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(Citation)

神戸大学経済学研究科 Discussion Paper, 1508

(Issue Date)

2015

(Resource Type)

technical report

(Version)

Version of Record

(URL)

<https://hdl.handle.net/20.500.14094/81008760>



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February 2015
Discussion Paper No.1508

**GRADUATE SCHOOL OF ECONOMICS
KOBE UNIVERSITY**

ROKKO, KOBE, JAPAN

Fiscal Stimulus Effectiveness in Japan: Evidence from Recent Policies*

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Abstract

This paper examines the effects of Japanese fiscal policy after the 2008 global financial crisis using a mixed vector autoregression/event study approach. We focus on the effects of stimulus packages with environmental benefits. The empirical results show that a tax break and subsidy program designed to promote the adoption of eco-friendly cars helped stimulate automobile production, while a similar program intended to promote the purchase of energy-efficient appliances had no effect on appliance production.

JEL classification: E23, E62, H30

Keywords: Fiscal policy effectiveness in Japan; Environmental stimulus package; Eco Subsidy

* This is a revised version of Discussion Paper No. 1416.

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1. Introduction

In the wake of the 2008 global financial crisis, governments in many developed countries enacted economic stimulus packages. In some countries, including the United States and Japan, these included environment-related policies. Specifically, the Japanese government subsidized consumer purchases of energy-conserving home appliances from May 2009 to March 2011, offering refundable “eco points” on energy-efficient appliance purchases. Additionally, a program of tax breaks and subsidies for purchasing “eco-friendly” cars (henceforth, “the eco-car program”) was implemented between April 2009 and February 2011.¹ Under this program, if a consumer bought a new car with emissions below a given threshold or with low fuel consumption, such as a gas-electric hybrid, the automotive tax would be lowered and the price subsidized.²

Unlike most other developed countries, the Japanese government had regularly implemented fiscal stimulus packages including increases in public investment and tax cuts even before the 2008 global financial crisis. As a result, a considerable amount of empirical research has examined the effects of fiscal policy in Japan, such as Ihori et al.

¹ The effective periods for the tax break and subsidy program was extended after February 2011 but through a policy approach separate from the stimulus package. We thus do not include the extended policy period in our empirical approach.

² For information on the fiscal policy response after the global financial crisis in Japan, please see Iwaisako (2010) and Asako (2012). For the details of the eco-car program, please see Alhulail and Takeuchi (2014).

(2003), Miyazaki (2009), Miyazaki (2010), Kozuka et al. (2012), Rafiq (2012), Vu (2012), Fujii et al. (2013), Kameda (2014), and Morita (2015). Most of these studies suggest that the “conventional” Japanese fiscal stimulus moves, such as increasing public investment and cutting taxes, are ineffective. On the other hand, eco-friendly policies may be more useful policy instruments for economic stabilization if their policy effects are proved by empirical investigation to substantially stimulate the economy.

However, to our knowledge, there has been no research examining the size and persistence of fiscal policy in Japan after the global financial crisis that focuses on these environment-related stimulus packages. Rafiq (2012), Vu (2012), and Morita (2015) examine the size and persistence of Japanese fiscal policy by considering the post-crisis period through Vector Autoregression (VAR) models. However, these studies do not focus on the environment-related policies. Alhulail and Takeuchi (2014) examine the effects of the eco-car program on sales of ten eco-friendly vehicles in Japan but do not examine the size and persistence of the policy’s effects.

The purpose of this paper is thus to examine the effects of fiscal policy in Japan after the 2008 global financial crisis by considering these two environment-related stimulus measures: subsidies for purchasing energy-efficient home appliances (hereafter the “eco-points program”) and the eco-car program. To do so, we examine the policies’ effects

using time series analysis in conjunction with an event study. To capture policy changes, we construct dummy variables based on the announcement or implementation of the policies. This approach allows us to consider not only the size and persistence of each policy change's impact but also to compare the effects of the different stimulus policies implemented after the devastating financial crisis.

The remainder of the paper proceeds as follows. Section 2 explains the methodology and data, including how dummy variables are constructed and used to identify fiscal shocks. Section 3 then provides the empirical results, reporting that while the eco-car program had positive and significant effects on the automobile industry, the eco-points program's effect on electrical appliance production was insignificant. Section 4 concludes the paper.

