WP/16/20

IMF Working Paper

Wage-Price Dynamics and Structural Reforms in Japan

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INTERNATIONAL MONETARY FUND

 WP/16/20

IMF Working Paper

Asia and Pacific Department

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February 2016

Abstract

Structural reforms in the liquidity trap need not be deflationary. This paper develops a simple framework to study the role that key characteristics of Japan's labor and product markets—labor-market duality and weak corporate governance—play in generating unfavorable wage-price dynamics. The model allows a discussion of whether and in what form structural reforms may contribute to Japan's short-run goal of reflating the economy. It finds that boosting inflation with structural reforms implies an unusual trade-off with employment, that is an inverted Phillips curve. Simultaneous implementation of labor-market and product-market reforms is most effective in terms of reflating the economy.

JEL Classification Numbers: E24, E52, E64, J38, J41

Keywords: Abenomics, corporate governance, inflation, Japan, labor-market duality, liquidity trap, structural reforms, wage-price dynamics, single open-ended contract.

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[1] I would like to thank, without implicating, Dennis Botman and Luc Everaert for their guidance and insights. I would also like to thank all members of the Japan team and seminar participants in the Asia and Pacific Department for the many helpful suggestions, and Yihan Liu for excellent research assistance.

I. INTRODUCTION

The Japanese economy has been stuck in a liquidity trap for more than two decades now. Between 1992 and 2014, Japan's real GDP grew on average less than 1 percent per year and CPI inflation hovered around zero, with prolonged periods of falling prices. The combination of low growth and no inflation led to Japan's nominal GDP increasing by only about 2 percent in 23 years. During the same period, nominal GDP in the United States nearly trebled.

The liquidity trap is a condition that originates from a shortage of demand. At the prevailing real interest rate the supply of savings exceeds the demand for loans and, because of the zero lower bound on the nominal interest rate, the country's central bank is unable to lower the interest rate enough to close the output gap and restore full employment. Once Japan's economic malaise was diagnosed as a liquidity trap, wherein conventional monetary policy is ineffective, policymakers tried to end stagnation with expansionary fiscal policy and with unconventional monetary measures such as quantitative and qualitative easing.

Nonetheless, Japanese policymakers have repeatedly been criticized for failing to solve the economy's problems. In 2000 Ben Bernanke wrote that much of Japan's disappointing performance was due to "exceptionally poor monetary policymaking," and Kuttner and Posen (2002) found that "Japanese fiscal policy was contractionary over much of the 1990s" attributing part of the protracted downturn to insufficient fiscal stimulus. Indeed, the counterfactual exercise in Leigh (2010) suggests that a policy rule with a higher inflation target and more aggressive monetary easing in response to economic slack would have substantially improved the economy's performance and would have avoided the zero bound on nominal interest rates.

At the heart of Japan's economic challenge lie four, closely related, intertemporal problems: ending deflation, raising growth, securing fiscal sustainability, and maintaining financial stability. These objectives need to be achieved against the background of Japan's rapidly aging society, entrenched deflationary expectations, and a global economy that remains mired in subdued growth. Abenomics, the economic platform on which the current Prime Minister Shinzo Abe ran in the general elections of 2012, embraces the principle of policy coordination to meet these challenges. It is divided in three parts: aggressive monetary easing, flexible fiscal policy, and ambitious structural reforms. It has been stressed that complementarities among policies are the key to the program's success. Typically, the first two so-called arrows of Abenomics are represented as having the aim of reflating the economy in the near term, while implementation of the third arrow would lift potential growth in the long run.

Regarding the third arrow, many observers have dismissed structural reforms as deflationary in the short run. The argument goes that the resulting expansion in aggregate supply would take time to be met by the increase in aggregate demand, with the latter occurring for instance through higher permanent income expectations. However, there has been little analytical work on the short-run effects of structural reforms on prices, an issue relevant not just for Japan but also for other economies faced with zero interest rates, low inflation, and weak demand such as in the euro area. The main contribution of this paper is its analysis of the effects of Japan's

labor-market and product-market characteristics on the country's wage-price dynamics and hence of the role of structural factors in perpetuating the country's economic doldrums. This in turn allows a discussion of whether and in what form structural reforms may contribute to Japan's short-run goal of raising inflation.

Specifically, Japan has long been known for its life-time employment model, which served the country well during the high-growth decades. However, during the last two decades major changes have taken place in Japan's labor market. The main development is that labor-law reforms, demographics, and the prolonged recession have led to a growing share of workers holding so-called non-regular jobs, for instance part-time positions. The share of these workers in the total labor force now amounts to about 37%. This coincided with the waning importance of synchronized wage bargaining and with a marked decline in union power. In the theoretical framework, I model these factors as a decline in the market power of Japanese workers and study the implications for the dynamics of wages and prices.

Second, Japan's product market is characterized by a lack of firm dynamism as illustrated, for example, by the large share of cash holdings on corporate balance sheets. This too matters for price dynamics as firms have been reluctant to raise wages, investment, or dividend payments. I interpret this fact as an agency problem and therefore introduce a corporate-governance friction in the product market of the model: firm managers do not strictly maximize profits but engage in empire-building behavior putting some weight on the size of their firms when setting prices.

Policymakers have recognized that market frictions have been an obstacle to raising inflation and revitalizing growth. For instance, Prime Minister Abe's recent resolve to apply moral suasion on firms to raise wages, his call to raise minimum wage growth to 3 percent, as well as the passage of important corporate-governance reforms can be interpreted as the acknowledgment that price inflation is not only a monetary phenomenon, and that frictions in the labor and product market, where firms and consumers interact, can have substantial impact on the consumer price index.

In this paper, I use a standard dynamic model of the economy featuring the zero lower bound on the nominal interest rate. In order to display active wage- and price-setting behavior, the model assigns a degree of market power to both workers and firms. Moreover, the product market includes a departure from perfect alignment of shareholder and manager incentives, which I call the corporate-governance friction. It turns out that the macroeconomic effects of these frictions can be represented in a familiar AS-AD framework, which illustrates the effects of changes in workers' market power on the resulting equilibrium.

First, this paper finds that a large enough decline in workers' bargaining power makes a country's central bank hit the zero lower bound, and certainly can push an economy deeper in the liquidity trap if the nominal interest rate is already at zero. Second, with the nominal interest rate bounded at zero, a labor-market reform that strengthens workers' bargaining power, for example in the case of Japan the introduction of the single open-ended contract for non-regular workers, generates upward pressure on prices. However, the benefits that come from reflating the economy must be weighed against the loss of employment and output due to the increase

in workers' wage bargaining power. As such, insofar as changes in inflation and employment are driven by changes in workers' bargaining power, we should observe an inverted Phillips curve, where deflation is associated with expansion in employment. Third, the paper shows that a simultaneous improvement in corporate governance, which makes firms' price-setting behavior more responsive to increasing costs, increases the inflationary effect of an increase in the bargaining power of workers.

