Working time and environmental pressures revisited:
A dynamic Panel Data Approach

Abstract

The growing attentions on working time issues in academic communities and policy arenas are related to a tight associations with themes of utmost relevance to society, such as income inequality (Bowles & Park, 2005), labor markets(Chang, Dong, & MacPhail, 2011; Blank, 2014), and well-beings (Alesina, Glaeser & Sacerdote, 2006; Pouwels, Siegers, & Vlasblom, 2008; Becchetti, Giachin & Pelloni, 2010). Policies to promote environmental pressures reduction through less working hours are entering with strength the climate change agenda worldwide, Hence, there is considerable interest in understanding the effect of less working hours on environmental degradations, both in theory and in practice.

Based then on the theoretical and practical relevance of working time issues, scholars are endeavored to detect the relationship between work hours and environmental impacts, and generally yield the significant correlations through various methodologies and sampling countries. To be specific, previous attempts have focused on the use of static techniques, such as multivariate regression and first-difference panel regression. However, these "static" panel techniques do not incorporate any temporal dependency (lags) of the dependent variable, ignoring the fact that environmental indicators (carbon emission, energy use, etc) are likely to correlate strongly over time. Therefore, in order to control for the dynamics of the process and test whether significant correlations still explicitly exist in this new framework, we employ dynamic panel techniques which contain one or more lagged dependent variables in this analysis. Furthermore, restrictions existed among the research samples and periods employed: most of prior studies have taken data from developed economies as the empirical source of evidence, and correlations may be changed along with different research periods.

Corresponding to these limitations, this study employs various static and dynamic panel regression approaches to examine the relationship among 55 countries worldwide over the period 1980-2010, findings are listed below:

The first, except for Pooled OLS, Fixed Effect Model and Random Effect Model, we also employ the widely-used System GMM Approach, both confirming the positive significant correlation between working time and carbon emissions at 1% level. The magnitudes of coefficients for work-time are still the largest ones, although they are substantially lower than their counterparts in static models. As can be seen, all the regression results for the lagged dependent variables have strong positive relationships at 1% significant level, reflects the temporally correlated nature of carbon emissions.

The second, with regards to the interaction effects based on the classification of country groups, we observe correlation of 1% significant level for developed countries and 10% significant level for developing countries, illustrating that correlation degree in developing countries is not as high as developed countries in general. In fact, this findings is not surprising, since previous empirical works either sampled developed countries such as OECD countries (Schor, 2008; Nässén, Larsson & Holmberg, 2009; Knight et al., 2013), or aggregating developing and developed countries as a whole (Rosnick & Weisbrot, 2006 ; Hayden & Shandra, 2009). No specialized empirical research existed to date which examined the relations between working time and environmental pressure for developing/developed countries.

Lastly, although the interaction terms of the first two periods (1980-1990, 1991-2000) are positive and significant at 1% level, coefficient of interaction term of the third period (2001-2010) became negative, and no longer significant any more. This unexpected finding implies that the significant relationship between work hours and environmental pressures gradually *de-linked* during the past decade. Underlying reason of this phenomenon may be that annual working hours per worker of the developed countries remarkably declined, while total carbon emissions remain stable with a peak point at 2005. Possible explanation of this situation lies in the fact that

increased non-work hours in developed countries enhanced the environmental impacts through more energy-intensive activities (Nässén, Larsson & Holmberg, 2009; Nørgård, 2013)

This study provides three improvements upon previous seminal works. First, we used a sys-GMM dynamic analysis framework, which allows us to capture certain cumulative dimensions of working hours` impact on environmental pollution. This method take into account these aspects that were ignored by static techniques, such as environmental degradation caused by long-term working time policy, or the effects of population and urban population ratio on future environmental pressures.

The second contribution lies in the classification of developing and developed country groups, which aims to detect and compare the nexus among them. Findings show that correlations of developed economies are more significant compare to developing countries in general.

Lastly, three periods are analyzed to examine the correlations which are able to provide detailed information of interest. Results illustrate that nexus of work time and carbon emission in the first period (1980-1990) and second period (1991-2000) are all correlated at 1% significance level. Differently, no significant correlation occurs for the third period (2001-2010), which showing a *de-linking* trend of the relationship between working time and environmental pressures in recent years.

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Summary

In this article we have investigated the effect of working hours on environmental impacts through various approaches. Consistent with previous research, our panel regression analysis of 55 economies during 1980-2010 demonstrate that work-time is significantly associated with environmental pressures, and thus may be a valuable policy tool for policy-makers promoting environmental sustainability. Further, we find the effects of work hours on carbon emission in developed economies are more significant than developing counterparts in general. Significant correlations at 1% level existed before 2000 are vanished in the last ten year research periods (2001-2010), by using interaction terms, showing the de-linking trend of work time and environmental degradation. We contribute to a further understanding of the environmental effects of working time reduction policy by comparing the differences among various periods and country groups under sys-GMM dynamic framework.

Future studies on this topic can be enriched from three aspects: firstly, sampling countries can be classified more specifically [1], which are able to provide close comparisons; secondly, periods can be divide intrinsically by panel threshold approach developed by Hansen (1999); lastly, testing whether the excessive leisure hours in developing countries is the main cause of the recent nexus de-linking phenomenon. They are able to present innovative sights and new findings in working time literature.

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[1] For example, country groups can be classified into low-income, lower-middle-income, upper-middle-income and high-income countries according to the World Bank.