2. Methodology

2.1. Constructing the Dummy Variables

In our empirical approach, we use dummy variables to identify fiscal policy shocks based on official documents. When selecting the dummy variables, we face an identification problem. If we allow the dummy associated with each major policy change

to have its own distributed lag effect, we cannot identify the effects of each individual fiscal policy because the times at which they were announced and/or implemented are too close together. Therefore, the value of a given policy dummy variable is changed from 0 to 1 in the month in which the policy was implemented and remains 1 throughout the time period for which the policy was in effect, as in the case of Blanchard and Perotti (2002) and Miyazaki (2010).

To construct dummy variables capturing the effects of environmental policies, we thus clarify the start and end dates of the policy's implementation periods. The *Eco-point* and *Eco-car* variables thus indicate the implementation periods for the eco-points and eco-car programs, respectively. *Eco-Point* equals 1 from May 2009 to March 2011 and *Eco-Car* equals 1 from April 2009 to February 2011.

2.2. Outline of VAR Estimation

We include these variables in our empirical models. As the examined policies are assumed to be targeted at increasing production of specific industries, we focus on the individual industries most directly impacted by each policy. We estimate two separate VAR models that include industry-specific policy dummies and production indexes.³

³ We also estimate our VAR model using the index of industrial production, which denotes the production of all mining and manufacturing industries, instead of y_t^{EI} or y_t^{Auto} . However, the impulse

The first (“Case 1”) includes *Eco point* and uses $\log y_t^{El}$, where y_t^{El} denotes electric appliance production. The second model (“Case 2”) includes *Eco Car* and uses $\log y_t^{Auto}$, where y_t^{Auto} indicates automobile production.

Throughout the analysis, we follow the recent convention seen in the VAR literature and use levels, rather than the first or second differences, for all series. As Hamilton (1994) argues, a levels specification yields consistent estimates regardless of whether or not cointegration exists, whereas a difference specification is inconsistent if some variables are cointegrated. The lag length is set as eight in Case 1 and six in Case 2 based on the likelihood ratio test of Sims (1980).

Now we can set up the structural VAR model $A(L)X_t = \varepsilon_t$, where $X_t = (D_t, \log y_t^j)'$, $A(L) = A_0 - A_1L - \dots - A_pL^p$ is a p th-order lag polynomial of the two-by-two coefficient matrix A_k ($k = 0, 1, \dots, p$), and $\varepsilon_t = (\varepsilon_{D_t}, \varepsilon_{y_t^j})'$ is vector of serially uncorrelated structural disturbances with a mean zero and a covariance matrix Σ_ε . Here D_t is a dummy variable specifying the policy change (“Eco Point” or “Eco Car”) and $\log y_t^j$ is the logarithm of the index of productions ($\log y_t^{El}$ or $\log y_t^{Auto}$).

Structural disturbances are assumed to be orthogonalized, the recursive identification procedure implies that A_0 in the structural form becomes a lower

response functions are found to be insignificant.

triangular matrix, and the ordering in the VAR determines the degree of exogeneity of the variables. We treat the policy dummy variable as being the most exogenous, as it takes policymakers and the legislature over a month to learn of shocks to economic activity, and it is very difficult to make discretionary adjustments to fiscal policy within the space of a month. Therefore, there should be no feedback from the current economic variables to fiscal expansion.⁴ This justifies our treatment approach.

2.3 Datasets

We estimate the model using monthly data, as in the case of Miyazaki (2009) and Kozuka et al. (2012). This is motivated by the short duration of the post-crisis sample period, making it difficult to set a certain level of lag length when using quarterly data.

There are two variables that capture production: y_t^{El} , an indicator of electric appliance production (*minsei-yo denki kikai* in Japanese), and y_t^{Auto} , one for automobile production (*jou-you sha* in Japanese).⁵ They are set equal to 100 in 200. y_t^{El} includes the production of air conditioners and refrigerators, which were targeted by the eco-points program.⁶ These data are downloaded from the homepage of the Ministry of

⁴ This follows the arguments in Blanchard and Perotti (2002) and Miyazaki (2009).

⁵ To capture the effects of each policy, we would ideally focus on the production of the items most affected by the policies, such as gas-electric hybrid cars, air conditioners, and refrigerators. However, the data provided by METI is not available at such a detailed level.

⁶ The eco-points program also targeted LCD televisions capable of receiving digital terrestrial

Economy, Trade and Industry (METI) (<http://www.meti.go.jp/statistics/>). Both y_t^{EI} and y_t^{Auto} are seasonally adjusted using the X12-ARIMA method. We take the logarithm for y_t^{EI} and y_t^{Auto} , and the sample period is from January 1980 to December 2012.⁷

3. Empirical Results

3.1. Estimation Results

Figures 1a and 1b report the estimation results for Case 1 and Case 2, respectively.

