The Impact of Demand Shock on the Employment of Temporary Agency Workers: Evidence from Japan during the Global Financial Crisis

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This study investigates the effect of a negative demand shock on the composition of worker types at firms and examines the change in the share of temporary agency workers. The 2007-2009 global financial crisis is used as the natural experiment to clearly identify the causal link between the demand encountered by a firm and the composition of its workforce in terms of worker types, as well as to rule out any reverse causation. The decrease in demand experienced by Japanese exporting firms is adopted as the exogenous demand shock. Results indicate that compared with other firms, those with higher export ratio, lower liquid asset ratio, higher share of temporary agency workers, larger increase in the share of temporary agency worker ratio, and lower volatility in their sales prior to the crisis decreased their share of temporary agency workers in response to

the demand shock. The quantitative effects of these pre-crisis firm characteristics are all economically significant. These results suggest that temporary agency workers serve as a buffer to demand shocks, and liquid assets work as a substitute for temporary agency workers.

Keywords: Demand shock, Temporary agency worker, Employment adjustment

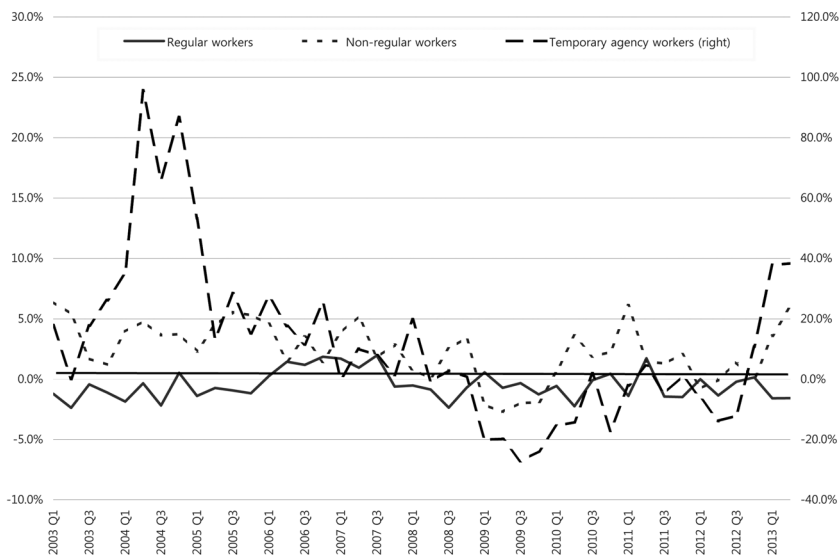*JEL Classification*: J21, J23, E24

I. Introduction

Labor market reforms, including the reduction of dismissal costs, promotion of part-time contracts, and loosening of regulations on temporary agency work, have led to the prevalence of flexible labor contracts in developed economies, particularly in Europe and Japan. With reference to this widespread use of flexible labor contracts, considerable research has examined the effects of different dismissal costs on labor demand between permanent (or primary) and temporary (or secondary) workers. Numerous theoretical and empirical studies suggest that lowering dismissal costs for temporary workers results in more volatile labor demand, although it also temporarily increases total labor demand (Saint-Paul 1991; Bentolila, and Saint-Paul 1995; Boeri, and Garibaldi 2007; Boeri 2011; Sala, Silva, and Toledo 2012; Costain, Jimeno, and Thomas 2010). From a theoretical perspective, labor demand becomes volatile because temporary workers are used by firms at the margin as a means for adapting to demand fluctuations. However, the number of empirical evidence confirming that firms actually use temporary workers to adjust employment levels in response to demand fluctuations is insufficient. This issue is relevant even if firms initially employ temporary workers as a buffer to demand shocks. For example, once hit by negative demand shocks, firms may continuously utilize their temporary workers who have accumulated some firm-specific skills. Instead of terminating the contracts (with an agency) of their temporary agency workers and once again singing new contracts with others after the recovery of demand, firms can continuously utilize these employees to save on labor cost. The present study aims to fill the above mentioned gap in the empirical literature and examine how demand shocks affect the demand for temporary workers.

To address the matter at hand, empirical researchers should clearly

identify the demand shocks. However, this undertaking is generally not as easy as it seems because while demand shocks may affect the share of temporary workers, such share may affect the productivity and output of firms. The latter is likely to occur if temporary workers are less trained. In both cases, the procyclicality of temporary workers is observed. In this study, the problem in identifying demand shocks is resolved by using the global financial crisis of 2007-2009 as a natural experiment, in which the precipitous drop in global demand represents the exogenous demand shock for Japanese exporters. The global financial crisis led to a severe global recession and rapid appreciation of the Japanese yen, outcomes which substantially decreased the demand for Japanese exports (Harada *et al.*, 2011; Hosono, Takizawa, and Tsuru 2013). Total real exports were reduced by 14.0% and 25.3% in the fourth quarter of 2008 from the previous quarter and in the first quarter of 2009 respectively. These downturns were significantly larger than those in the total exports of member countries of the Organisation for Economic Co-operation and Development (6.7% and 8.2% respectively in the two quarters). These export declines are used in the current study as a demand shock for Japanese exporters to examine the subsequent changes realized by these exporters regarding their share of temporary agency workers.

