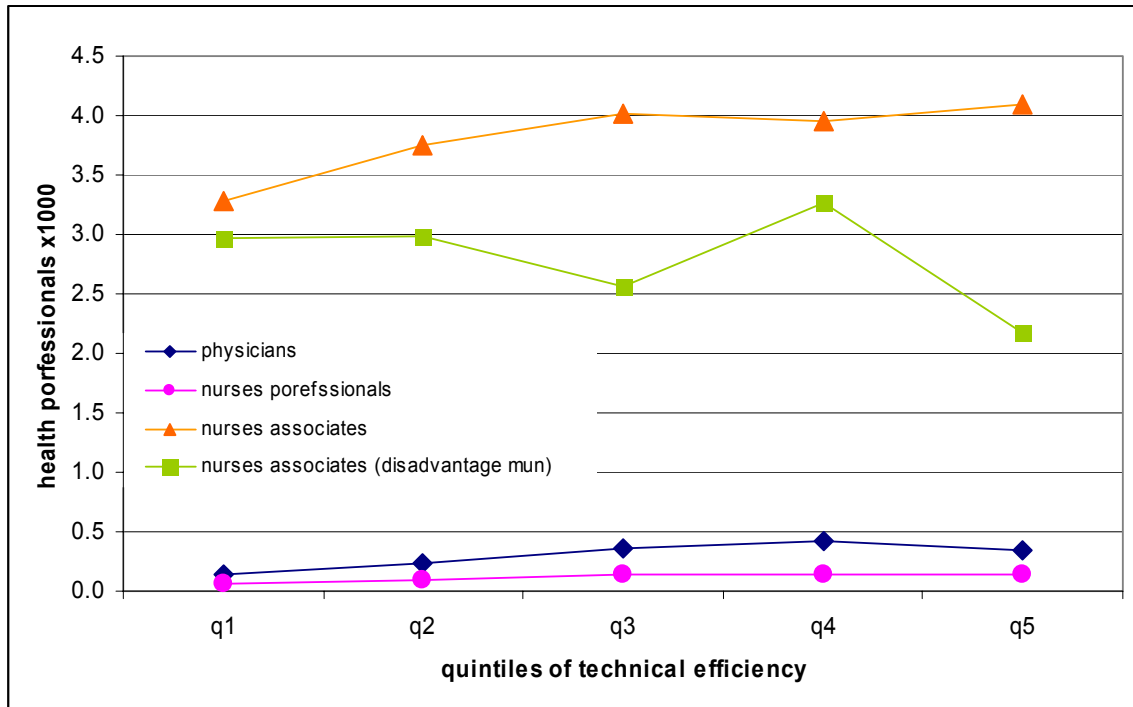
Source: Author's calculation

Figure 5. Distribution of level of efficiency within the states and regions of Brazil



Note: Distrito Federal was not part of the analysis for not having the required information to estimate the production function. N=3,923 municipalities.
Source: Author's calculations.

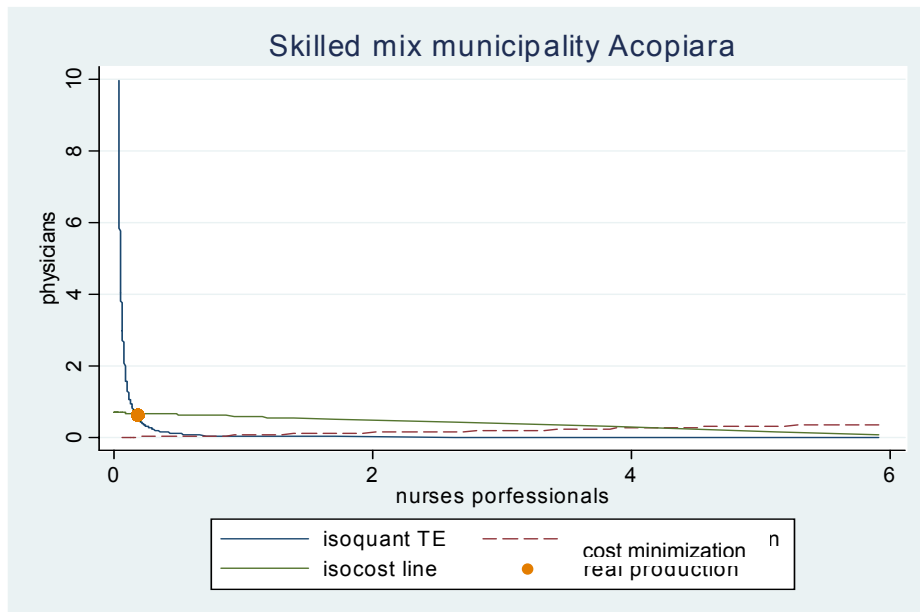
Figure 6. Distribution of health professionals across quintiles of technical efficiency



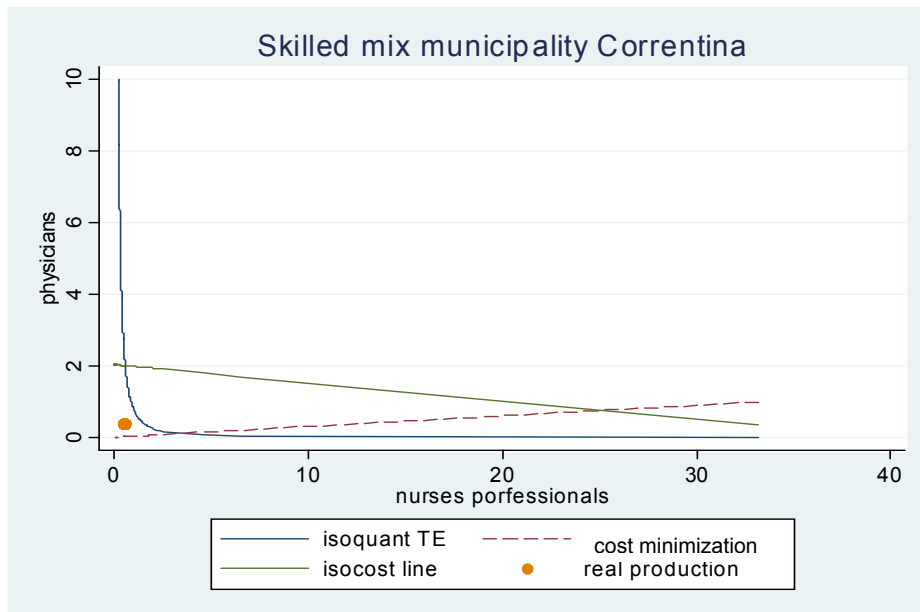
Source: Author's calculations. N=3,923 municipalities.

Figure 7. Isoquant, isocost and cost minimization in two disadvantage municipalities with different levels of efficiency

a. Disadvantage municipality with high technical efficiency



b. Disadvantage municipality with low technical efficiency



Source: Author's calculations