The solid line depicts the estimated response and the dotted lines represent the 95% confidence intervals based on asymptotic distributions.⁸

Figure 1a indicates that the effect of the eco-points program is not statistically significant. However, the eco-car program has a positive and significant effect on automobile production, as shown in Figure 1b. This implies that this program was

broadcast signals, which are included in the “electric machines for home use” data category (*minsei-yo denshi kikai* in Japanese). LCD televisions are the only items in this category targeted by the policy, whereas y_t^{EI} covers a broader set of target items. Further, the Japanese government encouraged households to purchase this type of television leading up to July 2011, when all of Japan’s TV programming was switched from analog broadcasting to digital terrestrial broadcasting. If we examine the effects on electric machines for home use, it is clear that we cannot disentangle the policy effects of the eco-points program from the increase in the production of LCD televisions before this transition. As such, we use y_t^{EI} .

⁷ Another option would be to end the sample period in February 2011 in order to eliminate the influence of the Great East Japan Earthquake. When this is done, however, the impulse response functions are not estimated to be significant.

⁸ Other methods, such as Monte Carlo integration and bootstrap replications, could also be considered to calculate the confidence intervals of the impulse response functions. However, since there is no established method for calculation, we report the results based on asymptotic distributions. For confirmation, we also calculate the confidence intervals with 500 bootstrap replications, but the results and implications are not fundamentally changed.

effective at stimulating production of the automobile industry. However, the magnitude of the effect is very small, and it becomes insignificant four months after implementation.

3.2. Alternative Frameworks

We re-run the VAR analysis under alternative specifications. First, we re-estimate the model by changing the ordering such that $X_t = (\log y_t^j, D_t)'$. Second, we control for the real effective exchange rate (e_t), as foreign events and economic changes can strongly affect production in these two industries. In this specification, the ordering in the VAR is $X_t = (D_t, \log y_t^j, \log e_t)'$ and the lag lengths are set as five and nine in Cases 1 and 2, respectively. Finally, we limit the sample period after January 1990 as, following Christiano (1986) and Cecchetti and Karras (1994), we note a structural change in the data after this month. The lag length is set as four in both cases.⁹

The results are reported in Figures 2a to Figures 4b, showing that the results are not changed from the original specification: while the eco-points program has no positive effect on $\log y_t^{El}$, the eco-car program stimulates production in the automobile industry.

The effects on the real effective exchange rate are not estimated to be significant.

⁹ The lag lengths used for the additional tests in this subsection are also chosen using the likelihood ratio test of Sims (1980).

4. Conclusion

This study examined the effects of Japanese fiscal policy following the 2008 global financial crisis. We focused on two environment-related stimulus packages: the eco-points program for purchases of energy-efficient appliances and the eco-car program, including a tax break and subsidy for environmentally friendly vehicles. The impulse response function estimation results report that while the eco-points program had no significant effect, the eco-car program had a positive impact on automobile production. However, this effect was small and soon became insignificant. When evaluating the effects of Japanese discretionary fiscal policy following the global financial crisis, it must thus be concluded that even a policy with a positive effect generated very limited benefits for the economy.

Incidentally, when both packages were implemented, the announcements noted their termination dates. The increased automobile production might thus reflect consumers' incentives to purchase before the end of the eco-car tax program period: such a phenomenon might not be applicable to the case of electrical appliances.

There are some limitations of our analysis. First, we did not examine effects on

consumption or investment. In addition, to evaluate the effects more precisely, we should consider production of individual items, such as refrigerators or hybrid cars. Furthermore, more recent econometric techniques, such as factor-augmented or time-varying VAR models, could be employed within our approach. These extensions are left for future research.

Acknowledgments

The author would like to thank Akihiro Kawase, Yuji Kawano, Masao Tsuru, and Prateek Goorha for their insightful comments and suggestions. The delegates of 12th international conference of the Japan Economic Policy Association and the 51th annual meeting of the Public Choice Society are also acknowledged. This work was financially supported by a Grant-in-Aid for Scientific Research (Young Scientist) and financial aid from the Zengin Foundation for Studies on Economics and Finance. The usual disclaimer applies.