In section II the paper briefly presents a literature review followed in section III by a description of labor-market and product-market stylized facts for Japan that motivate the frictions at the heart of this paper's contribution. In section IV I present the set up and solution of the model. Section V concludes by discussing the policy recommendations that emerge from the model and by indicating what further work I propose to carry out in the future.

II. LITERATURE REVIEW

Krugman (1998) introduced the liquidity trap in modern macroeconomics. This seminal paper showed that depressions caused by the zero bound on the nominal interest rate are not just a quirk of the ad-hoc IS-LM framework but can be reproduced in standard dynamic models. Ever since, a large literature has emerged describing the mechanisms that can push a country against the zero lower bound and the policy recommendations implied by different frameworks.

The literature unanimously finds that creating expectations of inflation is the "natural" solution to the liquidity trap. Inflation expectations are how the economy can achieve the needed negative real interest rate, even though the nominal interest rate is constrained by the zero lower bound. So, monetary policy is not ineffective, insofar as it can affect expectations of the future path of the nominal interest rate, and thus of future inflation, by means of forward guidance.

Eggertsson and Woodford (2003) is a convincing attempt to quantify the effectiveness of fully-credible optimal forward guidance in the liquidity trap. They find that an economy can avoid most of the depression if the central bank commits in a fully credible way to keeping the nominal interest rate at zero for a period of time after the natural real rate of interest (i.e. the real rate of interest consistent with full employment) has turned positive again. For instance, in their calibrated model the optimal fully-credible policy response to a shock keeping the natural rate of interest negative for fifteen quarters is to immediately decrease the nominal interest rate to zero and then to commit to holding it there for twenty quarters, regardless of inflation rising above target and of the positive output gap from the fifteenth quarter on.

However, overcoming the time-consistency problem inherent in forward guidance has proven very difficult in practice. Forward guidance requires that central bankers be credible in the promise of changing their attitude to inflation once the economy is out of the liquidity trap, for instance by adopting a higher inflation target. But central bankers see themselves as defenders against rather than promoters of inflation and might reasonably be expected to revert to type at the first opportunity.

As for the other types of unconventional monetary policy, quantitative and qualitative easing, Eggertsson and Woodford (2003) formalize a neutrality proposition for open-market operations, according to which in a standard model of the liquidity trap the size and composition of central-bank asset purchases do not have any effect on whether a deflationary price-level path will represent an equilibrium. And, despite Ben Bernanke's quip that "the problem with QE is it works in practice but it doesn't work in theory," Woodford (2012) authoritatively reported that empirical studies have mostly found QQE operations having small impact, in particular on the long-term interest rate. Moreover, Woodford (2012)'s interpretation of the data is that the effects of QQE are due to changes in expectations on the course of future monetary policy rather than to the balance-sheet expansions per se.

Early papers mostly used preference shocks as reduced-form causes for hitting the zero lower bound, and thus gave little insight into the reasons why an economy's natural real interest rate may turn negative. So, an important step forward in the theoretical literature on the liquidity trap was the attempt to put more structure on the shocks. Eggertsson and Krugman (2012) formalized the popular notion of a deleveraging shock inducing a liquidity trap. In their model, a tightening of credit constraints in the economy, which can be thought of as a change in the general view of what is a safe amount of debt, leads to a lower natural real interest rate. This is because the most impatient agents, who were indebted, must reduce their consumption in order to run down their debt, and the patient agents will pick up the slack only if they have a strong incentive not to carry on with their thrifty ways. If the natural real interest rate falls below zero, then the central bank hits the zero lower bound and, if agents do not believe that it will pursue inflationary policies in the future once the economy is out of the liquidity trap, a negative output gap opens up and deflation starts. An amplification mechanism called Fisherian debt-deflation emerges too. Accordingly, if debt is denominated in nominal terms, deflation increases the real debt burden of impatient agents, forcing them to deleverage even more. In terms of policy implications, Eggertsson and Krugman (2012) make a strong case for expansionary fiscal policy as a solution for the liquidity trap. They recommend that, while the private sector is repairing its balance sheets by saving, the public sector run up debt.

Eggertsson (2010) is related to this paper in that it describes labor-market dynamics in the context of a liquidity trap. It describes the paradox of toil: in the liquidity trap an increase in people's willingness to work paradoxically leads to less work being done because the real interest rate increases as wages and prices drop making the output gap even more negative. The author defines the policy conclusions of the paper exotic and claims that one possible interpretation of the result is the presence of weaknesses in New Keynesian theory. The paradox of toil relies heavily on the price-rigidity assumption. This paper does away with it in the model by assuming flexible prices. Moreover, this model's labor market has more structure in that workers have a degree of market power. This allows us to better map the model to the macroeconomic variables of interest to us.

A key shortcoming of the literature is the limited number of analyses of the role of structural factors in causing and perpetuating the liquidity trap, and thus of the potential of structural reforms to solve it. This paper, by setting out a dynamic model with active wage- and price-setting behavior, studies the effect of changes in characteristics of the labor and product market on the economy when the nominal interest rate has a lower bound.

Structural reforms at the zero lower bound are discussed in Eggertsson et al. (2014) and in Fernandez-Villaverde et al. (2014). The papers agree that such reforms have two opposing effects on today's inflation rate and production level: on the one hand the expansion in supply is deflationary, on the other hand expectations of higher future output increase demand and are therefore inflationary. Eggertsson et al. (2014) stresses the deflationary effects of structural reforms at the zero lower bound and argues that in the short run they are contractionary, while Fernandez-Villaverde et al. (2014) looks at more persistent reforms and argues that, given the time lag between the announcement of a reform and its effects, the expansion in demand is the dominating force. The above papers analyze the trade-off, generally inherent in structural reforms at the zero lower bound, between short-run inflation, which requires higher profit margins, and long-run output, which conversely is decreasing in profit margins.

This paper differs from Eggertsson et al. (2014) and Fernandez-Villaverde et al. (2014) in that it only focuses on the short-term effects of structural reform at the zero lower bound, disregarding the productivity channel. There is evidence that the trade-off discussed in Eggertsson et al. (2014) and Fernandez-Villaverde et al. (2014) for structural reforms in general does not apply to the analysis of labor-market reforms that reduce duality. In fact, Aoyagi and Ganelli (2015) find that higher employment protection for non-regular workers would actually improve productivity. Given the contradiction between empirics and theory on the direction of the effect on productivity of a change in workers' bargaining power in a dual labor market, this paper leaves the discussion of the productivity channel to future research and focuses on the direct short-run effects of changes in workers' market power at the zero lower bound.