In Japan, non-regular workers (*i.e.*, workers other than permanent full-time workers) can be classified into numerous types. Firms often directly hire temporary (*i.e.*, workers hired based on a fixed-term contract) and part-time workers. By contrast, some firms depend on an agency and utilize temporary agency workers. These employees are hired by an agency and work for a firm based on a fixed-term contract existing between such agency and firm. This study focuses on temporary agency workers among the various types of non-regular workers because dismissing this group is considerably easier than dismissing other types of non-regular workers (*e.g.*, part-time and full-time directly hired temporary workers) and far easier than dismissing permanent full-time workers. According to legal precedent, if firms regularly renew the contract of their directly hired temporary workers, then they will find it more difficult to dismiss these employees because such contract renewals prompt the workers to expect their contracts to be renewed when they expire. In the case of temporary agency workers, firms can either renew or terminate the contract with the agency whenever they wish.

Figure 1 shows that the number of temporary agency workers in Japan has been more volatile than that of other types of workers. In

Source: Labour Force Survey

FIGURE 1

ANNUAL RATE OF CHANGE IN THE NUMBER OF REGULAR, NON-REGULAR,
AND TEMPORARY AGENCY WORKERS IN JAPAN

particular, the number of these workers in the early 2000s was sub-
stantially increased. However, this volume suddenly decreased from late
2008 in the wake of the global financial crisis. Such a downturn in
2009 was caused by the crisis and the preceding regulatory changes. The
restrictions for manufacturing firms to utilize temporary agency workers
were initially loosened for within-one-year term contracts in 2004 and
were even further loosened for within-three-year term contracts in 2007.
Although this deregulation increased the population of temporary agency
workers within the manufacturing sector in 2007, the number of workers
declined in 2009, during which the three-year term contracts signed in
2007 were terminated.

   Using a firm-level dataset of Japanese exporters, we examine whether
the firms greatly exposed to the demand shock in the wake of the global
financial crisis decreased their share of temporary agency workers more
than others. We also analyze how other pre-crisis firm characteristics
affected the changes in the share of temporary agency workers during
the global financial crisis. The results of this study can be summarized
into two findings. First, firms decreased their share of temporary agency

workers more as they exported more before the crisis. Second, firms decreased their share of temporary agency workers less as they had higher liquid asset ratio or volatility of sales growth. These findings suggest that firms actually use temporary agency workers at the margin so they can adapt to fluctuations in demand. They also suggest that liquid assets work as a substitute for temporary agency workers. The effects of these pre-crisis characteristic variables are economically significant.

The rest of the paper is organized into six sections. Following the Introduction, Section II reviews the relevant literature. Section III briefly describes the Japanese labor market to provide information regarding the subsequent analysis. Section IV describes the dataset and empirical methodology. Section V presents and discusses the research findings. Finally, Section VI concludes the study.

II. Literature Review

This paper is closely related to three strands of literature. The first is the literature on the reasons firms use or increase the number of their temporary workers. Adopting either the U.S., European, or Japanese firm-level data, several studies have determined that the firms challenged by a high degree of uncertainty about their future production use temporary workers as a buffer to employment fluctuations (Boockmann, and Hagen 2001; Cappelli, and Neumark 2004; Houseman 2001; Ono, and Sullivan 2006; Morikawa 2010; Asano, Ito, and Kawaguchi 2011; Dräger, and Marx 2012; Matsuura, Sato, and Wakasugi 2011; Matsuura 2013).[1]

The second strand of literature stipulates that mitigating the regulations on the protection of temporary workers can increase total employment during booms and the volatility of total employment. This hypothesis has been verified by the majority of the studies, which examine employment at European firms (Boeri, and Garibaldi 2007; Boeri 2011; Bentolila, and Saint-Paul 1992; Sala, Silva, and Toledo 2012; Costain, Jimeno, and Thomas 2010).[2] The third strand of literature, which emerged only recently, examines the effects of liquidity dry-up in financial markets on employment during the global financial crisis. Using either the U.S. or

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[1] Apart from the degree of uncertainty of future production, expected sales also account for the use of temporary agency workers (Pfeifer, 2005).

[2] A notable exception is the study of Jahn, and Bentzen (2012), who use the aggregate monthly data of Germany. Correspondingly, these researchers fail to prove that the observed increase in temporary agency employment was driven by the lifting of regulations governing this sector.

European data, most of these studies posit that liquidity shortage adversely affects employment (Boeri, Garibaldi, and Moen 2012, 2013; Chodorow-Reich 2014; Carneiro, Portugal, and Varejao 2013). Accordingly, these studies verify the premise that firms use temporary workers as a buffer to demand shocks. Whether firms *actually* decrease the number of their temporary workers when they are hit by negative demand shocks is yet to be extensively explored.

