# Business Cycle Properties of Product Turnover: Evidence from Japanese Monthly-Based Firm-Level Production Data

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**Abstract**

This paper studies the business cycle properties of product creation and destruction in the manufacturing sectors and the product switching behavior of manufacturing firms by employing a unique monthly-based firm-level production database for the Japanese manufacturing industry from January 2000 to December 2014, including the period of the Great Recession. This paper also uses an annual-based firm-level dataset for the Japanese manufacturing industry from 1981 to 2010 for reinforcing our empirical findings. The key findings of this paper are the followings: Net product creation is procyclical, which is driven by countercyclical product destruction rather than procyclical product creation. product creation is countercyclical and lags by approximately one quarter. Moreover, product creation and the fraction of firms increasing products are countercyclical and lag by around one quarter. The empirical evidence of this paper contributes to future studies on the modeling of product turnover or firms' product switching behavior over the business cycle.

## 1 Introduction

This paper studies the business cycle properties of product creation and destruction in manufacturing industries and the product switching behavior of manufacturing firms by employing a unique monthly-based firm-level production database for the Japanese manufacturing industries. The main object of this paper is to answer to whether product creation (destruction), which is the ratio of new (disappearing) products to existing products, is procyclical, acyclical, or countercyclical over the business cycle.

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Creative destruction is a famous concept of the theory of innovation and business cycles proposed by Joseph A. Schumpeter. The concept states that an innovation makes existing technologies obsolete and destroying them, the process of which repeats over time, and which evolves economic structure. While existing studies find out the importance of new factories or new products for economic growth or productivity (e.g. Bernard, Redding and Schott, 2010), there are not many existing studies about movements of product creation and destruction over the business cycle because of data availability. One of the exceptions is the study of Broda and Weinstein (2010). They show that product creation is procyclical while product destruction is weakly countercyclical, which leads to strongly procyclical net creation, by employing the Universal Product Codes (a.k.a. barcodes) data of the approximately 700,000 goods (covering the total expenditure on the goods in the CPI) purchased by approximately 55,000 households in the U.S. at the quarterly frequency for 1994 and 1999-2003. Their empirical findings are the starting point of our study.

Cyclicality of product creation, both theoretically and empirically, is arguable. Schumpeter (1939) originally argues that innovation is autonomous and takes place irrelevant to booms or recessions; in other words, innovation is acyclical. Shleifer (1986) proposes a theoretical model where inventions autonomously take place but innovations, or new products, do not appear in the market in recessions. The reason is that selling a new product based on an invention in the market must be profitable and need to meet at least fixed cost. According to his model, product creation is procyclical and he calls it "Implementation Cycle." Lee and Mukoyama (2015) find manufacturing plant entry is procyclical by employing the U.S. Annual Survey of Manufactures from 1972 to 1997. They also find that the average size and productivity of plants entering into the market in booms are relatively smaller than those in recessions. Meanwhile, Bernard and Okubo (2016) show somewhat countercyclical product creation by employing the Japanese Census of Manufactures, which is a census on manufacturing industries in Japan on an annual basis. They insist that product creation takes place at around troughs of business cycles based on "Trapped Factor Model" proposed by Bloom, Romer, Terry and Van Reenen (2013). The idea of trapped factor model is that employees inside a firm are difficult to be terminated even in recessions and the trapped resources (employees) are allocated to innovative activities, which leads to new products entry into the markets. Our results of countercyclical product creation support the point of view of Bernard and Okubo (2016).

Product destruction theoretically appears to be countercyclical but the arguments of existing empirical studies are mixed. Hamano and Zanetti (2017) create a general equilibrium model of endogenous product creation and destruction and insists that recessionary aggregate technology impacts lead to suspending the production of unprofitable goods, which means product destruction is basically countercyclical. Lee and Mukoyama (2015) empirically argue that manufacturing plant exit is acyclical based on the U.S. data. Meanwhile, as mentioned above, Broda and Weinstein (2010) show that product destruction appears to be weakly countercyclical. Our finding of countercyclical product creation is strongly countercyclical, which is more consistent with the finding of Broda and Weinstein (2010) than that of Lee and Mukoyama (2015).

This paper employs two types of datasets. The first one is the Census of Manufactures, which collects the information about manufacturing establishments in Japan with 5 or more employees on an annual basis. The second one is the Current Survey of Production, which surveys relatively large scale manufacturing establishments in Japan on a monthly basis. The Current Survey of Production covers the period of 15 years from January 2000 to December 2014. This monthly-based firm-level dataset includes four business cycles in Japan. The first business cycle is the boom and recession caused by the Dot-com bubble from January 1999 to January 2002. The second one is the longest economic boom after the WWII and the sharp downturn of the Great Recession from January 2002 to March 2009. The third one is the recovery from the Great Recession and a relatively short and small downturn from March 2009 to November 2012. The last one is the Abenomics boom since the beginning of Shinzo Abe administration from November 2012 to present. Unlike the Census of Manufactures, the Current Survey of Production is a survey, which means that it does not cover all of the establishments producing manufacturing products. Moreover, since the establishments to be surveyed are determined based on the scale of production of manufacturing products to be surveyed, it is not suitable for the purpose of seeing the status of market entry and exit of establishments or firms. Therefore, empirical findings of this paper primarily indicate the business cycle properties of product creation and destruction of continuing firms.

The rest of this paper is organized as follows. Section 2 describes the datasets that we used. Section 3 overviews our datasets and shows the empirical findings of product creation and destruction in the Japanese manufacturing industries. Section 4 concludes.

# 2 Data

## 2.1 Census of Manufactures

The Census of Manufactures (CMF) is the Japanese government's official measure of the manufacturing industry of Japan. It is conducted on manufacturing establishments in Japan by the Ministry of Economy, Trade, and Industry (METI) every year except the year when the Economic Census for Business Activity (ECBA), which collects information about all establishments in all industries in Japan, is conducted every five years. The beginning of the CMF dates back to 1883. The CMF from 1920 to 2010 had been conducted every year. After the ECBA began in 2011, the CMF is not conducted when the ECBA is conducted. The CMF started as a census for collecting information about manufacturing establishments with 5 or more employees. The CMF from 1939 to 1980 had been conducted on all manufacturing establishments. The CMF from 1981 to 2009 had been conducted on all manufacturing establishments in years ending with 0, 3, 5, and 8, while conducted on manufacturing establishments with 4 or more employees in other years. The CMF from 2010 has been conducted on manufacturing establishments with 4 or more employees. The CMF in 2013 was conducted on 218,551 establishments and its response rate is 95.2 percent.

The establishment-level data of the CMF from 1980 to the present are available by applying the secondary use of official statistics to the METI. Note that it is necessary to

use the ECBA for the year 2011 and 2015. The original establishment-level data are not assigned permanent IDs. Thus, some establishment master database is needed for associating each of the original census-year IDs with some permanent ID in order to analyze the data over the years. There are two types of establishment master databases: the response-based establishment master database and the list-based establishment master database.[1] The response-based establishment database is created by Shinpo et al. (2005) and extended by Matuura and Suga (2007). This master database is based on the presence or absence of responses to the questionnaire. For instance, when there is a response of an establishment to the 2000 CMF questionnaire and there is no response of the establishment to the 2001 CMF questionnaire, the establishment is considered exiting from the manufacturing market. In the case that there are not any responses of an establishment before 2001 and there is a response of the establishment to the 2001 questionnaire for the first time, the establishment is considered entering into the market and given a permanent ID. On the other hand, the list-based establishment master database is created by Abe et al. (2012). This master database is based on the establishment list prepared in advance of the CMF every year. If there is an establishment on the list, the establishment is considered doing business in the manufacturing market regardless of the presence or absence of responses to the questionnaire.

Those two master databases have contrasting advantages and disadvantages. While the response-based establishment master database has the advantage for making it possible to analyze the panel data in a relatively long time series from 1981 to the present, the master database has the disadvantage that an establishment is considered exiting from the market even in the case that the establishment remains in the market but did not respond to the questionnaire. This disadvantage generates a bias in measuring the entry and exit establishment flows. On the other hand, the list-based establishment master database has the advantages for being able to measure a more certain exit by using the establishment list and the information about the presence or absence of answer in the establishment list introduced since 2007. However, this master database has the disadvantages that a relatively short-time series is available because the establishment list can be used only from 1993 and furthermore the accurate measurement of entry and exit flows are available only from 2008. This study uses the response-based establishment master database in considering that the purpose of this study is to clarify the product cycle over the business cycle and the main interest is the product adding, dropping, and switching activity inside establishments or firms.

The CMF has two-types of questionnaires: Kou-type (K-type) questionnaire for establishments with 30 or more employees and Otsu-type (O-type) questionnaire for establishments with 29 or fewer employees. K-type questionnaire asks the basic information on the output and input factors such as total shipment amount, shipment value by product classification, inventory, number of employees, tangible fixed assets, raw materials, fuel and electricity usage amount, as well as geographical information, distributional information, including the total amount of labor compensation, and the ratio of the direct export amount to the ship-

[1]Those two master databases are available by submitting applications to the Research Institute of Economy, Trade and Industry.

ment amount.[2] On the other hand, O-type questionnaire also asks the basic information on output and input factors, geographical information, and distribution information but does not ask the amount of tangible fixed asset for establishments with less than 10 employees. The product items of CMF are classified following the Japan Standard Industrial Classification (JSIC) and each product item is assigned a 6-digit product ID number. The 2-digit, 3-digit, and 4-digit numbers from the top of the product ID numbers correspond to the major group, group, and class numbers of the JSIC. The industrial classification of an establishment is based on the 6-digit product ID numbers. When an establishment produces various products across the industries and the largest amount of the products is classified to an X industry, the establishment is classified as an establishment engaged in the X industry.[3]

## 2.2 Current Survey of Production

The history of the Current Survey of Production (CSP) is somewhat shorter than that of the CMF dating back to the Meiji era (from 1868 to 1912). The origin of the CSP can be found in the Monthly Textile Production Survey (Orimono Tsukibetsu Sangaku Chosa in Japanese) started in 1927. Subsequently, Monthly Survey of Important Production (Jyuyou Seisan Tsukibetsu Chosa in Japanese) started in June 1930 surveying the production status of important products on a monthly basis. After the WWII, the CSP started in January 1943 for grasping the production status and for adjusting the supply and demand of products and materials at the request of the Supreme Commander for the Allied Powers. In general, the CSP surveys the production status of materials and manufacturing products produced within manufacturing establishments on a monthly basis. The CSP asks the information on production value and quantity, shipment value and quantity, inventory, machinery, equipment, production capacity, and the number of workers at the end of the month for each product produced within establishments. CSP covers approximately 12,000 manufacturing establishments producing surveyed products more than a certain amount, which means that the covered establishments engage in production activities on a relatively large scale. The response rate of the CSP is approximately 94 percent.