The modeling of wage-price dynamics in this paper is taken from Blanchard (1986), where monopolistically competitive firms and workers face each other in the labor and product market. In addition to Blanchard (1986), this paper's model adds an intertemporal margin for the worker, given the centrality of dynamic considerations in the analysis of the liquidity trap.

In terms of the labor-market friction, the insider-outsider theory of the labor market is the intellectual ground on which I draw a link between an increasingly dual labor market and the deterioration of workers' bargaining power. According to this literature, workers' market power depends on the employer incurring costs to substitute them. If it is easier for employers to hire workers on temporary contracts, the bargaining power of the marginal worker decreases. A comprehensive survey is offered in Lindbeck and Snower (2002).

Blanchard and Summers (1987) build on the insider-outsider theory of the labor market to develop an influential framework where equilibrium employment depends on current employment, because real wages are bargained primarily with an eye to the interests of incumbent workers. Their model is fundamentally different from this paper's in that it assumes away labor-market duality. Specifically, the bargaining power of labor-market outsiders does not matter for firms' pricing decisions because outsiders are outright unemployed, unlike in this paper in which outsiders are employed, just with fewer protections. If labor-market outsiders are defined as unemployed rather than as second-tier workers, they clearly do not affect firms' marginal costs.

The model's product-market friction draws on agency theory. Jensen (1986) is the seminal paper on empire-building behavior by managers. It argues that, since firm growth increases managers' power by increasing the resources under their control, managers have incentives to grow their firms beyond the optimal size. The link between better corporate governance and profit maximization is empirically confirmed by Brown and Caylor (2006), who find that firms with better governance quality are more profitable and more valuable.

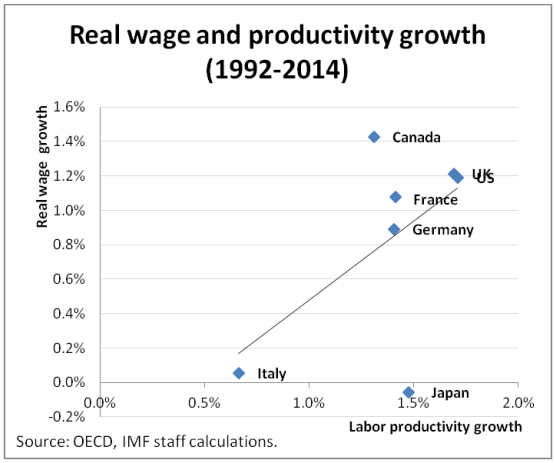
III. Key Characteristics of Japan's Labor and Product Markets

A. Japan's Labor Market

In this subsection, I focus on facts that motivate the model's key assumption that workers' bargaining power is not constant over time but subject to significant shocks. Of course, bargaining power is unobservable, but I think there is evidence for its decline in Japan over the last three decades.

Figure 1 shows the empirical relationship between labor productivity growth and real compensation growth for G7 countries from the Japanese financial crisis of 1991 to 2014[2]. Japan stands out because over the last two and a half decades productivity improvements did not lead to increases in real wages. There is some evidence of this phenomenon in Italy and more recently also in Germany. See appendix 2 for figures 5 and 6 showing the same cross-country comparison respectively for the period from 1992 to 2007 and from 1999, the year when the Bank of Japan lowered its nominal interest rate to zero for the first time, to 2007.

Figure 1: Real wages decoupled from productivity.



Source: OECD, IMF staff calculations.

This paper explains this empirical fact by pointing out that Japan, unlike the other countries considered, has had its policy interest rate against the lower bound for most of this period. As a consequence, the Bank of Japan has been unable to offset adverse wage-price dynamics due to the deterioration in workers' bargaining power.

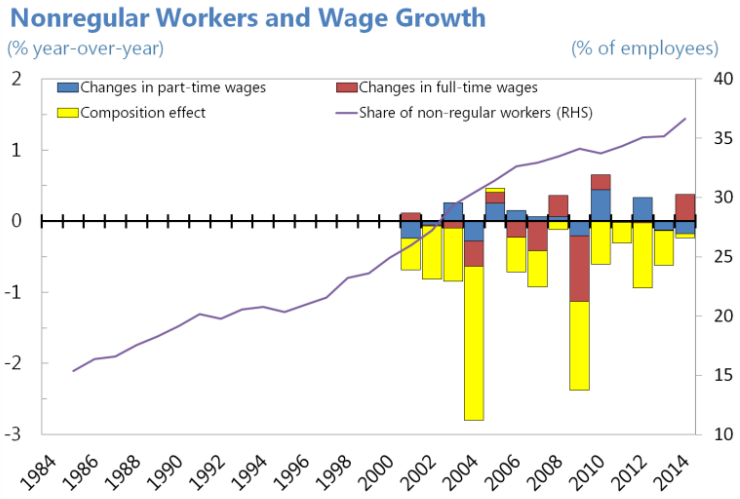
On unemployment Japan fares well by international comparison. The unemployment rate has ranged between 3 percent and 5 percent from the 1980s until the 2000s, despite the severe economic contraction following the bursting of the bubble in the early 1990s. In the last five years the unemployment rate has returned to the lower end of the range at 3.5 percent in 2015. Noticeably, the average figure hides some intergenerational inequality in that youth

[2] Real wages are the aggregate wage bill as defined in the national accounts divided by full-time-equivalent workers, where the latter is the total number of employees in the economy multiplied by the ratio of the regular hours worked by a full-time employee and the total hours worked in the economy. Labor productivity is defined as real GDP per hour worked.

unemployment (i.e. 15 to 34 years cohort) has risen faster in the last three decades going from 3 percent in the 1980s to around 5 percent in 2015, with a maximum of 7 percent in the 1990s. Overall joblessness is remarkably low compared with other advanced economies. Even in the wake of the most recent global financial crisis, it increased by only a modest 1 percentage point, compared with increases of about 5 percentage points in the USA and 2 percentage points in the UK. More recently, in some sectors of the economy there have even been signs of substantial labor shortages.