The studies of Jahn, and Bentzen (2012) and Benio, and Hernando (2008) are the most relevant to the present research. Jahn, and Benzen (2012) use aggregate monthly data from Germany and determine that the demand for temporary agency workers in this country is highly procyclical. However, aggregate data cannot generally account for the heterogeneity among firms in terms of the use of temporary agency workers and the demand shock each firm faces. Importantly, procyclicality can be considered partly the consequence of low productivity of temporary agency workers. In the current study, we overcome these difficulties by using firm-level data and focusing on the exogenous demand shock that hit Japanese exporters during the global financial crisis. Benito, and Hernando (2008) use a panel dataset of Spanish firms and estimate a separate dynamic labor demand function for permanent and temporary workers. The authors realize that compared with permanent workers, the demand for temporary workers displays greater cyclical sensitivity. Moreover, Benito, and Hernando (2008) estimate a dynamic fixed-effect model using the generalized method of moment system estimator to control the firm fixed-effects and allow sluggish employment adjustment (*i.e.*, lagged dependent variables). By contrast, we use a cross-sectional data during the crisis because our study is focused on a one-time shock of the crisis and tries to explain the heterogeneous responses of firms to the shock. Given that a downturn in exports during the global financial crisis can be safely regarded as an exogenous demand shock, we apply the Ordinary Least Squares (OLS) estimator.

In sum, we examine whether and to what extent firms actually decrease the number of their temporary agency workers by using a natural experiment approach. We also follow a number of preceding studies to control the factors that may affect the demand for temporary agency workers (*e.g.*, demand uncertainty, past share of temporary agency workers, and liquid assets held by firms).

III. Background Information on the Japanese Labor Market

In the wake of the global financial crisis, Japanese firms were forced to adjust their employment levels by focusing on non-regular workers, particularly temporary agency workers. To explain the reasons behind this condition, information regarding the labor market developments in Japan before the 2007 financial crisis is presented in this section.

The demand for non-regular workers continuously increased for almost two decades, from 1990 to 2007.[3] With the exception of 1993-1994, the number of non-regular workers was not reduced even during recessions. In the recessions of 1997-1999 and 2000-2002, the number of non-regular workers continued to increase, whereas that of regular workers decreased. Among the various types of non-regular workers, the number of temporary agency workers increased at a higher pace than that of regular workers, although the share of temporary agency workers was still relatively low at approximately 2%. Low dismissal cost is one of the reasons the number of temporary agency workers increased. The ban on the employment of temporary agency workers for manufacturing operations was lifted in 2004, and therefore increased the share of this group of employees.

Similar to the case in Japan, European countries maintain relatively stringent employment protection for regular workers. However, these countries have implemented labor market reforms over the past decades to make their labor markets flexible and to cope with the rapid changes in macroeconomic conditions. Such reforms are focused on employment with fixed-term contracts or temporary work agency (Boeri 2011). As such, the deregulation of temporary work agency and an associated increase in the number of temporary agency workers prior to the global financial crisis can also be observed in many European countries. For example, citing CIETT (2012), Jahn, and Bentzen (2012) specify that while the temporary help services sector accounted for about 1% of the EU 15 workforce at the end of the 1990s, it employed nearly 2% in 2010.[4] The current study focuses on temporary agency workers in Japan, but its results are considered relevant to European countries, which also

[3] Kodama *et al.* (2015), using data for the 1993-2008 period, show that the increase in the number of part-time workers was one of the major factors that resulted in a decline of average wages particularly in the service industries.

[4] See also Storrie (2002); De Graaf-Zijl, and Berkhout (2007) for the deregulation of temporary agency employment and an associated increase in temporary agency workers in EU countries.

display an increasing trend in their share of temporary agency workers.

IV. Data and Methodology

A. Construction of the Dataset

For our empirical analysis, we primarily rely on two firm-level data sources. First, the information on the exports of firms is obtained from the *Basic Survey of Business Structure and Activities* (BSBSA; *Kigyo Katsudo Kihon Chosa* in Japanese) compiled by the Ministry of Economy, Trade, and Industry. This survey primarily aims to quantitatively gauge the activities of Japanese enterprises. In particular, BSBSA covers all enterprises in Japan with more than 50 employees and with paid-up capital of over 30 million yen. From this data source, we obtain firm-level data on the number of temporary agency workers and other types of workers, as well as the exports, sales, and equity capital of Japanese firms.

Second, we rely on Nikkei Economic Electronic Database Systems-Corporate Governance and Evaluation System (NEEDS-CGES), a firm-level database for listed firms, provided by Nikkei Digital Media Inc. NEEDS-CGES provides information for the qualitative assessment of the listed firms' corporate governance. This database covers all firms listed on a stock exchange in Japan. From this data source, we obtain relevant information on the ownership share of foreign shareholders.

Apart from these data sources, we use the Corporate Finance Databank provided by the Japan Economic Research Institute. This database contains information regarding the financial statements of all firms listed on the stock exchanges in Japan. From this data source, we acquire statistics on liquid assets.

