

ECONOMIC ESTIMATION OF AIR POLLUTION IMPACTS THROUGH PERCEPTION ASSESSMENT: A CASE STUDY WITH EXPOSED WORKERS TO VEHICULAR TRAFFIC IN SÃO PAULO, BRAZIL.

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Abstract:

São Paulo city has the largest population and vehicle fleet in Brazil, with 11,057,629 inhabitants and 6,834,886 vehicles. In large urban areas air pollution is attributed mainly to mobile sources as the vehicles, and numerous epidemiological and experimental studies have shown significant associations between health indicators and air pollutants. The traffic controllers and taxi drivers represent a special group because their work activities directly imply that these individuals spend a greater amount of time in close proximity with mobile sources of air pollution, increasing the risks and impacts in health associated with longer exposure to air pollutants. Thus, this study aims to evaluate the individual perception, medicine costs and individual economic evaluation resulting from the health impacts associated with air emissions due to occupational exposure to vehicular traffic in São Paulo. The individual perception assessment of subjects exposed to emissions may provide new evidences for economic valuation of air pollution impacts and to subsidize the optimization of the public resources' allocation. In order to assess the perception of the air pollution impacts by workers, a questionnaire was developed addressing socioeconomic and occupational aspects, health status and the individual perception concerning environmental problems. Then it was ascertained the individual economic evaluation of the air pollution impact by workers through two instruments: 1) the inquiry of willingness to pay (WTP) for obtain a cleaner air and 2) the allocation of a percentage of the value of electricity bill (VEB) to implement control measures to air pollution. The questionnaire was based on international guidelines to bias control and consolidated through the pre-tests' application. The study population included two groups of active workers in São Paulo city: traffic controllers and taxi drivers, all of male sex and nonsmokers. Three campaigns of individual face to face interviews were conducted in a sample of 112 individuals (76 traffic controllers and 36 taxi drivers). Preliminary analysis of the WTP and the VEB was performed using descriptive statistics and Spearman's correlation. For the VEB was adopted multiple regression analysis to determine the main factors associated with the economic value attributed by the workers. Generalized Linear Model (GLM) was fitted utilizing a log-link function and used as goodness-of-fit criteria in order to choose the best statistical model, the Akaike Information Criterion and residual analysis. The results showed that workers were 45 ± 10 years old on average, personal income of USD 1,124 to USD 1,686 per month and high school degree or higher educational level (just 9.8% of the sample had lower educational level). The labor time average was of 12 ± 8 years, with average duration of occupational exposure to vehicular traffic of 7 ± 3.5 hours. The traffic controllers performed on an average 14.1 ± 12.4 overtime hours per month (indicating an increase in exposure time due to work). The arithmetic average of the WTP was of USD 43.57 ± 35.49 per month and of the VEB was of USD 18.39 ± 21.29 . Traffic controllers' WTP was 40% higher than the taxi drivers, while the taxi drivers' VEB was 17% higher than of the traffic controllers. However, the Mann-Whitney U's test showed that these differences by occupation type were not statistically significant. Spearman's correlation indicated a negative relationship between income and the WTP ($r: -.011$), as well as

labor time ($r: -.047$) and exposure hours to traffic ($r: -.038$), but the coefficients were not statistically significant. Overtime hours increase ($r: -.276$) and educational level ($r: -.204$) presented statistically significant correlation with WTP, and correlation between the WTP and the PVEB was also verified ($r: .217; p < 0.023$). The GLM results showed that the variables significantly associated with VEB were the labor time (negative association), age (increase of 3.8% on the VEB per life year), educational level (increase of 6.5% on the VEB due to educational level improvement) and the individuals with preexistence of symptoms associated with air pollution (increase of 14.1% on the VEB). Health problems related to air pollution were also identified in the traffic controllers, resulting potentially loss of well-being, restricted activity and increased medical expenses. Approximately 70% of traffic controllers were affected twice by respiratory illness during the winter, and the average individual spending with medicines such as eye drops, painkillers, and medicines to control blood pressure was of USD 33.17 per month. In conclusion, air pollution is a severe problem in urban centers and is percept by the exposed population to vehicular traffic, who demonstrated a willingness to pay for a cleaner air, especially in terms of value in the electricity bill. Therefore, this approach analysis showed a viable and complementary method for estimate air pollution costs.