ENVIRONMENTAL REGULATIONS AND FIRM PERFORMANCE: AN APPLICATION OF PORTER HYPOTHESIS ON TURKISH MANUFACTURING INDUSTRY

Ezgi Ozkirim, Faculty of Economics, University of Ljubljana, +386(0)51619503, ezgi.ozkirim@gmail.com
Nevenka Hrovatin, Faculty of Economics, University of Ljubljana, +386 (0)1 5892557, nevenka.hrovatin@ef.uni-lj.si
Istemi Berk, Faculty of Business, Dokuz Eylul University, +902323018283, istemi.berk@deu.edu.tr

Overview

The increasing threat of pollution and climate change generates a burden on the regulatory bodies to construct better environmental regulations. Regulatory pressures, especially on manufacturing industries, may influence the investment decisions of companies on new technologies and accordingly may increase costs and expenditures of the firms. Since Porter (1991) established the hypothesis that stringent environmental regulation would positively effect innovative activities and hence productivity of the firms, empirical research has been concentrated on testing these relationships. In this respect, the Porter Hypothesis (PH) is primarily tested as "weak" and "strong", i.e., the effect of environmental regulations on innovation and productivity, respectively.

Based on the review of previous works, studies on weak PH are more in consensus in the sense that vast majority of the studies find a positive relationship between environmental regulation and innovation activities of companies (Rubashkina et al., 2015; Yang et al., 2012; Lanoie et al., 2011). On the other hand, evidence for strong PH is rather mixed and inconsistent, varying across the context, i.e. sector, time frame and type of regulation (Kozluk and Zipperer, 2014). Most of the empirical literature so far analysed the PH using industry level or sub-sectoral level datasets. We, on the other hand, intend to shed more light on so-far ambiguous results by studying a firm-level micro dataset on the Turkish manufacturing industry.

In our model specification, we follow the relationship driven by Porter and Van der Linde (1995). We run two models separately to test weak and strong versions of PH. We used value-added and labor productivity (lab_prod) as main dependent variables for strong PH, investment on intangible assets (intangible_assets) as the dependent variable for weak PH, and environmental expenditures (pace) as the main independent variable for both of the PH's. In line with the relevant literature, we also added several control variables, such as ownership structure (foreign_ownership), share of exports in total revenue (ft_ex), share of imports in total cost (ft_im) and electricity costs of the firm (electricity).

Methods

We compile firm-level dataset from the Turkish Statistical Institute's two databases, namely (1) Annual Statistics on Industry and Services and (2) Environmental Employment, Income and Expenditure Statistics of Enterprises. The data set is an unbalanced panel with 2,741 firms from 24 manufacturing subsectors (main sub-sectors of Section C in NACE Rev 2. classification) for the period between 2012 and 2015.

As mentioned above, our preliminary analyses are based on eight variables and we use natural logarithm of all the variables, except for foreign_ownership, ft_ex and ft_im, which are converted to a percentage, since the mean and the standard deviations of the variables are quite different.

In line with previous literature, e.g., Yang et al. (2012) and Rubashkina et al. (2015), our preliminary empirical analyses are based on static panel data models, i.e., Fixed Effects (FE) and Random Effects (RE) estimators. We estimated the following equation for both weak and strong PH's.

$$y_{it} = \alpha + \beta x_{it} + \theta z_{it} + \mu_i + \epsilon_{it} \quad (1)$$

where y_{it} represents either ln(lab_prod) and ln(value-added) (for strong PH), or ln(intangible_assets) (for weak PH), x_{it} represents ln(pace), z_{it} represents different control variables included in the regressions, μ_i controls for firm-specific heterogeneity and ϵ_{it} is the idiosyncratic error term. Moreover, the choice of FE and RE estimators is based on Hausman statistics, which in our case rejects the consistency of RE estimator in each regression. Apart from the whole dataset, which covers an unbalanced panel of 2741 firms, we estimated the equation (1) using balanced dataset including data for 581 firms over 2012-2015 and using firm-level data of each of the 24 sub-sectors in the manufacturing industry.

Results

Preliminary empirical results on the estimation of equation (1) without control variables are reported in Table 1. The estimations reveal that environmental expenditures negatively affect both firm performance and innovative activities of the firm. Hence, our preliminary empirical analyses suggest that both Weak and Strong Porter Hypotheses are rejected when Turkish manufacturing firms are considered.

Table 1. Strong and Weak Porter Hypotheses Results (without control variables)

	Strong PH		Weak PH
	ln(value-added)	ln(lab_prod)	ln(intangible_assets)
ln(pace)	-0.03127***	-0.02887***	-0.07719**
	(0.0084)	(0.0082)	(0.0350)
constant	17.22786***	11.31052***	13.19761***
	(0.0931)	(0.0911)	(0.3922)

Notes: ***, ** represents significance at 1% and 5% levels, respectively. Moreover, figures in parentheses represent robust standard errors. Results using control variables are also available though, for the sake of space we have only provided the ones without control variables.

The results provided in Table 1 are robust to the control variables, as the relationship between ln(pace) and three of the dependent variables remains negative even after including control variables and when the analyses are conducted on the sub-sectoral level. Yet, the significance of the relationship differs substantially when control variables are added to the estimations. For instance, in strong PH estimation, even after adding various control variables to the regressions, the effect of ln(pace) on both ln(value-added) and ln(lab-prod) is still negative and significant. On the other hand, when control variables are added in weak PH estimations, the significant effect of ln(pace) on ln(intangible_assets) vanishes. Hence, according to our preliminary analyses, while firm-level data on the Turkish manufacturing industry strongly rejects the existence of strong Porter Hypothesis, estimation results on weak Porter Hypothesis are inconclusive.

Conclusions

In summary, our preliminary empirical analyses suggest rejection of Strong PH in the Turkish manufacturing industry, by leading negative and statistically significant effect of environmental expenditures on firms' performance and the results are rather inconclusive on Weak PH. As mentioned before, the Porter Hypothesis is based on the fact that regulation induced environmental expenditures would foster innovation and hence increase the firm's performance. According to our results, environmental expenditures (either regulation- or self-induced) creates a burden on the Turkish manufacturing companies because these expenditures do not create innovation. Hence, Turkish policy-makers should restructure environmental regulations that would eventually lead to innovative activities in the companies. In line with the previous literature, we plan to extend our empirical analyses with 2SLS regressions in order to control for possible endogeneity problem.

References

Koźluk, T., Zipperer, V., 2013. Environmental policies and productivity growth: a critical review of empirical findings. Economics Department Working Papers no. 1096, November.

Lanoie, P., J. Laurent-Lucchetti, N. Johnstone and S. Ambec (2011), Environmental Policy, Innovation and Performance: New Insights on the Porter Hypothesis, Journal of Economics and Management Strategy, Vol. 20(3), pp. 803-842.

Porter, M. E. (1991). America's Green Strategy. Scientific American 264(4), 168.

Porter, M., and Van der Linde, C. (1995). Toward a New Conception of the Environment-Competitiveness Relationship. The Journal of Economic Perspectives, 9(4), 97-118.

Rubashkina, Y., Galeotti, M., Verdolini, E., (2015). Environmental regulation and competitiveness: Empirical evidence on the Porter hypothesis from European manufacturing sectors. J. Energy Policy. 83, 288-300.

Yang, C., Tseng, Y., Chen, C., (2012). Environmental regulations, induced R&D, and productivity: evidence from Taiwan's manufacturing industries. Resour. Energy Econ. 34, 514–532.