Our dataset is constructed through four procedures. First, we match the firms included in the NEEDS-CGES and BSBSA datasets. Correspondingly, 1,962 firms are gathered. Second, we select firms that reported non-zero exports in 2006. Of the 1,962 firms obtained in the previous step, 1,863 firms provided information regarding their export transactions for 2006, while 962 reported non-zero exports. Third, we select firms for which all other information required for regression analysis is available. Information on the number of temporary agency workers is available only for a relatively small number of firms; thus, we are left with 360 firms at this stage. Finally, to exclude outliers, we drop the firms whose change in the share of temporary agency workers (which is the dependent

TABLE 1

INDUSTRY COMPOSITION

(a) Industry Composition of 962 Firms

SNA Industrial Classification	Number of firms	Share (%)	Cumulative Share (%)
Food products and beverages	25	2.6	2.6
Textiles	16	1.66	4.26
Pulp, paper and paper products	10	1.04	5.3
Chemicals	109	11.33	16.63
Petroleum and coal products	4	0.42	17.05
Non-metallic mineral products	29	3.01	20.06
Basic metal	43	4.47	24.53
Fabricated metal products	30	3.12	27.65
Machinery	119	12.37	40.02
Electrical machinery	169	17.57	57.59
Transport equipment	83	8.63	66.22
Precision instruments	69	7.17	73.39
Other manufacturing	41	4.26	77.65
Construction	8	0.83	78.48
Wholesale and retail trade	189	19.65	98.13
Service activities	18	1.87	100
Total	962	100	

Note: The table is based on the 962 firms both included in the BSBSA and NEEDS-CGES databases and that reported non-zero exports in 2006.

variable in the regression analysis below) falls into the 1% tails of their distribution. A total of 353 firms are then obtained for the analysis.

To examine whether our dataset suffers from sample selection bias, we compare the industry composition of 353 firms used for our analysis with that of the 962 firms we are left with after matching firms in the BSBSA and NEEDS-CGES databases and that reported non-zero exports in 2006. The industry composition of these groups of firms is shown in Tables 1(a) and (b). No substantial difference is observed between the two.

B. Methodology

To examine the determinants of temporary agency employment at firms, we estimate the following Equation (1) using OLS with standard errors clustered by industry.

(b) Industry Composition of 353 Firms

SNA Industrial Classification	Number of firms	Relative frequency (%)	Cumulative relative frequency (%)
Food products and beverages	9	2.55	2.55
Textiles	3	0.85	3.40
Pulp, paper and paper products	5	1.42	4.82
Chemicals	45	12.75	17.56
Petroleum and coal products	1	0.28	17.85
Non-metallic mineral products	11	3.12	20.96
Basic metal	22	6.23	27.20
Fabricated metal products	8	2.27	29.46
Machinery	39	11.05	40.51
Electrical machinery	59	16.71	57.22
Transport equipment	37	10.48	67.71
Precision instruments	14	3.97	71.67
Other manufacturing	28	7.93	79.60
Construction	2	0.57	80.17
Wholesale and retail trade	68	19.26	99.43
Service activities	2	0.57	100.00
Total	353	100	

Note: The table represents the data of 353 firms that constitute the dataset for our analysis.

Source: Authors' calculation based on the Basic Survey of Business Structure and Activities (BSBSA) and Nikkei Economic Electronic Database Systems-Corporate Governance and Evaluation System (NEEDS-CGES).

$$\Delta Temp_{i2009} = \beta_1 Exports_{i2006} + \beta_2 Liquidity_{i2006} + \beta_3 Temp_{i2006}$$
$$+ \beta_4 \Delta Temp_{i2006} + \beta_5 Volatility_{i2006} + \beta_6 ForeignOwn_{i2006} \qquad (1)$$
$$+ \beta_7 ROA_{i2006} + \beta_8 Size_{i2006} + \beta_9 Equity_{i2006} + Industry_s + \varepsilon_i.$$

The dependent variable ($\Delta Temp_{i2009}$) is the change in the share of temporary agency workers from fiscal 2007 to fiscal 2009 at firm i. The share of temporary agency workers is measured as the ratio of the number of temporary agency workers to the number of regular workers.[5]

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[5] According to the classification of workers in BSBSA, the temporary, part-time, and full-time workers constitute regular workers as long as they are directly hired by the firm with more-than-one-month fixed-term contracts, whereas temporary agency workers are not.

Moreover, the values of explanatory variables for fiscal 2006 (except for the industry dummies) are used. These variables are defined as follows. *Exports*$_{i2006}$ is the share of exports to total sales that aims to capture the size of demand shock during the crisis. This variable is expected to take a negative coefficient. *Liquidity*$_{i2006}$ is the ratio of cash and deposits to total assets. When a firm is hit by a negative demand shock, it can survive by selling liquid assets. Firms can also save cash by dismissing their temporary agency workers. Thus, liquid assets and temporary agency workers replace each other in the sense that they both act as a buffer to negative demand shocks.[6] Therefore, *Liquidity*$_{i2006}$ is expected to take a positive coefficient.