The establishment-level data of the CSP from January 2000 to the present are available by applying the secondary use of official statistics to the Ministry of Economy, Trade, and Industry. Unlike the CMF, it is not difficult to create panel data because the surveyed establishments are already given permanent IDs. The most difficult part to handle the CSP data is to connect the surveyed items of each questionnaire chronologically. The questionnaire as of 2015 can be classified into (1) steel, nonferrous metals, and metal products, (2) chemical

[2]The ratio of the direct export amount to the shipment amount is available only from 2000.

[3]To be precise, an establishment producing only a single product is classified into some major group, group, and class of the JSIC based on the upper 2-digit, 3-digit, and 4-digit of the 6-digit product ID number, respectively. First, the major group-level classification of an establishment producing multiple products is decided by aggregating the amount of products with the same 2-digit number. The group-level classification of the establishment is decided based on the aggregated amount of products with the same 3-digit product ID number belonging to the major group that the establishment are classified into in the first step. The class-level classification of the establishment is decided in the same manner.

industry, (3) machinery, (4) ceramic and building materials, (5) textile and daily necessities, (6) paper, printing, plastic products, and rubber products, (7) natural resources and energy, but there are 109 types of questionnaire forms and these forms are different from each other. Thus, it is necessary to identify the correspondence relationship between each questionnaire form. Moreover, approximately 1600 product ID numbers are reviewed and changed every year.[4] Against this backdrop, as Konishi (2012) pointed out, there are few studies using the CSP compared to the CMF.

In principle, the CSP covers the establishments producing product items whose production value or shipment amount is large in the CMF, and the total shipment value of the CSP is approximately 20 percent of that of the CMF. This is not attributable only to the simple coverage rate of the establishment, but to not covering the food manufacturing, pharmaceuticals, or medical equipment manufacturing industries.[5] As already mentioned, the product items to be surveyed is revised each year. The basic criterion for the revisions is that product items to be excluded are the ones whose annual shipment values are less than 10 billion yen according to the CMF. Meanwhile, the product items to be added are the ones whose annual shipment values are more than 100 billion yen. The criteria of the selection of establishments to be surveyed are different for each product item. For some products, all the establishments to be surveyed, while for other products the establishments with a certain amount of employees to be surveyed. As a result, the shipment value based on the CSP is approximately 80 percent of the shipment value based on the CMF compared with the same product item.

# 3 Business Cycle Properties of Product Turnover

## 3.1 Overview

Figures 1–3 report the fraction of continuing firms adding products, dropping products, and both adding and dropping products calculated based on the CMF. In these figures "Adding" is defined as the ratio between the number of firms only adding products in period $t$ relative to period $t-1$ and the number of all the firms existing both in period $t$ and $t-1$ (continuing firms). "Dropping" is the fraction of firms only dropping products to all the continuing firms. "Both Adding and Dropping (hereafter Both)" is the fraction of firms both adding and dropping products to all the continuing firms. At a glance, it is found that there is a sharp temporary increase in Both in the following five periods: 1984 to 1985, 1993 to 1994,

[4]As of 2016, there are 1609 products (corresponding to approximately 6-digit product items of the CMF). Some product items are finer than those of the CMF. For instance, the product ID number 311111 of 2014 CMF is "light and small passenger cars, less than 2000 ml of cylinder capacity, including chassis," while the corresponding product items in the CSP are "midget passenger cars (cylinder capacity less than or equal to 660 ml)" and "small passenger cars (cylinder capacity greater than 660 ml and less than or equal to 2,000 ml)."

[5]The current survey of production for the food manufacturing products is conducted by the Ministry of Agriculture, Forestry and Fisheries. The current survey of production for the pharmaceuticals and medical equipment manufacturing products is conducted by the Ministry of Health, Labour and Welfare.

1998 to 1999, 2001 to 2002, and 2007 to 2008. Existing studies about product switching using the CMF also reports similar results. This finding, however, should be considered being affected to some extent by revisions of product classification. The circle markers in the figures stand for the periods when the product classification of the CMF was revised. All of the circle markers coincide with the five sharp temporary increases in Both. We investigated several firm samples categorized into Both and found that some of the firms likely answered to have changed their product portfolio even though actually they did not change their product portfolio at the timing of product classification revisions. Therefore, there is a possibility of measurement errors in firms' product changes. Of course, it does not mean that all of the temporary sharp increases are caused by the revisions of product classification. Some of the increases are the results of the reasonable product switching behavior of the firms in response to the surrounding economic environment. Nevertheless, these sharp temporary increases in Both should be interpreted carefully.

## 3.2 Product Creation and Destruction

### 3.2.1 Evidence from Census of Manufactures

Figure 4 reports product entry and exit rates of the Japanese manufacturing sector for the period from 1981 to 2010 calculated on the CMF. Product entry rate is defined as the number of new products in period $t$ relative to period $t-1$ divided by the number of all the products in period $t$. This definition is the same as that of Broda and Weinstein (2010). Product exit rate is the fraction of the number of disappearing products in the current period to the number of total products in the previous period. As seen in this figure, entry and exit rates are acyclical or countercyclical. As a matter of facts, the correlation of the entry rate with the total shipment growth rate is –0.082, that of the exit rate is –0.473, and that of net entry rate (entry minus exit) is 0.390. It is safe to say that the net entry rate of the manufacturing sector is procyclical not because the entry rate is procyclical but because the exit rate is countercyclical.

Figures 5–7 show product creation and destruction measured based on the CMF. Product creation is defined as the value of new products in period $t$ relative to period $t-1$ divided by the total value of products in period $t$ following the definition of Broda and Weinstein (2010). Product destruction is defined as the value of disappearing products in period $t$ relative to period $t-1$ divided by the total value of products in period $t-1$. Net product creation is defined as product creation subtracted by product destruction. It is remarkable that the net product creation of the manufacturing sector and the growth rate of the total shipment of manufacturing products is positively correlated; in other words, net product creation is procyclical. In point of fact, the correlation of the net product creation with the growth in total shipment is 0.403. Meanwhile, product creation and destruction seem to be acyclical or countercyclical in the same manner as product entry and exit. In fact, the correlation of the entry rate with the growth rate of total shipment is 0.013 and that of the exit rate is –0.148. Procyclical net product creation found here is the same as the empirical findings of Broda and Weinstein (2010) while countercyclical product creation is contrary to the result

of their study. We will revisit this contradiction later.

Figure 8 shows the decomposition of the growth in shipment into that in new, disappearing, and continuing products calculated based on the CMF. As seen in this figure, the contribution of the value of new products is not small to the total shipment growth in the manufacturing sector. The degree of average annual contribution of new products for the period from 1981 to 2010 is 3.84 percent. Meanwhile, the negative impact of the value of disappearing products is also not small on the total shipment growth. The degree of average annual contribution of disappearing products for the same period is –4.01. Therefore, the contribution of the net value of new products is not large and most of the contribution to the total shipment growth comes from increases in continuing products as shown in figure 9.

Summarizing the above findings from the CMF, (1) net product creation is procyclical in terms of both value and number of products, (2) procyclical net product creation is caused by countercyclical product destruction rather than procyclical product creation, (3) product creation is even countercyclical, which contradicts the empirical facts argued by Broda and Weinstein (2010), and (4) most of cyclical growth in total shipment is accounted for by growth in continuing products.

### 3.2.2 Evidence from Current Survey of Production

Figures 10–12 report product creation and destruction measured based on the CSP. The definitions of creation, destruction, and net creation are the same as those of the above. Note that product creation and destruction in the figures are the three-month centered moving averages of the original time series of product creation and destruction for the purpose of extracting the basic trend from these seasonally adjusted monthly-based time series. Findings from the CSP are similar to those from the CMF. The correlation of net product creation with HP filtered ($\lambda = 129600$) total shipment is 0.16, which means net product creation is weakly procyclical. Meanwhile, as seen in figure 11, creation is countercyclical. In point of fact, the correlation of product creation with the detrended total shipment is –0.41. Product destruction is more countercyclical than product creation, and the correlation between product destruction and the detrended total shipment is –0.47. Product destruction is more countercyclical than product creation, which is why net production is weakly procyclical.

Figures 13 and 14 are the decomposition of shipment growth into creation, destruction, and continuing products calculated based on the CSP. Their implication is similar to the case of CMF. Continuing products contribute the most to the cyclical growth of total shipment. Meanwhile, product creation and destruction contribute less than the case of the CSP. A potential explanation is that the establishments or firms surveyed in the CSP tend to be large scale and stable, which is why the contribution of product creation and destruction becomes smaller compared with the case of the CMF.

Here we change the point of view from product-level to firm-level business cycle properties. Figures 15–17 show the movements of the fraction of continuing firms (existing firms in both period $t$ and $t-1$) switching their product portfolios and HP filtered shipment for the period from January 2000 to December 2014. At a glance, it appears that the fractions of firms only adding products, only dropping products, and both adding and dropping are

countercyclical. In fact, the correlation of the fractions of only adding, only dropping, are both adding and dropping products are –0.375, –0.499, and –0.341, respectively. Meanwhile, there is a difference in leads and lags relationship with total shipment among those fractions. As shown in figure 18, the fraction of firms only dropping products is coincident, for its correlation with detrended shipment has the largest negative correlation at zero. The fraction of firms only adding products lags by two months, or approximately one quarter. In contrast, the faction of firms both adding and dropping leads by three months, or one quarter.

Which is more dominant adding or dropping products for continuing firms in response to the business cycle fluctuation? Figure 21 shows the movements of the fraction of firms increasing the number of products relative to the previous period and detrended total shipment. It appears that the movement of the fraction of firms increasing the number of products is countercyclical. Like the cross-correlation of the fraction of firms only adding products with the total shipment, the fraction of firms increasing the number of products is countercyclical and lags by two months, or approximately one quarter.