Although Japan has done well in terms of avoiding unemployment, nominal and real wage growth have been very low, with increases in real compensation consistently smaller than increases in labor productivity. As a consequence, the labor income share has declined markedly since the 1990s, from 66 percent in 1991 to 59 percent in 2007. The slow wage growth has been partly due to anemic increases or even outright decreases in compensation for regular workers. However, the largest factor that has contributed to paltry wage growth, as can be seen in figure 2, has been a composition effect: the share of workers who hold lower-paying non-regular positions[3] almost doubled since 1991 to 37 percent of the workforce in 2014. This dramatic increase in duality has been the most notable development in Japan's labor market since the 1990s.

Figure 2: The increase in labor-market duality and impact on wages.



Sources: Haver Analytics; and IMF staff estimates

Labor-market duality has had some important positive aspects: it contributed to keep overall unemployment low and it increased the labor force participation of some segments of the population, for example married women. However, there is evidence that it hampers TFP growth, as firms have a lesser incentive to train non-regular workers and the latter to exert effort in the workplace. Fukao et al. (2007) estimate that Japanese part-time workers are 75 percent less productive than full-time workers. And, non-regular employment is not only driven by workers' desire to have more flexible working hours, it is to some extent concealing underemployment: many non-regular workers in Japan would prefer regular jobs. For example, JILPT (2011) found that 37 percent of all fixed-term employees and 35 percent of all dispatched employees (i.e. not employed directly) took up such positions because of lack of opportunity to work as regular employees. Ohtake et al. (2011) show that about 80 percent of dispatched workers in the manufacturing sector and 50 percent of all part-time workers would be willing to work as regular workers. Another measure of the degree of labor-market duality is the probability of moving from a non-regular to a regular job, which is estimated in Japan in a range between 1.7 percent and 10.3 percent

[3] Regular workers are those who (i) are hired directly by the employer, (ii) work full time, and (iii) have an open-ended contract. Compared to regular workers, non-regular workers have a much lower level of job security, are paid lower wages, and receive significantly less social insurance coverage.

(Kosugi, 2010; Genda, 2010), compared to about 30 percent in the UK (Booth, Francesconi, and Frank, 2002) and 45 percent in Germany (Hohendanner, 2010).

One of the determinants of firms' decisions to hire non-regular workers could be the high level of employment protection enjoyed by regulars. Japan's laws are not particularly restrictive, but the legal doctrine on unfair dismissal is among the strictest in the OECD. The high level of employment protection for regular workers has served the country well in high growth decades, by facilitating accumulation of firm-specific human capital. However, Asano et al. (2011) and Abe, Higuchi, and Sunada (2004) show that since the 1990s returns to firm-specific human capital have fallen in Japan. This might have made Japanese firms reluctant to employ the same share of regular workers as in the past.

Japan's labor law already provides for a kind of contract that, if used more widely, could put an end to the stark dichotomy in Japan's labor market: the limited regular contract ("gentei seishain"). Employees classified as limited regular workers enjoy regular worker benefits but with limitations on one or more of the following: (i) job content, (ii) working hours, and (iii) mandatory relocations. However, firms have avoided using this kind of contract, because of uncertainty on the legal framework, in particular with regard to dismissals.

In spite of the failure of wage increases to keep up with increases in labor productivity, Japan has experienced a spectacular decrease in industrial conflict, with the number of strikes dropping from 707 per year on average in the 1980s, to 220 in the 1990s, and to 63 in the 2000s. In 2013, the last year with data, as few as 31 cases of strikes were recorded. Unionization of Japanese workers is low and decreasing too, with 18 percent of employees enrolled in a union in 2014 compared to 25 percent in 1991.

B. Corporate Governance in Japan

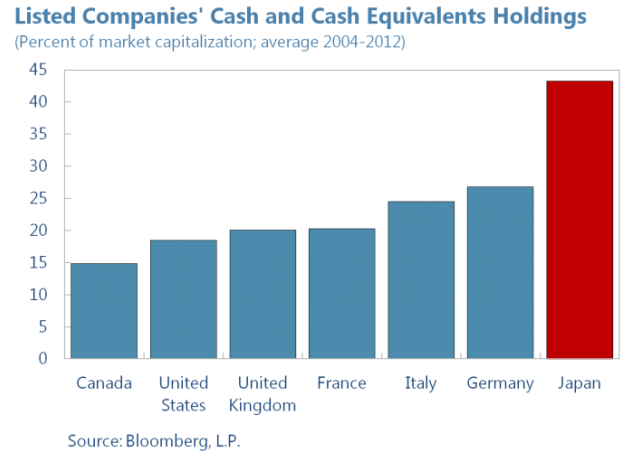
This subsection describes facts of Japan's product market that motivate the model's assumption of imperfect incentive alignment between shareholders and firm managers.

Japanese non-financial firms in 2013 held cash and cash-equivalent assets of about 50 percent of nominal GDP. This is high by international standards: compared to the USA, non-financial firm cash holdings are one-third higher in Japan as a share of assets and more than twice as high as a share of the firms' market capitalization (see figure 3).

Studies such as Aoyagi and Ganelli (2014) have found results suggestive that better corporate governance reduces cash holdings. According to Sher (2014), each percentage point reduction in the proportion of firms with dual CEOs could release cash holdings worth around 2 percent of annual GDP.

Aggarwal et al. (2010) developed a firm-level governance index. According to it, corporate governance is weaker in Japan than in other advanced economies. As a consequence, managers in Japan might have more leeway to pursue "individual benefits" rather than maximize shareholder value.

Figure 3: High cash holdings by international standards.



Recently, Japan's authorities have implemented reforms to corporate governance. In June 2015, the Corporate Governance Code was formally introduced and all listed companies are now asked, on a comply-or-explain basis, to appoint at least two outside directors, and to disclose overall policy and voting criteria of cross-shareholdings. Also, the new Stewardship Code, which encourages investors to fulfill their fiduciary duties to clients, has been adopted by more than 190 institutional investors, including the Government Pension Investment Fund, one of the largest pension funds in the world.

IV. THE MODEL

This section presents a closed-economy model where consumer-workers and firms interact in the labor market and in the product market, and the central bank pursues a price stabilizing monetary policy.

There is monopolistic competition in the goods and the labor markets. Consumer-workers supply differentiated labor types that are imperfectly substitutable factors of production for firms, and firms produce differentiated goods for consumers. Monopolistic competition crucially enables us to study active price- and wage-setting behavior. The paper's focus is on the general equilibrium effects of changes in the market power of workers in the context of this double monopoly.

In the product market we include a corporate-governance friction: the incentives of firms' management are not perfectly aligned with those of shareholders. Managers do not solely seek to maximize profits, as in the interest of shareholders. They place a weight on maximizing the firm's revenue too. We can interpret this as managers engaging in "empire-building" behavior. Notice that the model encompasses the frictionless case of perfect incentive alignment of managers with shareholders.