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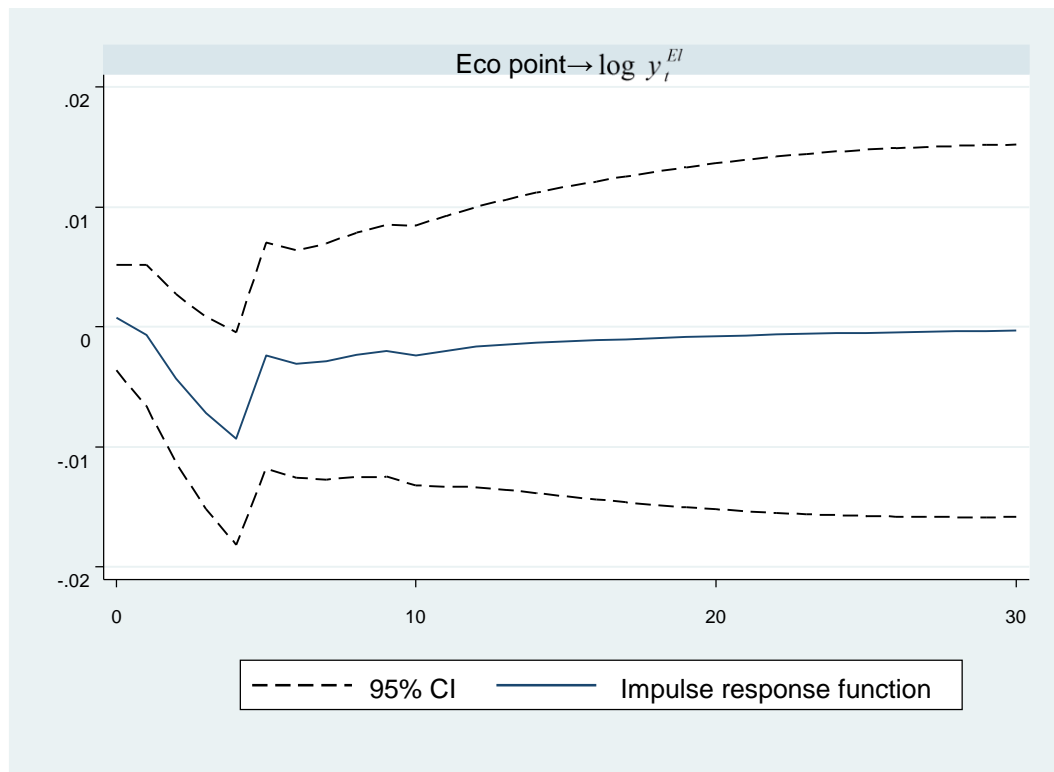
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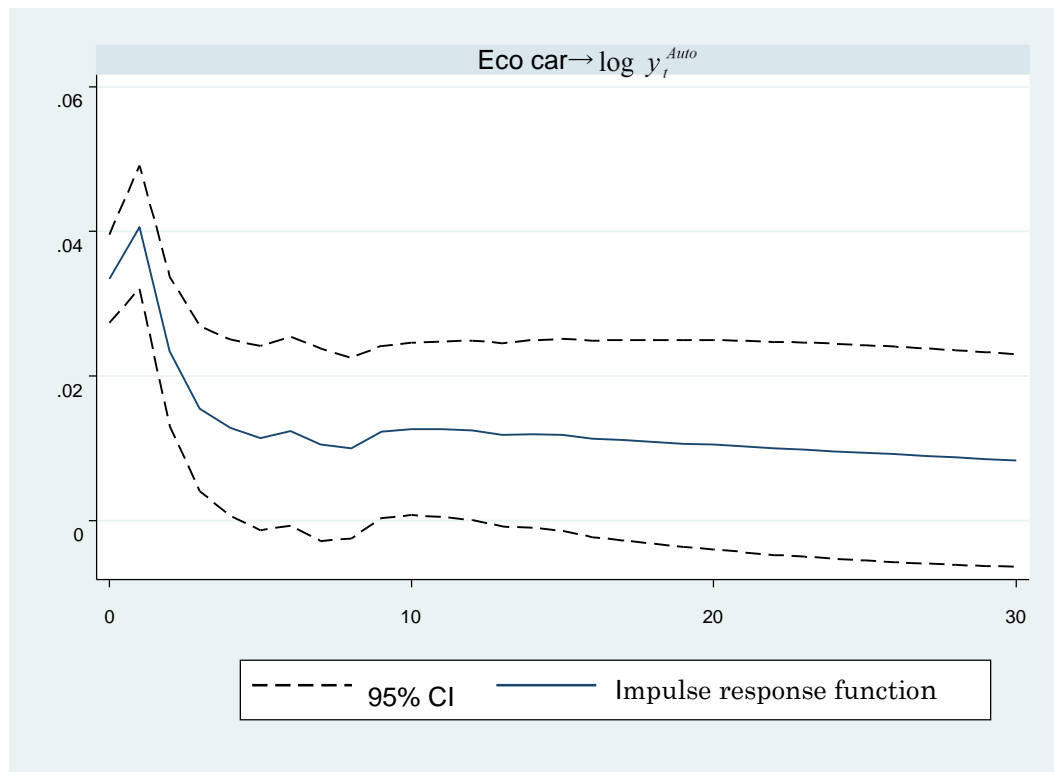
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Figure 1a. Impulse response function for the electrical appliance production index, y_t^{EI}



Note: The solid line indicates the estimated response and the dotted lines represent the 95% confidence intervals.