Summarizing the above findings from the CSP, Like the facts based on the CMF, (1) net product creation is weakly procyclical, (2) product creation and destruction are countercyclical (3) weakly procyclical net product creation comes from more countercyclical product destruction than product creation, (4) product creation is countercyclical, which is contrary to the facts put forward by Broda and Weinstein (2010), and (5) most of the cyclical growth in total shipment is attributed to growth in continuing products. Moreover, from the point of view of firm-level business cycle properties, (6) the fraction of firms switching products is countercyclical, and (7) the fraction of firms increasing products is also countercyclical and lags by approximately one quarter.

## 3.3 Potential Product Turnover within the Boundary of a Continuing Product

Figure 21 shows detrended product price variation and detrended shipment from January 2000 to 2001. Product price variation is defined as the standard deviation of relative prices of products in each period. The definition of the relative price of a product is the price of the product produced by an establishment relative to the average price of the same products produced by each establishment. It appears that the product price variation is procyclical. The price of a product is calculated by dividing the value of shipment of the product by the quantity of shipment of the product. According to the definition above, the price can move when there are any changes in the combination of products at lower aggregate level than the product classification level of the CSP. An increase in product price variation means an increase in the variation of relative prices of products.

# 4 Conclusion

This paper studied the business cycle properties of product creation and destruction in the manufacturing sectors and the product switching behavior of manufacturing firms by employing a unique monthly-based firm-level production database for the Japanese manufacturing industry from January 2000 to December 2014, including the period of the Great Recession. This paper also used an annual-based firm-level dataset for the Japanese manufacturing industry from 1981 to 2010 for reinforcing our empirical findings.

The key findings of this paper are the followings. First, product creation is countercyclical and lags by approximately one quarter. Second, product destruction is also countercyclical but its negative correlation is larger than that of product creation. Third, net product creation is procyclical, which is driven by countercyclical product destruction rather than procyclical product creation.

We believe the empirical evidence of this paper will contribute to future studies on the modeling of product turnover or firms' product switching behavior over the business cycle.

# References


**Bernard, A. B. and T. Okubo**, "Product Switching and the Business Cycle," *National Bureau of Economic Research Working Paper Series*, 2016, *No. 22649.*

**_ , S. J. Redding, and P. K. Schott**, "Multiple-Product Firms and Product Switching," *American Economic Review*, 2010, *100* (1), 70–97.

**Bloom, N., P. M. Romer, S. J. Terry, and J. Van Reenen**, "A Trapped-Factors Model of Innovation," *American Economic Review*, 2013, *103* (3), 208–13.

**Broda, C. and D. E. Weinstein**, "Product Creation and Destruction: Evidence and Price Implications," *American Economic Review*, 2010, *100* (3), 691–723.

**Hamano, M. and F. Zanetti**, "Endogenous Product Turnover and Macroeconomic Dynamics," *Review of Economic Dynamics*, 2017, *26*, 263–279.

**Lee, Y. and T. Mukoyama**, "Entry and Exit of Manufacturing Plants over the Business Cycle," *European Economic Review*, 2015, *77*, 20–27.

**Schumpeter, J. A.**, *Business Cycles*, Vol. 1, McGraw-Hill New York, 1939.

**Shleifer, A.**, "Implementation Cycles," *Journal of Political Economy*, 1986, *94* (6), 1163–1190.

Table 1: An Example of Product Classification of CMF and CSP

| Census of Manufactures | | Current Survey of Production |
|---|---|---|
| 31 | Transportation Equipment | |
| 3111 | Motor vehicles, including motorcycles | |
| 311111 | Light and small passenger cars, less than 2000 ml cylinder capacity, including chassis | Midget passenger cars (cylinder capacity less than or equal to 660ml) |
| | | Small passenger cars (cylinder capacity greater than 660ml and less than or equal to 2,000ml) |
| 311112 | Ordinary passenger cars, 2000 ml cylinder capacity or more, including chassis | Large passenger cars (cylinder capacity greater than 2,000ml) |
| 311113 | Buses | Small bus chassis (including complete buses) |
| | | Large bus chassis (including complete buses) |
| 311114 | Trucks, including tractors | Midget truck chassis with gasoline engines (including complete trucks) |
| | | Midget truck chassis with disel engines (including complete trucks) |
| | | Large truck chassis with gasoline engines (including complete trucks) |
| | | Large truck chassis with disel engines (including complete trucks) |
| | | Tractor truck chassis (including complete tractor trucks) |
| 311116 | Bus and truck chassis | |
| 311115 | Motor vehicles for special-use | Special passenger cars |
| 311117 | Motorcycles, less than 125 ml, including motor bicycles and motor scooters | Motor cycles (cylinder capacity less than or equal to 50ml) |
| | | Motor cycles (cylinder capacity greater than 50ml and less than or equal to 125ml) |
| 311118 | Motorcycles, more than 125 ml, including ones with side cars and motor scooters | Motor cycles (cylinder capacity greater than 125ml and less than or equal to 250ml) |
| | | Motor cycles (cylinder capacity greater than 250ml) |

Notes: The product ID number 31116 (Bus and truck chassis) of the Census of Manufactures corresponds to both buss chassis (including complete busses) and truck chassis (including complete trucks) of the Current Survey of Production.

Table 2: Numbers of Product Items of CMF and CSP

| Industry (JSIC) | | Number of Products | |
|---|---|---|---|
| | | CMF | CSP |
| 9 | Food | 134 | - |
| 10 | Beverages, Tobacco, and Feed | 41 | - |
| 11 | Textile Products | 249 | 80 |
| 12 | Lumber and Wood Products, except Furniture | 57 | 8 |
| 13 | Furniture and Fixtures | 30 | 25 |
| 14 | Pulp, Paper, and Paper Products | 72 | 51 |
| 15 | Printing and allied industries | 19 | - |
| 16 | Chemical and Allied Products | 229 | 254 |
| 17 | Petroleum and Coal Products | 28 | 27 |
| 18 | Plastic Products, except otherwise classified | 68 | 30 |
| 19 | Rubber products | 52 | 28 |
| 20 | Leather Tanning, Leather Products and Fur Skins | 45 | 7 |
| 21 | Ceramic, Stone and Clay Products | 152 | 86 |
| 22 | Iron and Steel | 88 | 94 |
| 23 | Non-ferrous Metals and Products | 71 | 62 |
| 24 | Fabricated Metal Products | 141 | 87 |
| 25 | General-purpose Machinery | 93 | 117 |
| 26 | Production Machinery | 169 | 157 |
| 27 | Business Oriented Machinery | 98 | 26 |
| 28 | Electronic Parts, Devices and Electronic Circuits | 71 | 91 |
| 29 | Electrical Machinery, Equipment, and Supplies | 132 | 160 |
| 30 | Information and Communication Electronics Equipment | 71 | 43 |
| 31 | Transportation Equipment | 92 | 89 |
| 32 | Miscellaneous Manufacturing Industries | 137 | 22 |
| Total | | 2339 | 1544 |

Notes: The figures are based on the 2014 CMF and the 2014 CSP. The number of products is the number of product items actually produced by the establishments surveyed.

# Table 3: Numbers of Product Items of CMF and CSP over Time

(1) Census of Manufactures

| Industry | 1981 | | 1985 | | 1994 | | 1999 | | 2002 | | 2008 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ORG | CNV | ORG | CNV | ORG | CNV | ORG | CNV | ORG | CNV | ORG | CNV |
| Food | 136 | 115 | 132 | 116 | 132 | 116 | 136 | 116 | 134 | 116 | 134 | 116 |
| Beverages, tobacco, and feed | 28 | 28 | 33 | 32 | 34 | 33 | 37 | 31 | 39 | 33 | 40 | 33 |
| Textile products | 346 | 220 | 324 | 221 | 323 | 222 | 278 | 222 | 279 | 222 | 248 | 221 |
| Lumber and wood products | 69 | 50 | 70 | 52 | 70 | 52 | 59 | 52 | 60 | 52 | 57 | 52 |
| Furniture and fixtures | 34 | 25 | 33 | 26 | 33 | 26 | 33 | 26 | 33 | 26 | 30 | 26 |
| Pulp, paper, and papr products | 76 | 65 | 75 | 65 | 76 | 65 | 78 | 65 | 76 | 64 | 72 | 65 |
| Printing and allied industries | 19 | 17 | 19 | 17 | 19 | 17 | 20 | 17 | 20 | 17 | 19 | 17 |
| Chemical products | 241 | 204 | 238 | 205 | 243 | 205 | 236 | 205 | 234 | 204 | 231 | 204 |
| Petroleum and coal products | 34 | 28 | 32 | 28 | 32 | 28 | 31 | 28 | 31 | 29 | 29 | 29 |
| Plastic products | 29 | 29 | 61 | 29 | 61 | 29 | 66 | 29 | 66 | 29 | 68 | 29 |
| Rubber products | 63 | 53 | 62 | 53 | 62 | 53 | 54 | 53 | 54 | 53 | 53 | 53 |
| Leather products and fur skins | 44 | 42 | 45 | 43 | 45 | 43 | 45 | 43 | 45 | 43 | 45 | 43 |
| Ceramic, stone and clay products | 152 | 144 | 157 | 145 | 158 | 146 | 158 | 146 | 161 | 146 | 156 | 144 |
| Iron and steel | 99 | 87 | 92 | 87 | 92 | 87 | 91 | 87 | 90 | 86 | 88 | 86 |
| Non-ferrous metals and products | 88 | 64 | 80 | 65 | 83 | 66 | 77 | 66 | 75 | 66 | 69 | 66 |
| Fabricated metal products | 135 | 130 | 139 | 131 | 139 | 131 | 139 | 131 | 139 | 131 | 141 | 131 |
| General-purpose machinery | 93 | 89 | 94 | 90 | 94 | 90 | 93 | 90 | 93 | 90 | 93 | 90 |
| Production machinery | 167 | 148 | 170 | 149 | 172 | 148 | 165 | 148 | 168 | 150 | 170 | 150 |
| Business oriented machinery | 96 | 80 | 98 | 81 | 96 | 81 | 99 | 81 | 103 | 81 | 103 | 81 |
| Electronic parts, devices and circuits | 23 | 21 | 26 | 22 | 41 | 24 | 55 | 24 | 55 | 24 | 73 | 24 |
| Electrical machinery, equipment, and supplies | 114 | 99 | 116 | 99 | 121 | 102 | 122 | 102 | 129 | 102 | 132 | 102 |
| ICT equipment | 41 | 35 | 43 | 36 | 45 | 37 | 58 | 37 | 66 | 37 | 69 | 37 |
| Transportation equipment | 99 | 80 | 96 | 81 | 94 | 81 | 91 | 81 | 93 | 82 | 92 | 82 |
| Miscellaneous | 149 | 118 | 152 | 119 | 154 | 119 | 142 | 119 | 143 | 119 | 136 | 120 |
| Total | 2375 | 1971 | 2387 | 1992 | 2419 | 2001 | 2363 | 1999 | 2386 | 2002 | 2348 | 2001 |