Temp$_{i2006}$, the ratio of temporary agency workers to full-time workers in fiscal 2006, and Δ*Temp*$_{i2006}$, the change in the shares of temporary agency workers from fiscal 2004 to fiscal 2006 at firm *i*, are also involved in the estimation. These variables are included because the firms that had a higher share of temporary agency workers and/or increased their share of these employees more than others prior to the global financial crisis were more likely to have decreased their share in response to the negative demand shock.[7] As such, both *Temp*$_{i2006}$ and Δ*Temp*$_{i2006}$ are expected to take negative coefficients.

Volatility$_{i2006}$ is the standard deviation of firm *i*'s sales growth from fiscal 2002 to fiscal 2006, capturing the degree of uncertainty faced by the firm. The firms that experience great uncertainty with regard to future demands are more likely to rely on temporary agency workers as a buffer to future demand shocks.[8] Based on this analysis, *Volatility*$_{i2006}$ is expected to take a positive coefficient.

ForeignOwn$_{i2006}$ is the ownership share of foreign shareholders in firm *i*. If foreign shareholders are more short-term profit-oriented than the domestic ones, as is often assumed, then *ForeignOwn*$_{i2006}$ takes a negative coefficient.

ROA$_{i2006}$ is the ratio of current income to total assets that captures

[6] Although they do not focus on temporary agency workers, several studies show that liquidity shortages negatively affected employment at European firms during the global financial crisis [*e.g.*, Boeri, Garibaldi, and Moen (2012, 2013); Chodorow-Reich (2014); Carneiro, Portugal, and Varejao (2013)].

[7] For evidence on this hypothesis, see Boeri, and Garibaldi (2007); Boeri (2011); Bentolila, and Saint-Paul (1992); Sala, Silva, and Toledo (2012); Costain, Jimeno, and Thomas (2010).

[8] For evidence on this hypothesis, see Cappelli, and Neumark (2004); Houseman (2001); Ono, and Sullivan (2006); Morikawa (2010); Asano, Ito, and Kawaguchi (2011); Dräger, and Marx (2012).

TABLE 2

DESCRIPTIVE STATISTICS

	Mean	Median	Maximum	Minimum	Standard deviation	Number of obser-vations
$\Delta Temp_{2009}$	-0.066	-0.042	0.098	-0.488	0.089	353
$Export_{2006}$	0.168	0.105	0.924	0.000	0.184	353
$Liquidity_{2006}$	0.102	0.080	0.541	0.001	0.090	353
$Temp_{2006}$	0.117	0.080	0.598	0.000	0.112	353
$\Delta Temp_{2006}$	0.013	0.009	0.191	-0.212	0.030	353
$Volatility_{2006}$	31907	4009	1165742	151	110503	353
$ForeignOwn_{2006}$	12.851	9.840	52.820	0.000	11.229	353
ROA_{2006}	0.067	0.058	0.324	-0.084	0.053	353
$Size_{2006}$	11.290	11.008	17.296	8.056	1.549	353
$Equity_{2006}$	0.521	0.516	0.903	0.077	0.184	353

Note: Volatility is the standard deviation in sales growth from fiscal 2002
      to fiscal 2006.
Source: Authors' calculation.

firm profitability. Similar to liquid assets, profits may serve as a buffer to demand shocks. Therefore, ROA_{i2006} is expected to take a positive coefficient.

$Size_{i2006}$ is the logarithm of total assets that captures firm size. Large firms produce various products and/or serve numerous countries. In other words, these firms can easily diversify away from products or countries affected by the demand shock. In this case, such firms need only a few temporary agency workers as a buffer to demand shocks, and $Size_{i2006}$ takes a negative coefficient.

$Equity_{i2006}$ represents the ratio of capital to total assets. On the one hand, similar to liquid assets, equity may serve as a buffer to demand shocks. Hence, firms with great equity capital are less likely to reduce the number of their temporary workers in response to a negative demand shock. On the other hand, firms with less equity capital are more likely to fail. To avoid failure, these firms decrease the number of their per-manent workers instead of their temporary agency workers to save on labor costs. Thus, the expected sign of the coefficient on $Equity_{i2006}$ is ambiguous.

$Industry_s$ represents the industry to which firm i belongs. Following the System of National Accounts, we use 22 industries for classification. However, we exclude six industries that no firm in our dataset falls into, leaving us with 16 industries. A total of 15 industry dummies are adopted to capture industry-specific effects that may arise from

technological or regulatory differences across industries. Nevertheless, given that part of the industry effects may be captured by the variables for firm characteristics described above, we conduct regressions both with and without such effects. ε_i depicts the disturbance term.

Table 2 shows descriptive sample statistics for the variables we use for the analysis above.

V. Results

A. Baseline Results

The estimation results are shown in Table 3. Columns (1) and (2) show the results for the specification with and without industry dummies, respectively. These specifications virtually yield the same results summarized in the succeeding paragraphs.