The first two subsections describe partial equilibrium from the perspective of the consumer-workers and of the firms. Then, in the third subsection I solve for the model's general equilibrium. The final subsection discusses the results and is divided into three parts: first, the long-run properties of the model are discussed; second, the short-run dynamics of the model,

where the liquidity trap is crucial, are analyzed; and, last, the possibility of representing the model within an AS-AD framework is highlighted.

A. The Consumer-Workers' Problem

There is a unit mass of consumer-workers $j \in [0,1]$. In every period, each of them chooses a level of consumption C_{jt} and decides how much of her differentiated labor N_{jt} to supply. They can transfer resources across time by purchasing bonds or holding money.

Consumer-workers make their choices to maximize a standard utility function with decreasing marginal utility in consumption and increasing marginal disutility from hours worked.

$$E_0 \sum_{t=0}^{+\infty} \rho^t \left(\frac{C_{jt}^{1-\gamma} - 1}{1-\gamma} - A_t^{1-\gamma} \frac{N_{jt}^{1+\eta}}{1+\eta} \right) \quad (1)$$

$\rho < 1$ is the consumer's discount factor, $\gamma \geq 0$ is the inverse of the elasticity of substitution of consumption across time, and $\eta \geq 0$ is the inverse of the Frisch elasticity of labor supply. A_t denotes the level of technology. The term $A_t^{1-\gamma}$ that affects the disutility of work is introduced to allow for a balanced growth path, as in Mertens and Ravn (2011). Notice that $C_{jt} \equiv \left(\int_0^1 C_{kjt}^{\frac{\theta-1}{\theta}} dk \right)^{\frac{\theta}{\theta-1}}$ is a Dixit-Stiglitz aggregator of consumption goods. It implies that goods $k \in [0,1]$ are imperfect substitutes for consumers. In particular, consumers' elasticity of demand is $\theta \geq 0$, where $\theta = 0$ indicates that goods are perfect complements and $\theta \to +\infty$ that they are perfect substitutes.

The consumer-worker's flow budget constraint is given by

$$P_t C_{jt} + Q_t B_{jt} + M_{jt} \leq W_{jt} N_{jt} + \int_0^1 V_{kt} dk + B_{jt-1} + M_{jt-1} \quad (2)$$

$P_t = \left(\int_0^1 P_{kjt}^{1-\theta} dk \right)^{\frac{1}{1-\theta}}$ is the Dixit-Stiglitz price aggregator corresponding to consumption bundle C_{jt}, and Q_t is the price of a bond maturing in period t+1. Consumers earn income from their wages and from the profits of the firms they own. Moreover, they can use their savings from the previous period.

By defining savings $S_{jt} \equiv B_{jt} + M_{jt}$, the flow budget constraint can be rewritten as

$$P_t C_{jt} + Q_t S_{jt} + (1 - Q_t) M_{jt} \leq W_{jt} N_{jt} + \int_0^1 V_{kt} dk + S_{jt-1} \quad (3)$$

This expression of the budget constraint stresses the opportunity cost $(1 - Q_t)$ of using money for saving. This opportunity cost exists because by definition money does not pay nominal interest rate, while bonds, the alternative saving device, may.

Consumers have market power in the labor market. Each consumer supplies a differentiated labor type, facing elasticity of demand $\sigma_t \geq 0$. As a consequence, each consumer faces a demand schedule for her labor

$$N_{jt} = \left(\frac{W_{jt}}{W_t}\right)^{-\sigma_t} \frac{Y_t}{A_t} \quad (4)$$

Demand for labor of type j is decreasing in the wage rate asked by consumer j and increasing in aggregate output Y_t. $W_t = \left(\int_0^1 W_{jt}^{1-\sigma_t} dj\right)^{\frac{1}{1-\sigma_t}}$ is the Dixit-Stiglitz wage aggregator, which can be interpreted as the average wage. See appendix 1 for derivation of the labor demand schedule.

The consumer-worker's problem is to maximize (1), subject to budget constraint (3) and labor demand (4) in each period. Given $\{Q_t, P_t, W_t, Y_t\}_{t=0}^{+\infty}$, which are determined in general equilibrium, the consumer's optimal behavior sets

$$\frac{W_{jt}}{W_t} = \left(\frac{\sigma_t}{\sigma_t - 1}\frac{P_t}{W_t} C_{jt}^{\gamma} Y_t^{\eta} A_t^{1-\gamma-\eta}\right)^{\frac{1}{1+\eta\sigma_t}} \quad (5)$$

$$Q_t \frac{P_{t+1}}{P_t} = \rho \left(\frac{C_{jt+1}}{C_{jt}}\right)^{-\gamma} \quad (6)$$

Equation (5) is consumer-worker j's wage-setting rule. Equation (6) is the Euler equation, which describes the optimal intertemporal pattern of consumer-worker j's consumption.

Finally, since money guarantees a zero nominal return and has the same payoff characteristics as bonds, in equilibrium arbitrage implies the zero lower bound on the nominal interest rate.

$$Q_t \leq 1 \quad (7)$$

B. The Firms' Problem

A unit mass of firms $k \in [0,1]$ produce a differentiated good each. In each period, firms determine the price and quantity of their good and hire workers to maximize

$$P_k Y_k - (W N_k)^{\varphi} \quad (8)$$

N_k is the Dixit-Stiglitz aggregator for labor hired by firm k and W is the associated wage aggregator.

$\varphi \in [0,1]$ is the parameter that governs the corporate governance friction. If $\varphi = 1$, the model is standard with firms maximizing profits in the full interest of shareholders. At the other extreme, if $\varphi = 0$, managers only care about making the firms as large as possible in terms of revenue. The corporate-governance friction impacts the elasticity of consumer prices to firms' marginal costs. Managers who are not strictly accountable to shareholders for their firm's

financial performance will be more reluctant to increase prices and hence lose market share, if they face an increase in marginal costs.

Due to monopolistic competition, each firm faces a downward-sloping demand curve for its product of the form:

$$Y_k = \left(\frac{P_k}{P}\right)^{-\theta} Y \quad (9)$$

θ is the elasticity of substitution across the differentiated goods. P is the Dixit-Stiglitz aggregator for consumer prices and Y is aggregate output. A similar equation is derived in appendix 1.

The firms' production function is linear in the only factor of production, N_k.

$$Y_k = AN_k \quad (10)$$

A is the exogenous productivity level.