(2) Current Survey of Production

| Industry | 2000 | | 2001 | | 2002 | | 2003 | | 2004 | | 2005 | | 2006 | | 2011 | | 2014 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ORG | CNV | ORG | CNV | ORG | CNV | ORG | CNV | ORG | CNV | ORG | CNV | ORG | CNV | ORG | CNV | ORG | CNV |
| Textile Products | 509 | 409 | 502 | 409 | 379 | 314 | 379 | 314 | 379 | 314 | 379 | 314 | 344 | 290 | 262 | 240 | 214 | 211 |
| Pulp, Paper, and Paper Products | 171 | 144 | 171 | 144 | 129 | 124 | 129 | 124 | 129 | 124 | 129 | 124 | 129 | 124 | 125 | 124 | 124 | 124 |
| Chemical Products | 713 | 621 | 708 | 621 | 436 | 411 | 436 | 411 | 433 | 410 | 413 | 394 | 411 | 392 | 390 | 386 | 382 | 380 |
| Rubber Products | 85 | 69 | 85 | 69 | 53 | 50 | 53 | 50 | 53 | 50 | 52 | 50 | 54 | 52 | 49 | 47 | 47 | 47 |
| Mining, Petroleum and Coal Products | 139 | 120 | 139 | 120 | 80 | 76 | 80 | 76 | 80 | 76 | 72 | 68 | 72 | 68 | 51 | 51 | 51 | 51 |
| Plastic Products | 50 | 42 | 49 | 42 | 42 | 41 | 42 | 41 | 42 | 41 | 42 | 41 | 42 | 41 | 42 | 41 | 42 | 41 |
| Ceramic, Stone and Clay Products | 303 | 250 | 297 | 250 | 188 | 172 | 188 | 172 | 189 | 171 | 173 | 161 | 173 | 161 | 146 | 138 | 143 | 138 |
| Iron and Steel | 343 | 304 | 338 | 304 | 314 | 285 | 314 | 285 | 235 | 213 | 235 | 213 | 235 | 213 | 235 | 213 | 134 | 133 |
| Non-ferrous Metals and Products | 351 | 302 | 351 | 302 | 192 | 182 | 190 | 182 | 179 | 171 | 174 | 171 | 170 | 168 | 154 | 152 | 150 | 150 |
| Fabricated Metal Products | 266 | 208 | 257 | 200 | 190 | 178 | 190 | 178 | 190 | 178 | 177 | 174 | 174 | 171 | 167 | 164 | 167 | 164 |
| General-purpose Machinery | 807 | 614 | 663 | 481 | 500 | 443 | 490 | 442 | 482 | 438 | 456 | 427 | 455 | 427 | 427 | 415 | 400 | 394 |
| Electronic Machinery, Devices, ICT Equipment | 541 | 383 | 472 | 353 | 442 | 356 | 435 | 351 | 416 | 350 | 397 | 337 | 391 | 334 | 375 | 336 | 362 | 335 |
| Transportation Equipment | 187 | 151 | 171 | 135 | 133 | 125 | 133 | 125 | 133 | 125 | 122 | 116 | 122 | 116 | 119 | 118 | 113 | 113 |
| Miscellaneous | 124 | 108 | 124 | 108 | 86 | 75 | 86 | 75 | 102 | 91 | 96 | 90 | 96 | 90 | 84 | 84 | 84 | 84 |
| Total | 4589 | 3725 | 4327 | 3538 | 3164 | 2832 | 3145 | 2826 | 3042 | 2752 | 2917 | 2680 | 2868 | 2647 | 2626 | 2509 | 2413 | 2365 |

Notes: ORG stands for the number of original product IDs in the CMF or CSP. CNV stands for the number of product new IDs combined over time.

Table 4: Items Surveyed in the Current Survey of Production

| Industry (JSIC) | Production | | Shipment | | Inventory |
|---|---|---|---|---|---|
| | Value | Quantity | Value | Quantity | Quantity |
| Textile Products | 80 | - | 63 | 30 | 63 |
| Lumber and Wood Products, except Furniture | 8 | - | 8 | 8 | 8 |
| Furniture and Fixtures | 25 | - | 25 | 25 | 25 |
| Pulp, Paper, and Paper Products | 51 | - | 49 | 49 | 51 |
| Printing and Allied Industries | - | 7 | - | - | - |
| Chemical and Allied Products | 254 | - | 254 | 249 | 254 |
| Petroleum and Coal Products | 27 | - | 27 | 7 | 27 |
| Plastic Products, except otherwise classified | 30 | - | 30 | 30 | 30 |
| Rubber Products | 28 | - | 28 | 28 | 28 |
| Leather Tanning, Leather Products, and Fur Skins | 7 | - | 7 | 7 | 7 |
| Ceramic, Stone, and Clay Products | 86 | 4 | 82 | 82 | 82 |
| Iron and Steel | 94 | 33 | 63 | - | 63 |
| Non-ferrous Metal and Products | 62 | 17 | 45 | 43 | 45 |
| Fabricated Metal Products | 87 | 47 | 68 | 44 | 69 |
| General-purpose Machinery | 117 | 132 | 64 | 64 | 63 |
| Production Machinery | 157 | 157 | 97 | 97 | 97 |
| Business Oriented Machinery | 26 | 26 | 25 | 25 | 25 |
| Electronic Parts, Devices, and Electronic Circuits | 91 | 84 | 45 | 42 | 45 |
| Electrical Machinery, Equipment, and Supplies | 160 | 162 | 73 | 73 | 73 |
| Information and Communication Electronics Equipment | 43 | 48 | 18 | 15 | 18 |
| Transportation Equipment | 89 | 123 | 26 | 26 | 26 |
| Miscellanous Manufacturing Industries | 22 | 5 | 22 | 22 | 22 |
| Total | 1544 | 845 | 1119 | 966 | 1121 |

Notes: Each number of items is surveyed and actually recorded in the 2014 CSP database.

Table 5: Number, Shipment, and Employees of Firms and Establishments

(1) Census of Manufactures (2010)

| | Firms | | Shipment (bil. Yen) | | Employees | |
|---|---|---|---|---|---|---|
| | Number | Ratio | Total | Average | Total | Average |
| Single-product | 122,343 | 59.2% | 68,551 | 0.6 | 2,975,004 | 24 |
| Multiple-Products | 18,408 | 8.9% | 15,710 | 0.9 | 482,184 | 26 |
| Multiple-Industries | 33,842 | 16.4% | 67,736 | 2.0 | 1,602,609 | 47 |
| Multiple-Sectors | 32,220 | 15.6% | 137,688 | 4.3 | 2,567,314 | 80 |
| Total | 206,813 | 100.0% | 289,685 | 1.4 | 7,627,111 | 37 |

(2) Current Survey of Production (2010)

| | Establishments | | Shipment (bil. Yen) | | Employees | |
|---|---|---|---|---|---|---|
| | Number | Ratio | Total | Average | Total | Average |
| Single-product | 3,561 | 45.7% | 9,230 | 2.6 | 220,782 | 62 |
| Multiple-Products | 3,002 | 38.5% | 22,281 | 7.4 | 387,258 | 129 |
| Multiple-Industries | 430 | 5.5% | 7,108 | 16.5 | 104,920 | 244 |
| Multiple-Sectors | 800 | 10.3% | 22,118 | 27.6 | 299,200 | 374 |
| Total | 7,793 | 100.0% | 60,737 | 7.8 | 1,012,160 | 130 |

Figure 1: Product Switching of All Firms (Census of Manufactures)

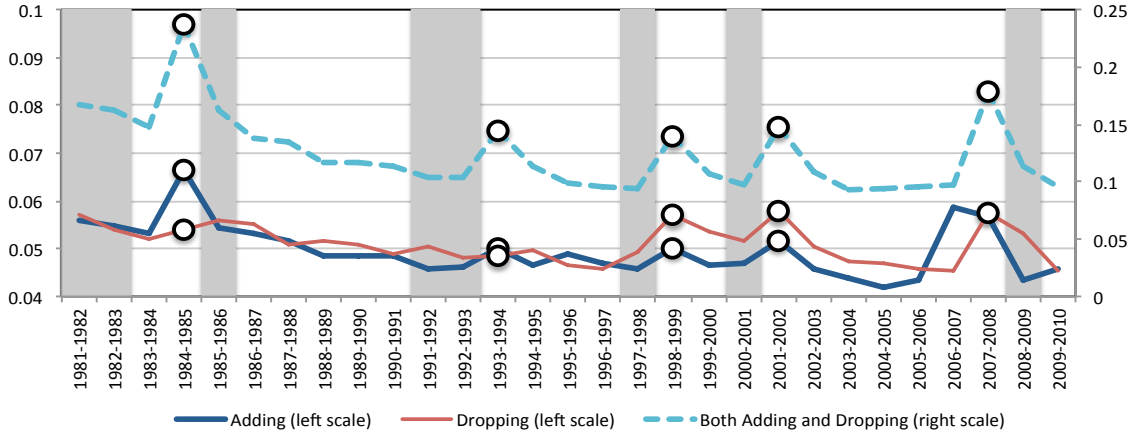



Figure 2: Product Switching of SP Firms (Census of Manufactures)