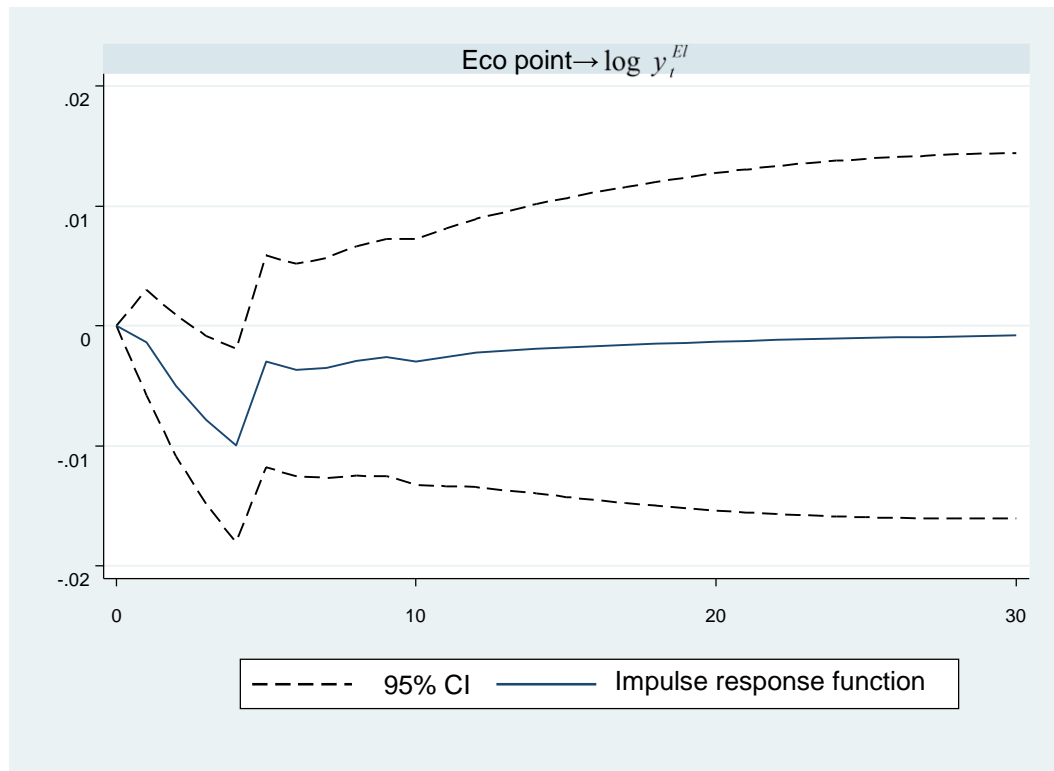
Figure 1b. Impulse response function for the automobile production index, y_t^{Auto}



Note: The solid line indicates the estimated response and the dotted lines represent the 95% confidence intervals.

Figure 2a. Impulse response function for the electrical appliance production index, y_t^{EI}