Given $\{Q_t, P_t, W_t, Y_t\}_{t=0}^{+\infty}$, which are determined in general equilibrium, the firms' optimal decisions require

$$\frac{P_{kt}}{P_t} = \left[\frac{\theta}{\theta - 1}\varphi\left(\frac{W_t}{P_t A_t}\right)^{\varphi}(P_t Y_t)^{-(1-\varphi)}\right]^{\frac{1}{1+\theta(\varphi-1)}} \quad (11)$$

C. General Equilibrium

Notice that consumption is the only source of demand for goods in the economy and bonds are in zero net supply.

Positing that the markets for bonds, goods, and labor clear, and realizing that consumer-workers and firms will adopt symmetric strategies since they are respectively identical, it is possible to derive the system of equations that govern the behavior of macroeconomic variables in the model's equilibrium.

$$w_t = \mu_t^w + p_t + (\gamma + \eta)y_t - (\gamma + \eta - 1)a_t \quad (12)$$

$$p_t = \mu^f + \varphi(w_t - a_t) - (1 - \varphi)y_t + ln\varphi \quad (13)$$

$$i_t - (p_{t+1} - p_t) = r + \gamma(y_{t+1} - y_t) \quad (14)$$

Lowercase letters stand for natural logarithms.

Equation (12) represents the equilibrium wage-setting decision of consumer-workers. Nominal wages are increasing in $\mu_t^w \equiv ln\left(\frac{\sigma_t}{\sigma_t - 1}\right)$, which can be thought of as the mark-up that workers command over their disutility of work, reflecting their degree of market power in the labor market. Increases in the price level make workers demand one-to-one salary raises. The wage rate is increasing in the level of production, since workers' marginal utility of consumption is decreasing and their disutility of working is increasing. Workers demand lower wages if productivity is higher, as they can produce the same amount of goods with fewer hours of work.

Equation (13) is the optimal price rule for firms. $\mu^f \equiv ln\left(\frac{\theta}{\theta-1}\right)$ is the mark-up that firms charge over their marginal cost of production. Firms' response to increases in the nominal wage rate depends on the corporate-governance friction: if managers solely seek to maximize profits, then they increase prices one-to-one with increase in costs; if they put some weight on the firm's market share, they will trade off some profits increasing their price less than one-to-one with costs in order to preserve the size of the firm.

Equation (14) is the Euler equation, where $i_t \equiv -ln(Q_t)$ is the nominal interest rate. This equation determines the real interest rate at which the bond market clears.

I close the model with Taylor rule (15) that targets a growing price level. Monetary policy is constrained by the zero lower bound on the nominal rate of interest.

$$i_t = \max\{0, r + \delta[p_t - (p^*_{t-1} + \pi^{p*})]\} \quad (15)$$

When the lower bound on the nominal interest rate is not binding, the central bank can keep the price level on target as long as

$$\delta[\varphi(\gamma + \eta) - (1 - \varphi)] > 0 \quad (16)$$

To interpret condition (16), we consider the case of the multiplicative factors having a positive sign: the price level is determined at the target outside of the liquidity trap if $\delta > 0$, which means that the central bank responds with its instrument to deviations of the price level from target, and if $\varphi > \frac{1}{1+\gamma+\eta}$, which means that the corporate-governance friction is small enough.

D. Results

The model combines standard long-run behavior with interesting implications for short-run dynamics when the liquidity trap becomes relevant. In the long run, the liquidity trap is irrelevant and wage-price dynamics are standard as described below. In the short run, we have that large enough shocks to workers' bargaining power may push the economy in the liquidity trap and that the Phillips-curve relation is inverted when fluctuations are driven by shocks to workers' bargaining power.

The Long Run

In this section, I study the model's balanced growth path. The balanced growth path represents the behavior of endogenous variables in the absence of shocks. As such, it can be thought of as representing the model's long-run properties.

To allow for a balanced growth path in this model, the corporate-governance friction must be turned off (i.e. $\varphi = 1$). The absence of a balanced growth path with the corporate-governance friction is not a concern, because the paper's aim is to analyze the interaction of weak corporate governance and workers' bargaining power with the zero lower bound, which in this model is only binding in the short run.

The balanced growth path of the model without corporate-governance friction can be represented by the following four equations.

$$\pi^{p}_{BGP} = \pi^{p*} \quad (17)$$

$$\pi^{w}_{BGP} = \pi^{p*} + g^{a} \quad (18)$$

$$g^{y}_{BGP} = g^{a} \quad (19)$$

$$i_{BGP} = r + \pi^{p*} + \gamma g^{a} \quad (20)$$

The most important equation for our purposes is (18) which describes the long-run wage-price dynamics. According to it, real wages grow one-to-one with productivity growth. According to equation (17), the country's central bank is able to anchor the inflation rate at the target rate. Equation (19) shows that productivity growth is the sole driver of growth. Finally, equation (20) pins down the long-run nominal interest rate.

Notice that monetary policy must respect the following condition for the liquidity trap not to be a permanent condition:

$$\pi^{p*} > -(r + \gamma g^{a}) \quad (21)$$

Condition (21) sets a lower bound for the level of price inflation in the economy that makes the liquidity trap irrelevant in the long run. Notice that such lower bound is increasing in the exogenous rate of productivity growth. An interesting policy implication is that in response to a slowdown in productivity growth a central bank may have to revise upwards its target for inflation in order to avoid a permanent liquidity-trap condition.

If the central bank sets itself a rule with a target for inflation which is too low, in the long run there is no real effect. However, the central bank loses control over nominal variables. Equations (22) and (23) describe the rates of inflation for the price level and for nominal wages that prevail in the balanced growth path of an economy permanently in the liquidity trap because of π^{p*} violating condition (21).

$$\pi^{p}_{BGP} = -(r + \gamma g^{a}) \quad (22)$$

$$\pi^{w}_{BGP} = -[r + (\gamma - 1) g^{a}] \quad (23)$$

This paper focuses on the liquidity trap as a short-run phenomenon, due to shifts in bargaining power and a corporate-governance imperfection. However, it is interesting to notice that, if inflation targeted by the central bank is too low, the nominal interest rate may be bounded at zero in the long run, too.

The Liquidity Trap

I study the short-run dynamics of the model as a consequence of unanticipated changes in workers' market power. The question is whether changes in the market power of workers affect the central bank's ability to hit its inflation target.

Result 1: Define a lower threshold

$$\underline{\mu} = \mu^w - \frac{\varphi(\gamma+\eta)-(1-\varphi)}{\varphi\gamma} r - \frac{\gamma+\varphi\eta-(1-\varphi)}{\varphi\gamma}\pi^{p*} - (\gamma+\eta)g^a \qquad (24)$$

If and only if $\mu_t^w \leq \underline{\mu}$, then the zero lower bound on the nominal interest rate is binding. In this case, in equilibrium $i_t = 0$.