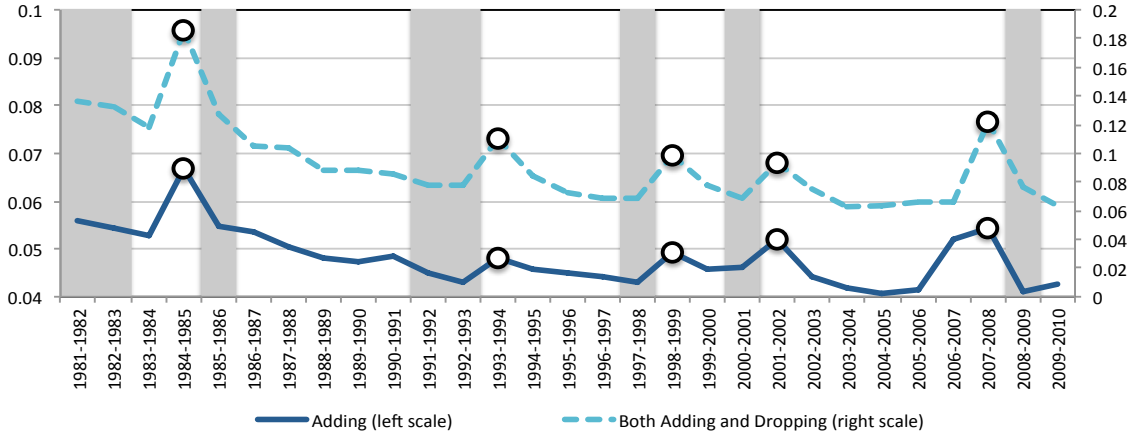
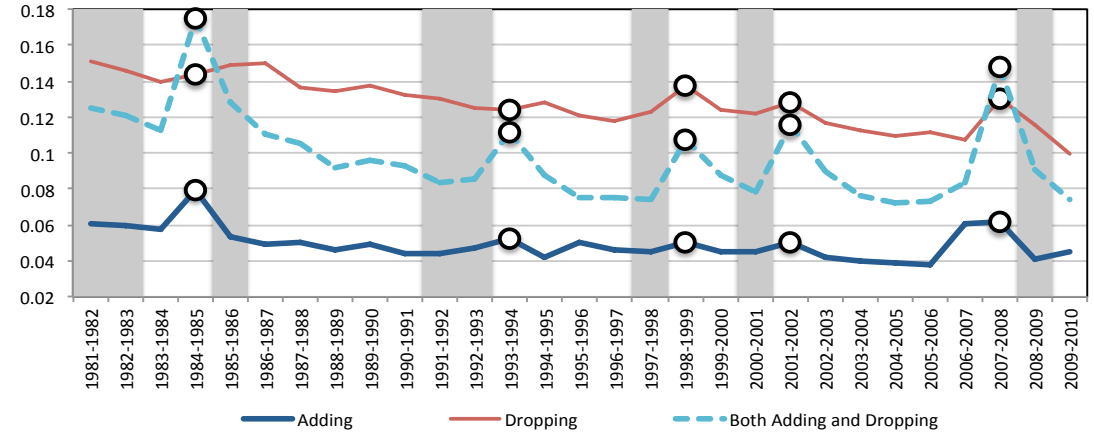
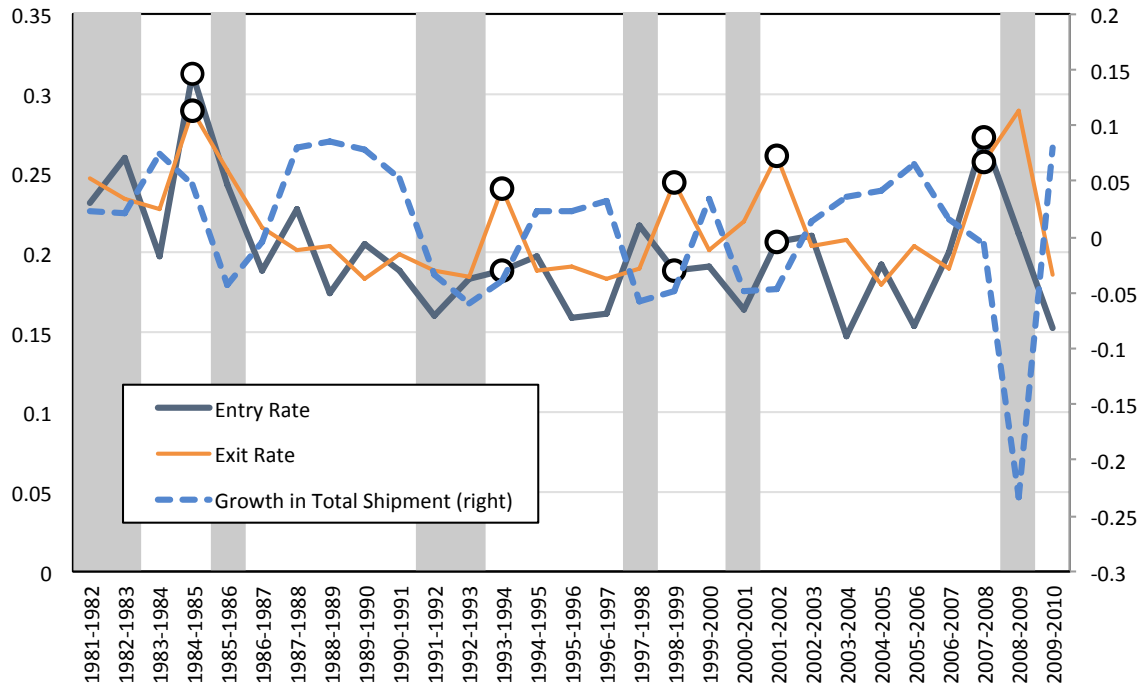



Figure 3: Product Switching of MP Firms (Census of Manufactures)




Notes: The circle markers in the figures stands for the periods when the product classification of the Census of Manufactures are revised. The parts colored gray in the background represent recession periods.

Figure 4: Product Entry, Exit Rate, and Shipment Growth (Census of Manufactures)




Notes: The circle markers in the figures stands for the periods when the product classification of the Census of Manufactures are revised. The parts colored gray in the background represent recession periods.

Figure 5: Net Creation and Shipment Growth (Census of Manufactures)

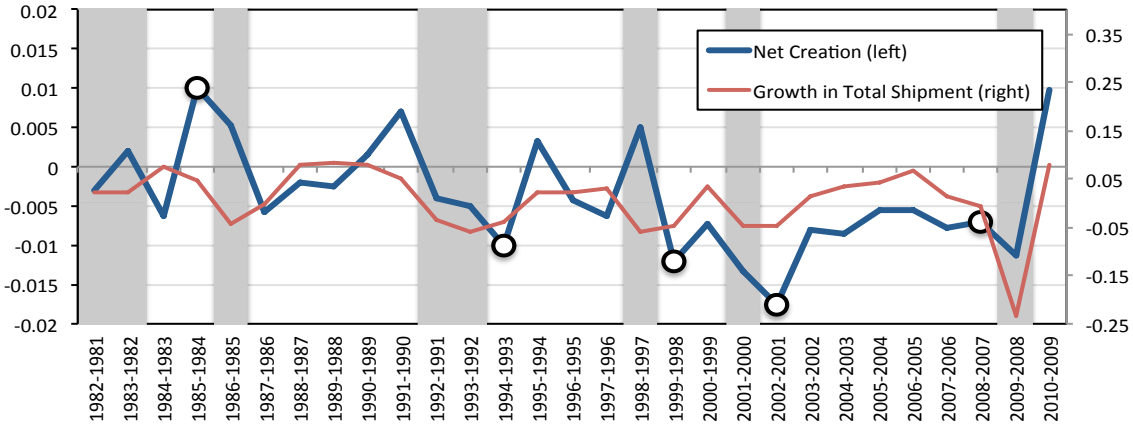



Figure 6: Creation and Shipment Growth (Census of Manufactures)

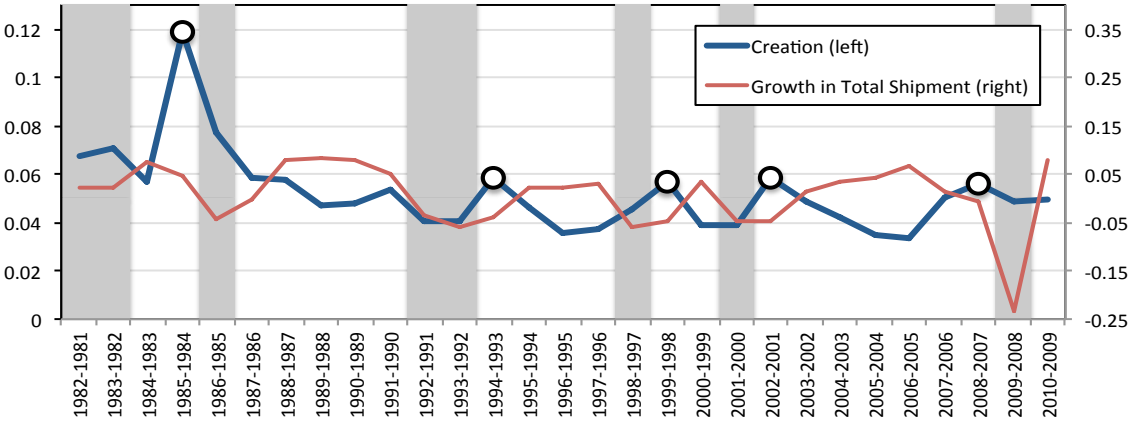
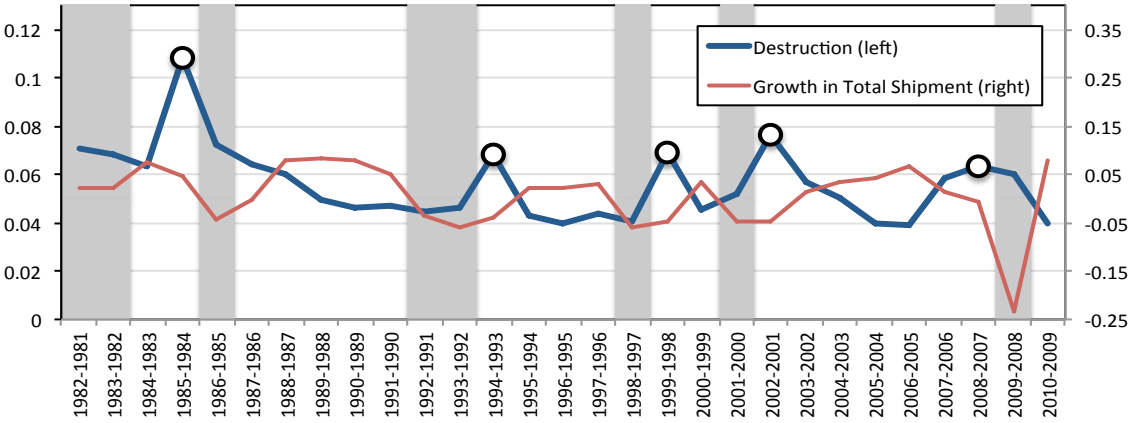



Figure 7: Destruction and Shipment Growth (Census of Manufactures)




Notes: The circle markers in the figures stands for the periods when the product classification of the Census of Manufactures are revised. The parts colored gray in the background represent recession periods.