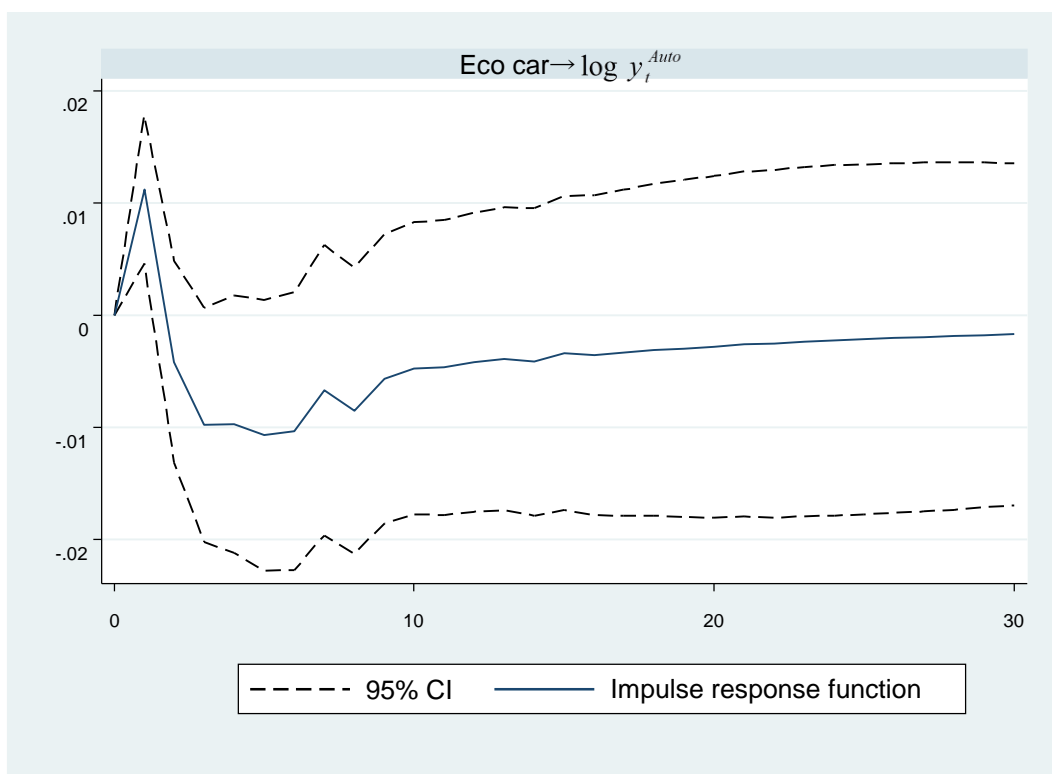
(Variable order changed)



Note: The solid line indicates the estimated response and the dotted lines represent the 95% confidence intervals.

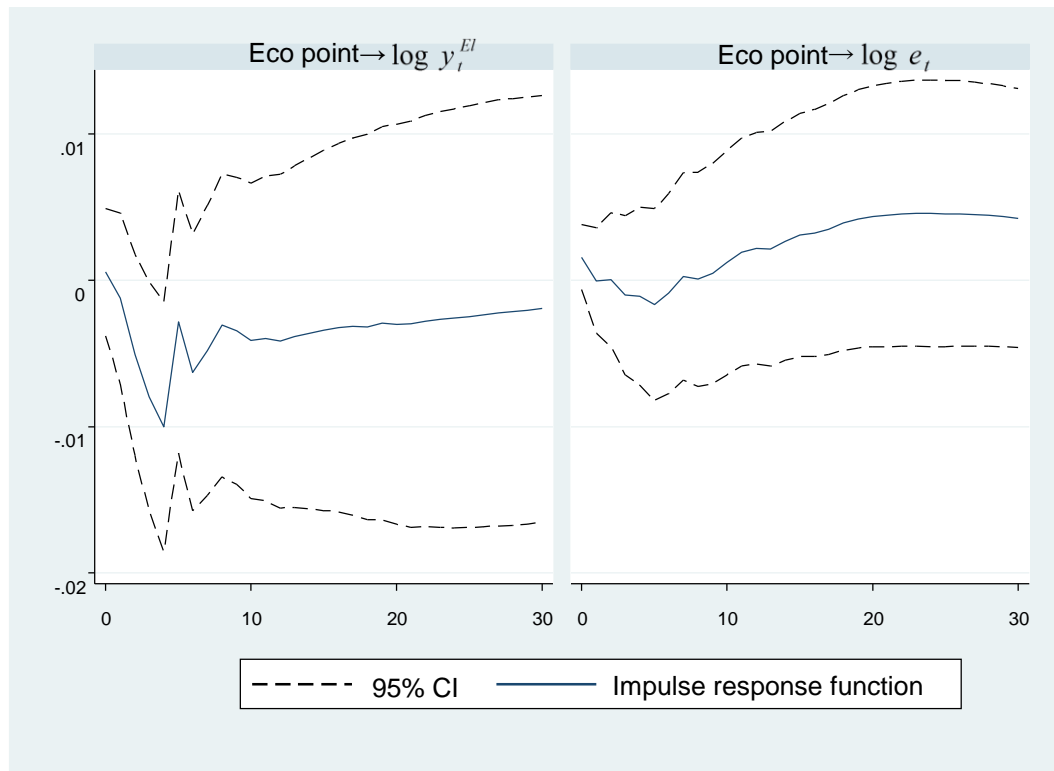
Figure 2b. Impulse response function for the automobile production index, y_t^{Auto}