The economic contingency described in result 1 is what we define as liquidity trap in the context of this paper. A decrease in workers' market power is deflationary. The central bank responds to the shock by lowering the nominal interest rate in order to support the price level. But if the shock is large enough, it will make the central bank hit the zero lower bound with its policy instrument. As a consequence, the price level must fall and the central bank fails to hit its target.

Notice that a higher discount rate, a higher inflation target, and faster productivity growth lower the threshold $\underline{\mu}$ and thus decrease the likelihood that the zero-lower-bound constraint becomes relevant. This is consistent with calls for increases in the inflation target in order to decrease the probability of economies being caught in the liquidity trap. Furthermore, it is consistent with the observation that liquidity traps are more likely to take place in economies with slow productivity growth.

The fact that a lower discount rate r increases the likelihood of hitting the zero lower bound suggests that the mechanism described in this paper interacts with deleveraging shocks as described in Eggertsson and Krugman (2012). In their paper, as some agents experience a deleveraging shock and have credit cut off, the marginal consumers become more patient, which in our setting can be thought of as a decrease in the discount rate. With a lower discount rate, smaller decreases in workers' market power are sufficient for the nominal interest rate to hit the zero lower bound. Thus, a simultaneous deleveraging shock as in Eggertsson and Krugman (2012) amplifies the downward pressure on prices exercised by our shock.

Result 2: Given the realization for workers' bargaining power $\boldsymbol{\mu_t^w}$, in the liquidity trap the real wage rate is lower than it would be in the absence of the zero lower bound on the nominal interest rate.

When the central bank loses its ability to stimulate the economy in order to employ all workers, the real wage rate adjusts downwards to guarantee market clearing.

AS-AD Analysis

The model's solution can be represented in a classic AS-AD framework.

The aggregate-supply schedule is obtained by combining workers' wage-setting rule (12) with firms' price-setting rule (13).

$$AS: \quad p_t = \frac{\varphi(\gamma+\eta)-(1-\varphi)}{1-\varphi} y_t + \frac{\varphi}{1-\varphi}\mu_t^w + \frac{[\mu^f - \varphi(\gamma+\eta)a_t + ln\varphi]}{1-\varphi} \qquad (25)$$

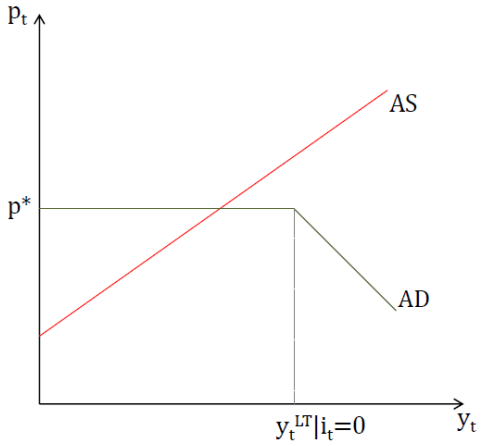
The aggregate-demand curve is a combination of the consumers' Euler equation (14) and the central bank's Taylor rule (15).

$$AD: p_t = \begin{cases} p_t^*, & if\ y_t \le y_t^{LT} \\ -\gamma y_t + r + \frac{[\gamma+\varphi\eta-(1-\varphi)](p_t^*+\pi^*)-\varphi\gamma\mu^w-\mu^f+\varphi(\gamma+\eta)(a_t+g^a)-ln\varphi}{\varphi(\gamma+\eta)-(1-\varphi)}, & otherwise \end{cases} \quad (26)$$

$$y_t^{LT} = \frac{r}{\gamma} + \frac{\gamma(1-\varphi)p_t^* + [\gamma+\varphi\eta-(1-\varphi)]\pi^* + \varphi\gamma(\gamma+\eta)(a_t+g^a) - \gamma\mu^f - \varphi\gamma\mu^w - \gamma ln\varphi}{\gamma[\varphi(\gamma+\eta)-(1-\varphi)]} \quad (27)$$

On the supply side, in equation (25), prices are increasing in output, because workers have increasing marginal disutility of work. Workers are only willing to provide additional hours at a higher wage rate. Hence, firms' marginal cost of production is increasing in output. Crucially, an increase in the degree of market power of workers, as represented by the markup μ_t^w, corresponds to an inward shift of the aggregate-supply schedule. It pushes up wages and thus makes firms charge higher prices for a given level of production.

Figure 4: The AS-AD framework.



The kink in aggregate demand, equation (26), is due to the zero lower bound on the nominal rate of interest. The central bank's objective is to keep the price level constant. If production becomes larger than threshold (27), for instance because workers' bargaining power has decreased, the central bank finds itself unable to stimulate domestic absorption enough while preserving price stability. Thus, the price level has to fall to create the negative real rate of interest that the economy needs.

A large enough deterioration of workers' bargaining power will shift out the aggregate-supply curve and push the economy onto the downward-sloping part of the aggregate-demand schedule. To the right of the kink, while the nominal rate of interest is stuck at zero, the economy experiences high employment and deflation. Notice that in this economic contingency the data would show an inverted Phillips curve, with negative correlation between GDP and inflation.

An outright inversion of the Phillips curve has not been observed in Japan's case but the empirical relation has clearly flattened since the 1990s, as reported by Muto and Shintani (2014). A flat Phillips curve in this context can be explained by a decline in workers' bargaining power taking place alongside changes in the natural real rate of interest, which in this model is assumed constant. For example, Del Negro et al. (2011) show that some financial shocks can be captured as decreases of the natural real interest rate.

V. Policy Implications

In this section, I consider the equilibrium effects of policies that change workers' bargaining power. Also, I discuss quite informally the desirability of such policies from the perspective

of a standard policymaker whose objective function is increasing in price stability and in output.

I find that, when the nominal interest rate is set against the zero lower bound, a labor-market reform that strengthens workers' bargaining power moves the price level back towards the target but reduces employment. The stronger bargaining position of workers starts wage-price dynamics that reflate the economy. In the labor market, this translates into an increase in the real wage rate, since firms are reluctant to increase prices one-to-one with wage hikes. An undesirable consequence is that in equilibrium firms hire fewer workers.

When deciding whether to increase workers' bargaining power in the liquidity trap, the relevant policy trade-off is between more inflation and more employment. Structural reforms that strengthen workers' bargaining power can reflate the economy at the cost of a reduction in employment. This is an unusual trade-off as it is the reverse of the Phillips curve, according to which more employment can be achieved at the cost of accepting higher inflation.