Figure 8: Decomposition of Shipment Growth into Creation, Destruction, and Continuing Product Growth (Census of Manufactures)

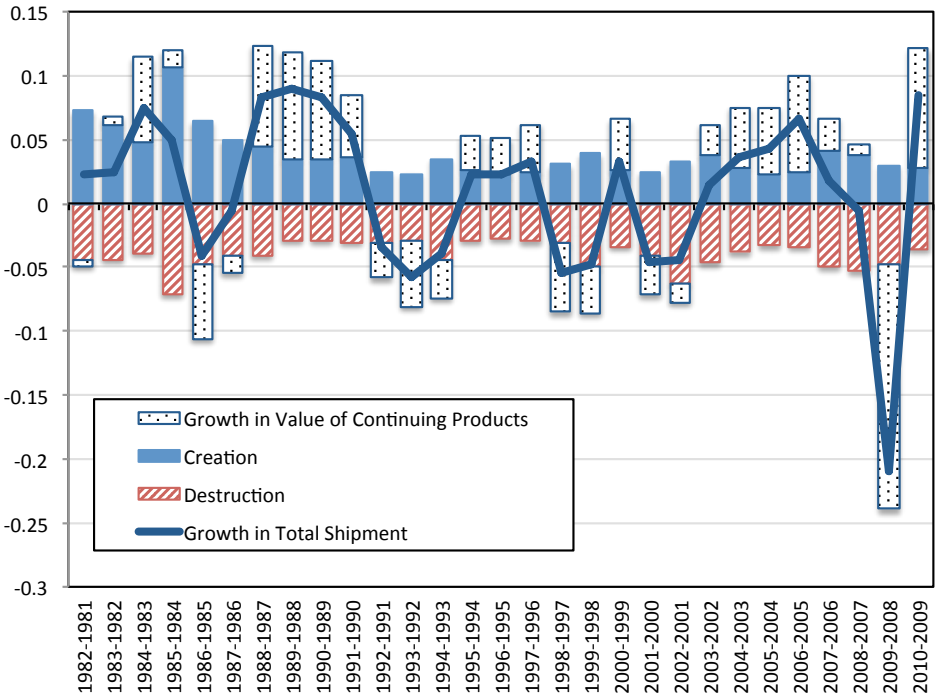



Figure 9: Decomposition of Shipment Growth into Net Creation and Continuing Product Growth (Census of Manufactures)

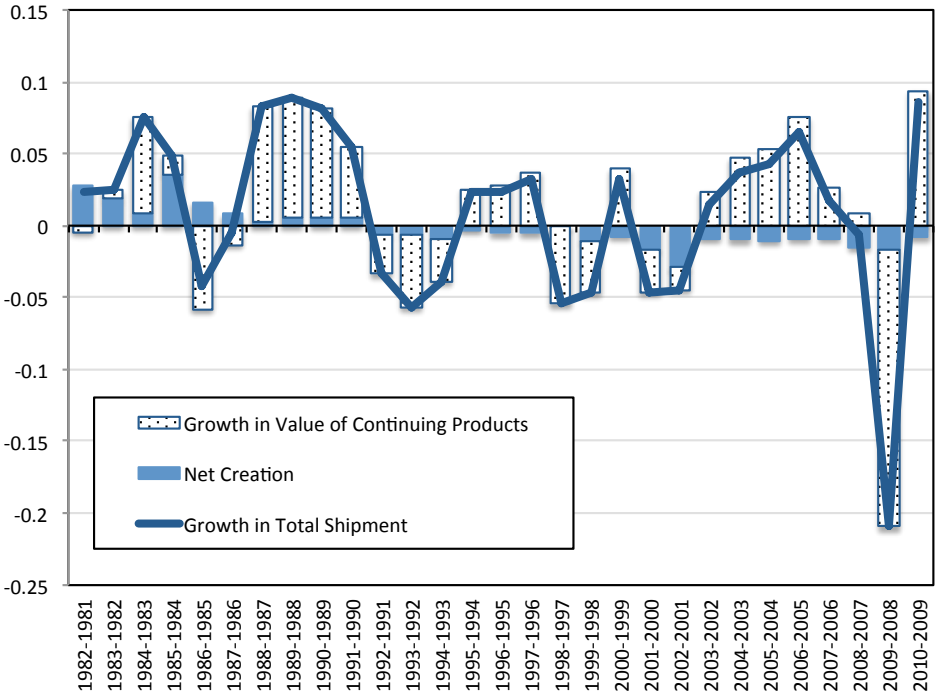


Figure 10: Net Creation and Shipment Growth (Current Survey of Production)

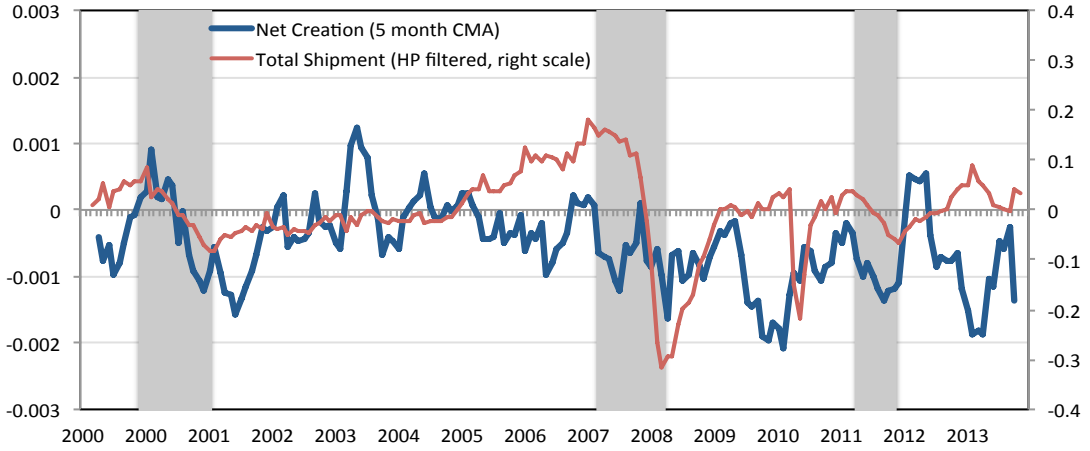



Figure 11: Creation and Shipment Growth (Current Survey of Production)

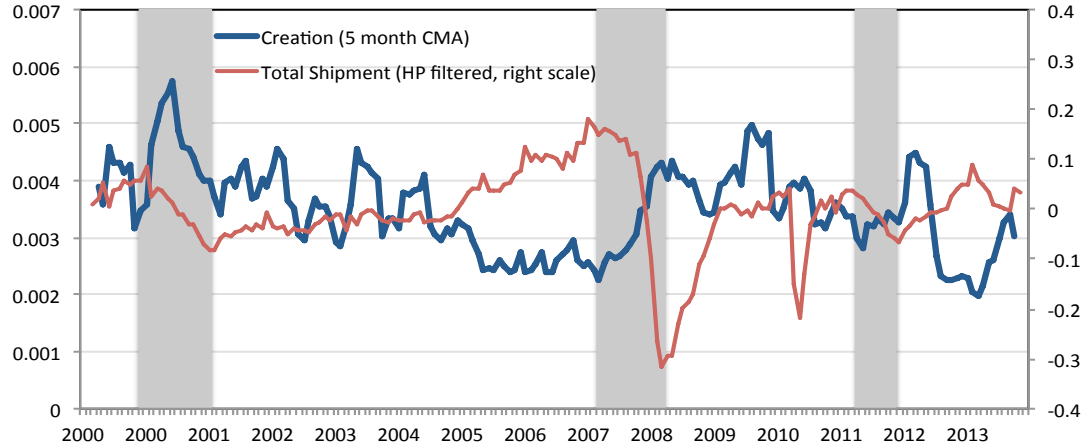
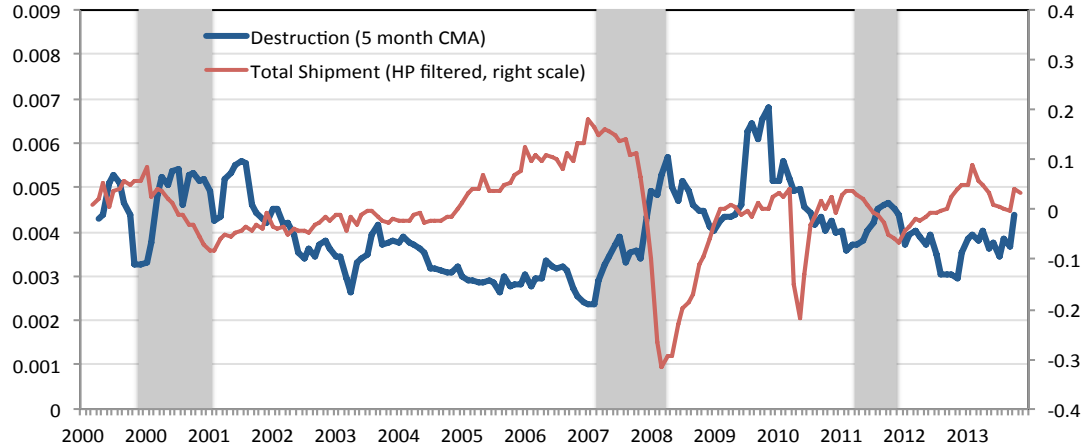



Figure 12: Destruction and Shipment Growth (Current Survey of Production)




Notes: Creation and Destruction in the above figures are the three-month centered moving averages of the original time series of Creation and Destruction, respectively. The parts colored gray in the background represent recession periods.