(Variable order changed)



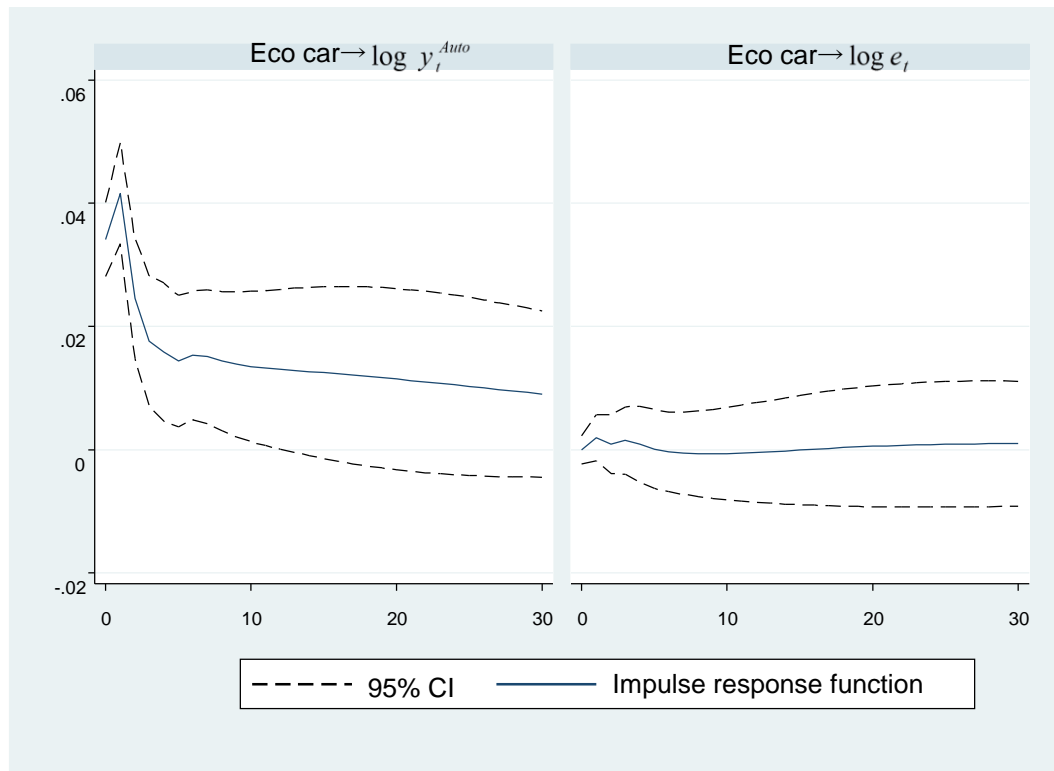
Note: The solid line indicates the estimated response and the dotted lines represent the 95% confidence intervals.

Figure 3a. Impulse response function for the electrical appliance production index (y_t^{EI}) and real effective exchange rate (e_t).



Note: The solid line indicates the estimated response and the dotted lines represent the 95% confidence intervals.

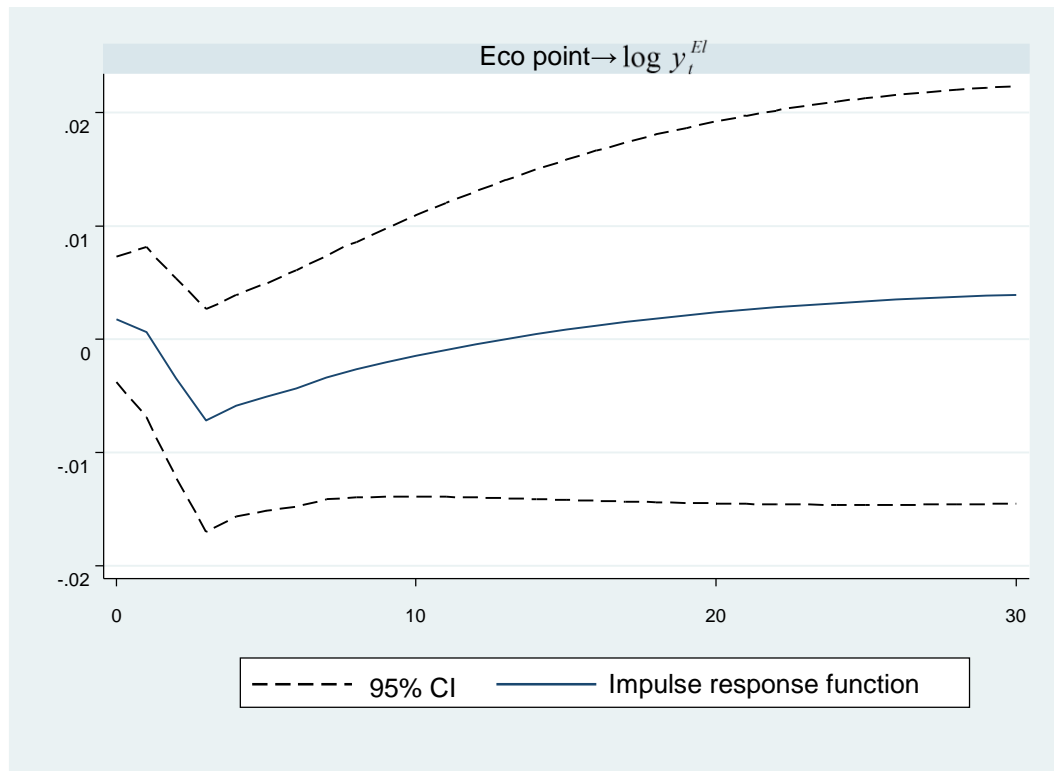
Figure 3b. Impulse response function for the automobile production index (y_t^{Auto}) and real effective exchange rate (e_t).