First, $Exports_{i2006}$ takes a negative and significant coefficient, consistent with the hypothesis that the firms that depended on exports and consequently experienced large demand shock because of the global financial crisis tended to decrease their share of temporary agency workers. The absolute value of the coefficient suggests that the quantitative effect of the demand shock was sizable. Multiplying the coefficient in column (1) (-0.054) by the standard deviation of $Exports_{i2006}$ (0.184) yields -0.010, which accounts for 11.3% of the standard deviation of $\Delta Temp_{i2009}$ (0.089).

Second, $Liquidity_{i2006}$ takes a positive and significant coefficient, supporting the hypothesis that liquid assets replace temporary agency workers and serve as a buffer to negative demand shocks. An increase in $Liquidity_{i2006}$ by its one standard deviation leads to an increase in $\Delta Temp_{i2009}$ by 0.008, accounting for 9.5% of the standard deviation of $\Delta Temp_{i2009}$.

Third, $Temp_{i2006}$ and $\Delta Temp_{i2006}$ take negative and significant coefficients, suggesting that the firms that had many temporary agency workers and/or increased their reliance on these employees prior to the crisis decreased the number of these workers in the wake of the crisis. The coefficients of $Temp_{i2006}$ and $\Delta Temp_{i2006}$ imply that while both of them are economically significant, the former induces a larger effect than the latter. An increase in $Temp_{i2006}$ and $\Delta Temp_{i2006}$ by their respective standard deviations accounts for 44.6% and 14.0% respectively of the standard deviation of $\Delta Temp_{i2009}$.

Fourth, $Volatility_{i2006}$ takes a positive and marginally significant (at the 10% level) coefficient, verifying the hypothesis that firms that face a

TABLE 3

BASELINE ESTIMATION RESULTS

(Dependent Variable: $\Delta Temp_{2009}$)

	(1)			(2)		
	Coefficient	Standard Error		Coefficient	Standard Error	
$Export_{2006}$	-0.054	0.018	***	-0.076	0.020	***
$Liquidity_{2006}$	0.094	0.043	**	0.098	0.044	**
$Temp_{2006}$	-0.353	0.102	***	-0.421	0.064	***
$\Delta Temp_{2006}$	-0.409	0.169	**	-0.352	0.155	**
$Volatility_{2006}$	0.902E-07	0.493E-07	*	0.707E-07	0.335E-07	*
$ForeignOwn_{2006}$	0.001	0.001		0.001	0.001	*
ROA_{2006}	0.013	0.092		-0.028	0.104	
$Size_{2006}$	-0.004	0.005		-0.004	0.006	
$Equity_{2006}$	-0.020	0.027		0.003	0.038	
Constant	0.056	0.053		0.022	0.058	
Industry dummy	Yes			No		
Number of obs	353			353		
F	.			154.97		
Prob>F	.			0		
R-squared	0.522			0.438		
Root MSE	0.063			0.067		

Notes: Volatility is the standard deviation in sales growth from fiscal 2002
   to fiscal 2006.
   Robust standard errors are shown.
   F-test cannot be conducted in column (1) because the variance-
   covariance matrix is not of full rank.
   * $p<0.10$, ** $p<0.05$, and *** $p<0.01$
Source: Authors' calculation.

high degree of uncertainty about future demands greatly rely on tem-
porary agency workers as a buffer to future demand shocks. A change
in $Volatility_{t2006}$ by its one standard deviation accounts for 11.3% of the
standard deviation of $\Delta Temp_{t2009}$.[9]

Fifth, $ForeignOwn_{2006}$ is not significant, and therefore does not support
the hypothesis that firms with a high foreign ownership stake are short-
term profit-oriented.

Finally, we determine that none of the control variables (*i.e.*, ROA_{2006},

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[9] To check the robustness of our results, we redefine $Volatility_{t2006}$ as the
standard deviation of firm i's sales growth from fiscal 2004 to fiscal 2006. The
results, not shown in the paper due to space limitation, for the baseline remain
the same, except for the newly defined $Volatility_{t2006}$, which is not significant.
Three years may be short to adequately measure volatility.

TABLE 4
ESTIMATION RESULTS FROM A SAMPLE INCLUDING NON-EXPORTERS
(Dependent variable: $\Delta Temp_{2009}$)

	(1)		(2)	
	Coefficient	Standard Error	Coefficient	Standard Error
$ExportDummy_{2006}$	-0.012	0.009	-0.025	0.007 ***
$Liquidity_{2006}$	0.043	0.041	0.059	0.042
$Temp_{2006}$	-0.337	0.064 ***	-0.398	0.049 ***
$\Delta Temp_{2006}$	-0.308	0.155 *	-0.290	0.173
$Volatility_{2006}$	0.533E-07	0.364E-07	0.214E-07	0.182E-07
$ForeignOwn_{2006}$	0.001	0.001	0.001	0.001
ROA_{2006}	-0.069	0.053	-0.114	0.072
$Size_{2006}$	-0.003	0.004	-0.002	0.004
$Equity_{2006}$	0.001	0.017	0.006	0.024
Constant	0.099	0.048 *	0.017	0.041
Industry dummy	Yes		No	
Number of obs	507		507	
F	.		15.69	
Prob>F	.		0	
R-squared	0.509		0.414	
Root MSE	0.062		0.066	

Notes: Volatility is the standard deviation in sales growth from fiscal 2002 to fiscal 2006.
Robust standard errors are shown.
F-test cannot be conducted in column (1) because the variance-covariance matrix is not of full rank.
* $p<0.10$, ** $p<0.05$, and *** $p<0.01$
Source: Authors' calculation.