Figure 13: Decomposition of Shipment Growth into Creation, Destruction, and Continuing Product Growth (Current Survey of Production)

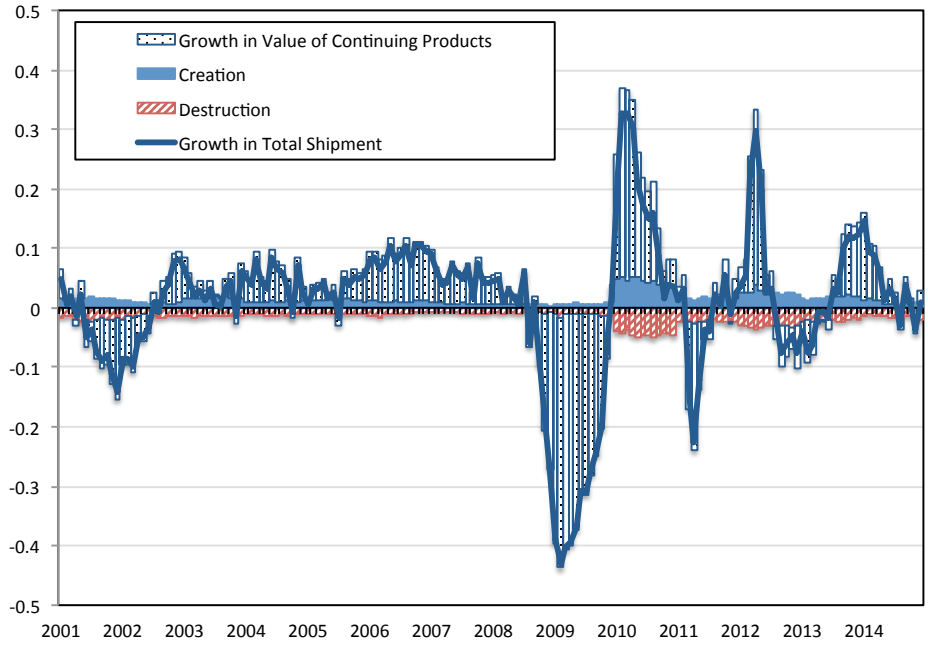



Figure 14: Decomposition of Shipment Growth into Net Creation and Continuing Product Growth (Current Survey of Production)

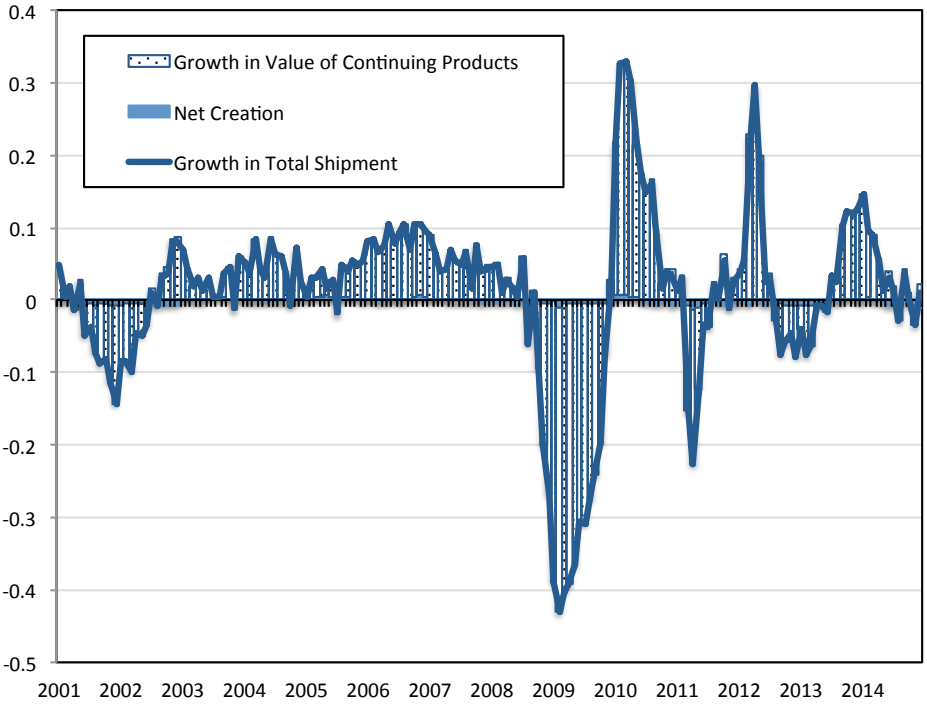


Figure 15: Fraction of Firms Adding Products and Shipment

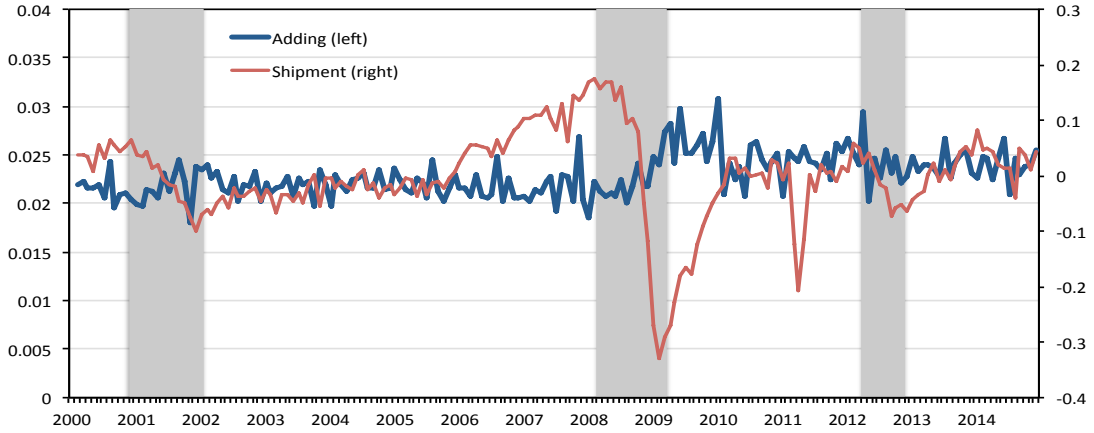



Figure 16: Fraction of Firms Dropping Products and Shipment

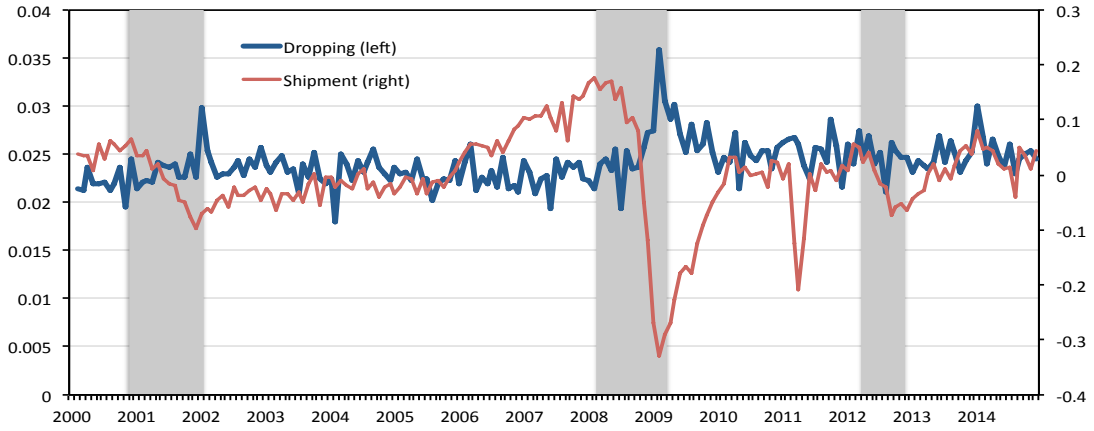
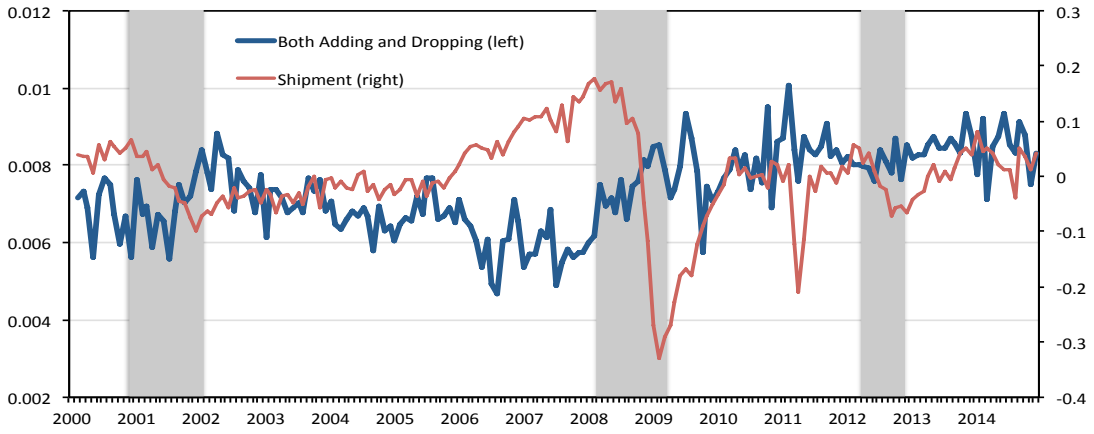



Figure 17: Fraction of Firms Both Adding and Dropping Products and Shipment




Notes: The parts colored gray in the background represent recession periods.