Note: The solid line indicates the estimated response and the dotted lines represent the 95% confidence intervals.

Figure 4a. Impulse response function for the electrical appliance production index, y_t^{EI}

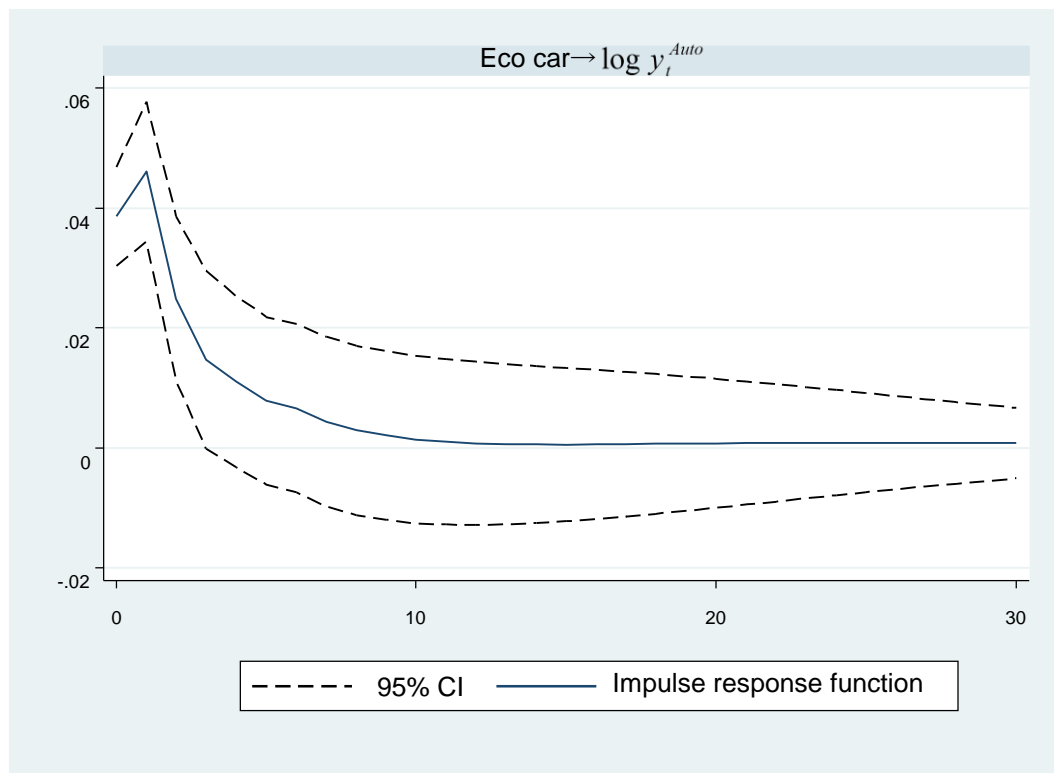
(Sample periods limited to post-January 1990)



Note: The solid line indicates the estimated response and the dotted lines represent the 95% confidence intervals.

Figure 4b. Impulse response function for the automobile production index, y_t^{Auto}

(Sample periods limited to post-January 1990)



Note: The solid line indicates the estimated response and the dotted lines represent the 95% confidence intervals.