$Size_{2006}$, and $Equity_{2006}$) is significant.

B. Robustness Checks

In this subsection, we conduct several robustness checks. First, we enlarge the sample size by including the firms that did not export in fiscal 2006. Using this dataset consisting of 507 firms, we replace $Exports_{i2006}$ with $ExportDummy_{i2006}$, a dummy that takes one if the firm exported in 2006 and zero otherwise. The results with and without industry dummies are shown in columns (1) and (2) of Table 4 respectively. Most of the results do not virtually change, although some coefficients have weak significance levels. For example, the coefficients of $ExportDummy_{i2006}$ are negative in both columns but significant only in

TABLE 5

ESTIMATION RESULTS FROM DROPPING FOREIGN OWNERSHIP

(Dependent Variable: $\Delta Temp_{2009}$)

	(1)			(2)		
	Coefficient	Standard Error		Coefficient	Standard Error	
$Export_{2006}$	-0.047	-0.063	**	-0.063	0.024	**
$Liquidity_{2006}$	0.101	0.113	*	0.113	0.051	*
$Temp_{2006}$	-0.347	-0.413	***	-0.413	0.065	***
$\Delta Temp_{2006}$	-0.436	-0.393	**	-0.393	0.144	**
$Volatility_{2006}$	0.774E-07	0.539E-07	**	0.539E-07	0.223E-07	**
ROA_{2006}	0.034	-0.001		-0.001	0.105	
$Size_{2006}$	0.001	0.002		0.002	0.003	
$Equity_{2006}$	-0.008	0.019		0.019	0.033	
Constant	0.017	-0.048		-0.048	0.032	
Industry dummy	Yes			No		
Number of obs	353			353		
F	.			189.96		
Prob>F	.			0		
R-squared	0.517			0.428		
Root MSE	0.064			0.068		

Notes: Volatility is the standard deviation in sales growth from fiscal 2002
    to fiscal 2006.
    Robust standard errors are shown.
    F-test cannot be conducted in column (1) because the variance-
    covariance matrix is not of full rank.
    * p<0.10, ** p<0.05, and *** p<0.01
Source: Authors' calculation.

column (2). The possible reason behind this finding is the fact that
$ExportDummy_{i2006}$ does not adequately capture the size of demand
shocks. The coefficients of $Liquidity_{i2006}$ are negative in both columns
but not significant in either one. The role of liquidity may be important
particularly for exporters hit by severe negative demand shocks.[10]
$Temp_{i2006}$ and $\Delta Temp_{i2006}$ take negative and significant coefficients, similar
to the baseline specifications.

Second, using the same sample as in baseline specifications, we omit
$ForeignOwn_{2006}$, which is insignificant. The results are shown in Table

[10] To test this hypothesis, we add the interaction of $ExportDummy_{i2006}$ and
$Liquidity_{i2006}$ and determine that this interaction term takes a positive and
significant coefficient when we do not include industry dummies. The results are
not shown due to space limitation.

5. The findings for the variables other than $ForeignOwn_{2006}$ do not vary from the baseline results.

VI. Conclusion

This study investigated the effect of a negative demand shock on the composition of the type of workers at firms, focusing on the change in the share of temporary agency employees. To clearly identify the causal link between the demand encountered by a firm and the composition of its workforce in terms of the type of workers, as well as to rule out any reverse causation, we used the 2007-2009 global financial crisis as a natural experiment. The downturn in the demand experienced by Japanese exporting firms was adopted as an exogenous demand shock. We determined that in response to such shock, the firms that had high export ratio, low liquid asset ratio, high share of temporary agency workers, large increase in the share of temporary agency workers ratio, and low volatility in their sales prior to the crisis decreased their share of temporary agency workers more than others. The quantitative effects of these variables were all economically significant. In particular, the share of temporary agency workers prior to the crisis had the largest effect on the change in such share subsequent to the crisis. In sum, our results confirmed that temporary agency workers actually serve as a buffer to demand shocks, and liquid assets work as a substitute for temporary agency workers.

References

Asano, H., Ito, T., and Kawaguchi, D. Why Has the Fraction of Contingent Workers Increased? A Case Study of Japan. RIETI Discussion Paper Series No. 11-E-021, 2011.

Benito, A., and Hernando, I. "Labour Demand, Flexible Contracts and Financial Factors: New Evidence from Spain." *Oxford Bull Econ Stat* 70 (No. 3 2008): 283-301.

Bentolila, S., and Saint-Paul, G. "The Macroeconomic Impact of Flexible Labor Contracts, with an Application to Spain." *European Economic Review* 36 (No. 5 1992): 1013-47.

Bentolila, S., and Saint-Paul, G. "A Model of Labour Demand with Linear

Adjustment Costs." *Labour Economics* 1 (Nos. 3-4 1994): 303-26.