Figure 18: Correlation of Shipment with Leads and Lags of Fraction of Firms Switching Products

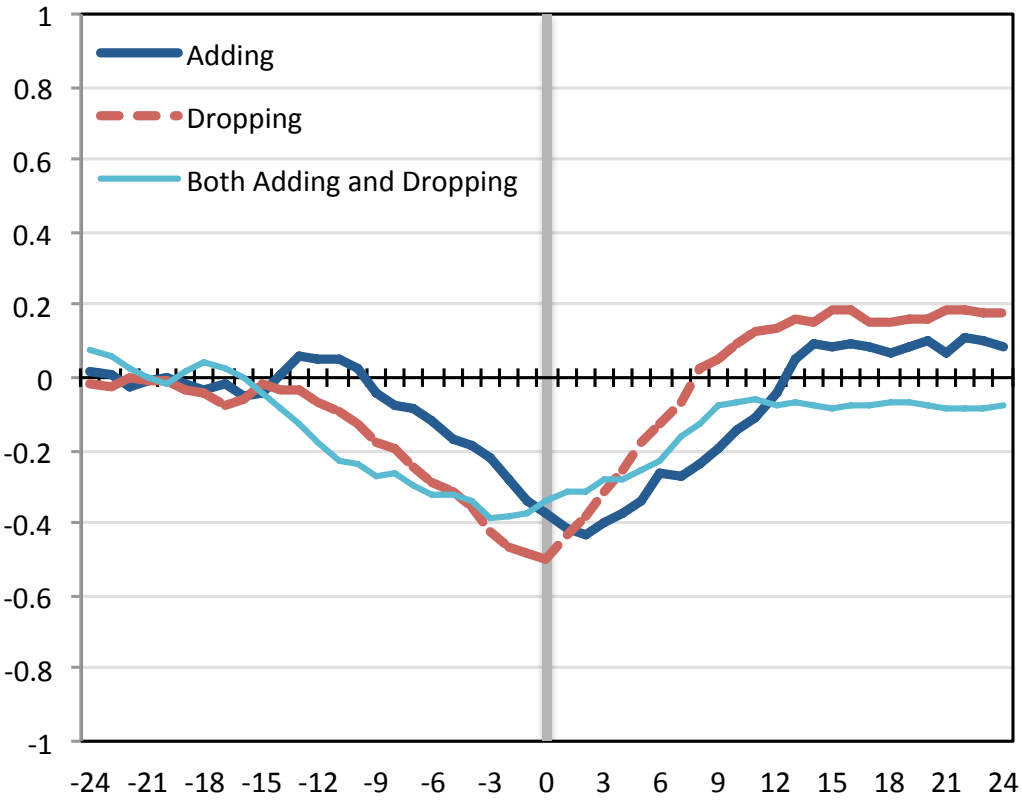
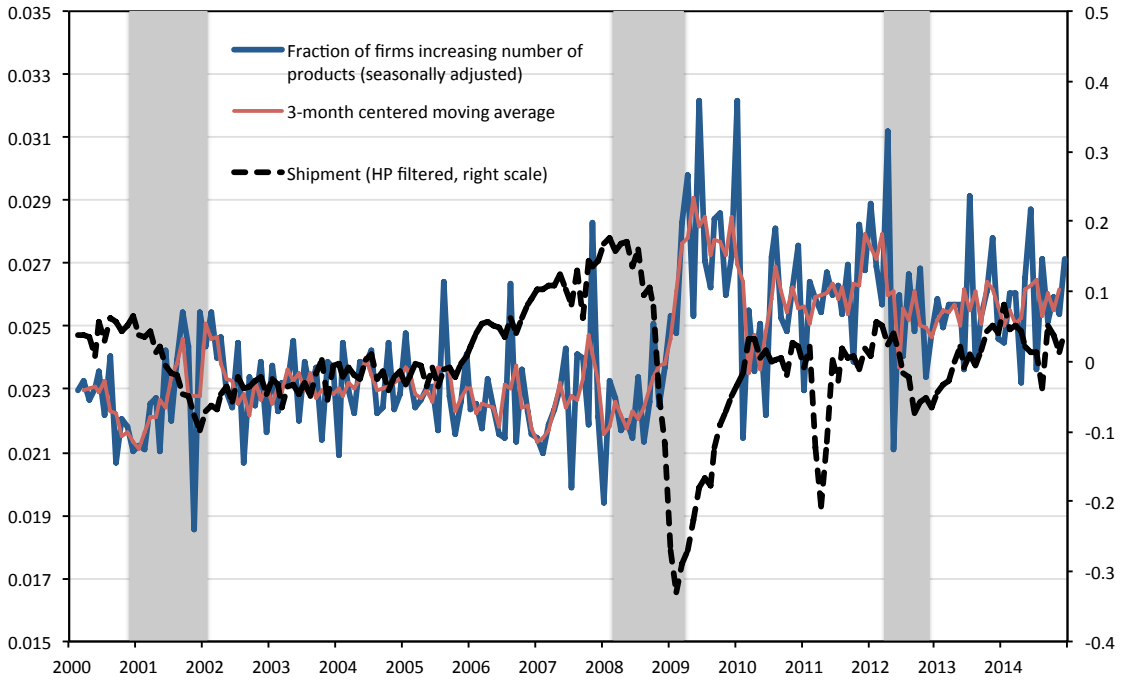


Figure 19: Fraction of Firms Increasing Products and Shipment




Notes: The parts colored gray in the background represent recession periods.

Figure 20: Correlation of Shipment with Leads and Lags of Fraction of Firms Increasing Number of Products

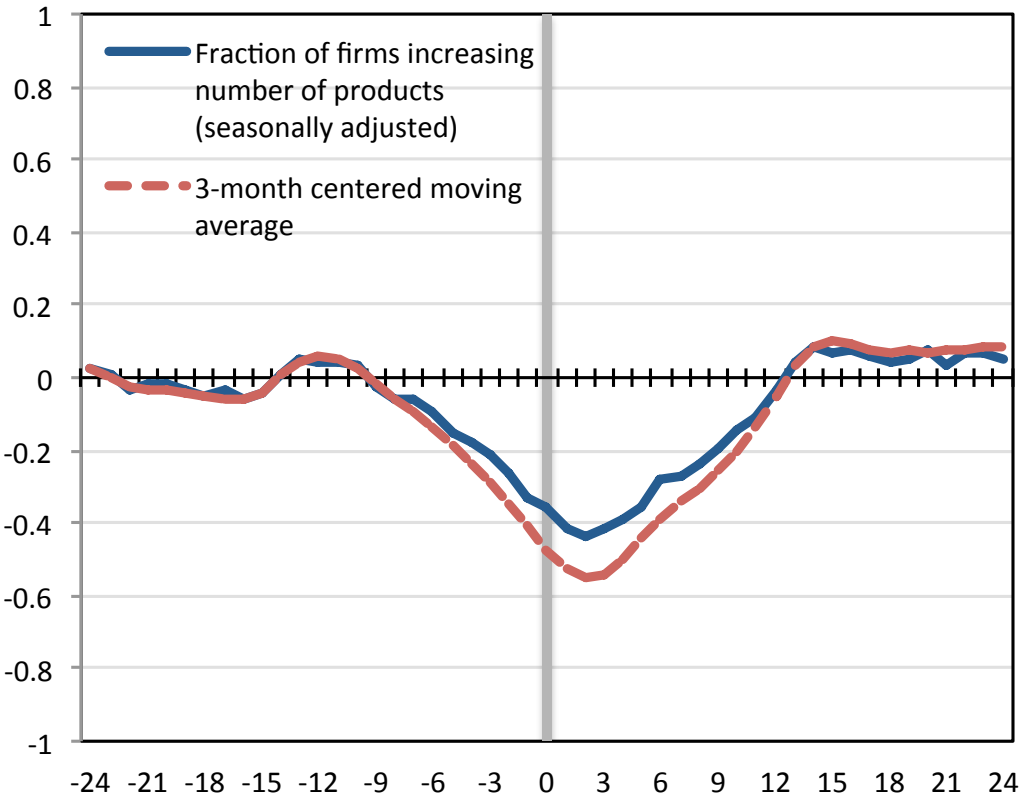
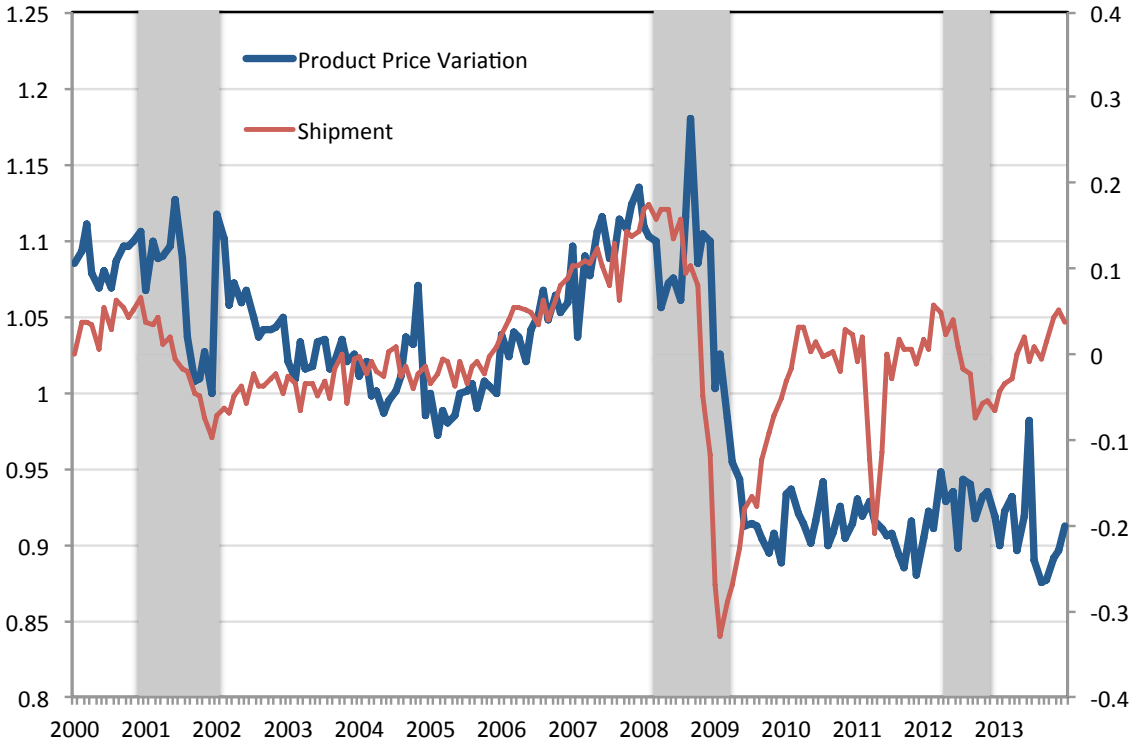


Figure 21: Relative Product Price Variation and Shipment




Notes: Product price variation is defined as the standard deviation of relative price of products in each period. The definition of the relative price of a product is the price of the product produced by an establishment relative to the average price of the same products produced by each establishment. Both two series are HP filtered ($\lambda = 129600$). The parts colored gray in the background represent recession periods.