Boeri, Tito. "Institutional Reforms and Dualism in European Labor Markets." *Handbook of Labor Economics* 4 (Part B 2011): 1173-236.

Boeri, T., and Garibaldi, P. "Two Tier Reforms of Employment Protection: A Honeymoon Effect?" *The Economic Journal* 117(No. 521 2007): F357-85.

Boeri, T., Garibaldi, P., and Moen, E. The Labor Market Consequences of Adverse Financial Shocks. IZA Discussion Paper No. 6826, 2012.

Boeri, T., Garibaldi, P., and Moen, E. "Financial Shocks and Labor: Facts and Theories." *IMF Economic Review* 61(No. 4 2013): 631-63

Boockmann, A., and Hagen, T. The Use of Flexible Working Contracts in West Germany: Evidence from an Establishment Panel. ZEW Discussion Papers No. 01-33, 2001.

Carneiro, A., Portugal, P., and Varejao, J. Catastrophic Job Destruction. IZA Discussion Paper No. 7670, 2013.

Cappelli, P., and Neumark, D. "External Churning and Internal Flexibility: Evidence on the Functional Flexibility and Core-Periphery Hypo- theses." *Industrial Relations: A Journal of Economy and Society* 43 (No. 1 2004): 148-82.

Chodorow-Reich, Gabriel. "The Employment Effects of Credit Market Disruptions: Firm-level Evidence from the 2008-9 Financial Crisis." *Quarterly Journal of Economics* 129 (No. 1 2014): 1-59.

CIETT. Agency Work Key Indicators, 2012. Available at: http://www.ciett. org.

Costain, J., Jimeno, J. and Thomas, C. Employment Fluctuations in a Dual Labor Market, Banco de Espana Working Paper No. 1013, 2010.

De Graaf-Zijl M., and Berkhout E. E. "Temporary Agency Work and the Business Cycle." *International Journal of Manpower* 28 (No. 7 2007): 539-56.

Dräger, V., and Marx, P. Do Firms Demand Temporary Workers When They Face Workload Fluctuation? Cross-Country Firm-Level Evidence on the Conditioning Effect of Employment Protection. IZA Discussion Paper No. 6894, 2012.

Harada, K., Hoshi, T., Hosono, K., Koibuchi, S., and Sakuragawa, M. "Lessons from Japan's Shadow Financial Regulatory Committee: Japan in the Global Financial Crisis." In Robert Litan (ed.), *The World in Crisis: Insights from Six Shadow Financial Regulatory Committees from Around the World*. Philadelphia, USA: Wharton Financial Institutions Center, University of Pennsylvania, pp. 222-

54, 2011.

Hosono, K., Takizawa, M., and Tsuru, K. International Transmission of the 2008-09 Financial Crisis: Evidence from Japan. RIETI Discussion Paper Series No. 13-E-010, 2013.

Houseman, Susan, N. "Why Employers Use Flexible Staffing Arrangements: Evidence from an Establishment Survey." *Industrial and Labor Relations Review* 55 (No. 1 2001): 149-70.

Jahn, E. J., and Bentzen, J. "What Drives the Demand for Temporary Agency Workers." *LABOUR* 26 (No. 3 2012): 341-55.

Kodama, N., Inui, T., and H. U. Kwon. "A Decomposition of the Decline in Japanese Nominal Wages in the 1990s and 2000s." *Seoul Journal of Economics* 28 (No. 1 2015): 53-84.

Matsuura, Toshiyuki. Why Did Manufacturing Firms Increase the Number of Non-regular Workers in the 2000s? Does International Trade Matter? RIETI Discussion Paper Series No. 13-E-036, 2013.

Matsuura, T., Sato, H., and Wakasugi, R. Temporary Workers, Permanent Workers, and International Trade: Evidence from Japanese Firm-Level Data. RIETI Discussion Paper Series No. 11-E-030, 2011.

Morikawa, Masayuki. Volatility of Firm Performance and Atypical Employment: An Empirical Analysis Using Firm-level Data. RIETI Discussion Paper Series No. 10-J-023, 2010 (in Japanese).

Ono, Y., and Sullivan, D. "Manufacturing Plants' Use of Temporary Workers: An Analysis Using Census Micro Data." *Industrial Relations: A Journal of Economy and Society* 52 (No. 2 2013): 419-43

Pfeifer, Christian. Fairness and the Labour Market; A Theoretical and Empirical Analysis of Layoffs in Germany. Hannover Economic Papers dp-328, 2005.

Saint-Paul, Gilles. "Dynamic Labor Demand with Dual Labor Markets." *Economics Letters* 36 (No. 2 1991): 219-22.

Sala, H., Silva, J., and Toledo, M. "Flexibility at the Margin and Labor Market Volatility in OECD Countries." *The Scandinavian Journal of Economics* 114 (No. 3 2012): 991-1017.

Storrie D. *Temporary Agency Work in the European Union.* Dublin: European Foundation for the Improvement of Living and Working Conditions, 2002.