The Phillips curve, as it is understood for instance in Galí (2008), is a relationship that monetary policy can exploit in the short run: since there is a degree of price rigidity on the part of firms, a monetary expansion does not only lead to an increase in prices but makes some firms increase their output too. In the liquidity trap of this paper's model, I obtain the opposite relation between inflation and production, because the zero lower bound prevents monetary policy from accommodating shifts in bargaining power. As a result, shocks to market power, which shift the aggregate-supply schedule along the downward-sloping aggregate-demand schedule, have an effect both on real variables and on nominal variables.

A simultaneous reform of corporate governance, which improves the incentive alignment of managers and shareholders, makes the effect of a given labor-market reform stronger in terms of reflating the economy. Corporate governance, by giving firms an incentive to react to changing costs, acts as the transmission belt that makes the developments in the labor market spill over to the product market.

The analysis of this paper characterizes well the effects of a reduction of labor-market duality carried out by introducing a single open-ended contract (SOEC) for new hires while grandfathering incumbent permanent workers. This is for the two following reasons.

First, my analysis does not take a stand on the effects of the policy on productivity and therefore on the associated wealth effects. In general, this is a strong limitation of the model. However, in the case of reform in a dual labor market the direction of this channel is unclear. According to Aoyagi and Ganelli (2015), increasing employment protection for temporary workers would increase productivity through greater incentives for on-the-job learning and training, which runs against standard economic theory. In fact, according to standard economic theory, any additional degree of market power in the economy reduces output. This paper does not attempt to resolve this issue and thus focuses exclusively on the policy's short-run effects on aggregate supply. Noticing that wealth effects as according to Aoyagi and Ganelli (2015) would strengthen the result of this paper, I think that this restricted focus is not a problem to think qualitatively about the effects of less labor-market duality.

Second, the paper does not explicitly model labor-market duality and assumes that the relevant bargaining power lies with the non-regular workers'. This may not be true for any type of policy intervention in the labor market and for any research question nor for any country. However, since this paper is mainly interested in how workers' bargaining power affects firms' pricing decisions and hence inflation, we need to focus on the impact on firms' marginal costs. In the case of Japan, with permanent employees strongly protected from redundancy and wages strictly increasing with seniority, the costs of permanent workers can be thought of as sunk costs for firms; on the other hand, non-regular workers, who can be hired and fired with greater ease, receive wages that are indeed marginal costs for firms. In consideration of this, the relevant bargaining power for this paper's question is that of non-regular workers.

While the introduction of the SOEC for new hires would be the first-best policy intervention to reduce labor-market duality, it may be difficult politically, including because it has not been successfully implemented in any country yet. Japan's labor law already provides for a limited regular contract ("gentei seishain"). Wider use of this contract would increase employment protection for non-regular workers, decreasing the degree of duality in Japan's labor market. Making the applicable legal framework more certain would encourage wider adoption of this contractual type.

VI. Conclusion and Future Work

This paper finds that, in the liquidity trap, structural factors and reforms may play an important role in a country's ability to hit an inflation target. In particular, structural reforms that reduce labor-market duality, and thus improve the bargaining power of workers, may generate favorable wage-price dynamics that move the economy closer to hitting its target for inflation.

The paper brings evidence that workers' bargaining power in Japan has been deteriorating since the early 1990s. This, together with the country's liquidity-trap economic contingency, explains the fact that real wages have failed to keep up with productivity improvements and CPI inflation has hovered around zero over the last two and a half decades. On the one hand, Japan has been able to keep a low rate of unemployment despite the strong economic slowdown, but the unfavorable wage-price dynamics resulting from workers' declining bargaining power have made price reflation even more difficult.

The short-run effects of structural reforms, especially when an economy is trapped at the zero lower bound, is a highly relevant topic for current economic challenges and the literature is not yet as vast as on other important subjects. As such, I think that this subject may offer many fruitful avenues for future research.

For a start, the highly stylized theoretical framework used in this paper can be made more realistic in many ways. I list three extensions below that could help us gain more insight in the topic.

First, a future paper could model more explicitly the sources of workers' bargaining power and perhaps include duality between labor contractual types as in Pissarides (2009). It could also

delve deeper into the Japan-specific institutional environment to see how best wage bargaining power could be recovered, including through adjustments to training, contract regulation, and switching and searching costs.

Second, the economy could be opened to study the effects of an increase in workers' bargaining power on the exchange rate and, for instance, on firms' decisions to relocate abroad. A large deterioration in Japan's terms of trade from the end of 1991 to the end of 2007 suggests that the country's external position played an important role in generating the persistent difference between real wage growth and real labor productivity growth. Terms-of-trade deterioration implies that the GDP deflator increased at a slower rate than the consumer price index, contributing to making real wages grow at a slower rate than real labor productivity.

Third, future research should look at the productivity channel. The direction and magnitude of the effect of the proposed policy intervention on productivity matter to pin down its overall effect on prices and output. However, in this paper I abstract from this and focus on the short-run direct effects of changes in workers' bargaining power on prices and output. I do so because Aoyagi and Ganelli (2015) provide evidence that a reduction in labor market duality, corresponding to an increase in workers' bargaining power in the model, would lead to an increase in workers' productivity, and this runs counter to standard economic theory. A model where workers make investments in firm-specific human capital and where the incentive to invest in such capital depends on the job's expected duration may be the right environment for this analysis.

Furthermore, a formal empirical study could be carried out on Japan's wage-price dynamics. The fact that different sectors of the economy have been affected by labor-market duality with different intensity may give the necessary variation.

Finally, increases in the degree of labor-market duality and flattening Phillips curves have been a global phenomenon. As most of the advanced world has been stuck in the liquidity trap since 2009, it would be interesting to take a wider perspective and study if other advanced economies display patterns that confirm this paper's theory. Moreover, some countries, in particular Spain and Italy, have recently passed legislation aimed at reducing the high degree of duality in their labor market. This offers an opportunity to confirm the theory and policy implications of this paper.

APPENDIX 1

The labor demand schedule is the result of firms' optimal hiring decisions across labor types, given a level of production.

In each period a representative firm chooses $\{N_j\}_{j\in[0,1]}$ to minimize its wage bill

$$\int_0^1 W_j N_j \, dj \tag{16}$$

subject to the production function

$$Y = A\left(\int_0^1 N_j^{\frac{\sigma-1}{\sigma}} dj\right)^{\frac{\sigma}{\sigma-1}} \tag{17}$$

Solving the minimization problem we obtain the firm's demand for each labor type:

$$N_j = \left(\frac{W_j}{W}\right)^{-\sigma} \frac{Y}{A} \tag{18}$$

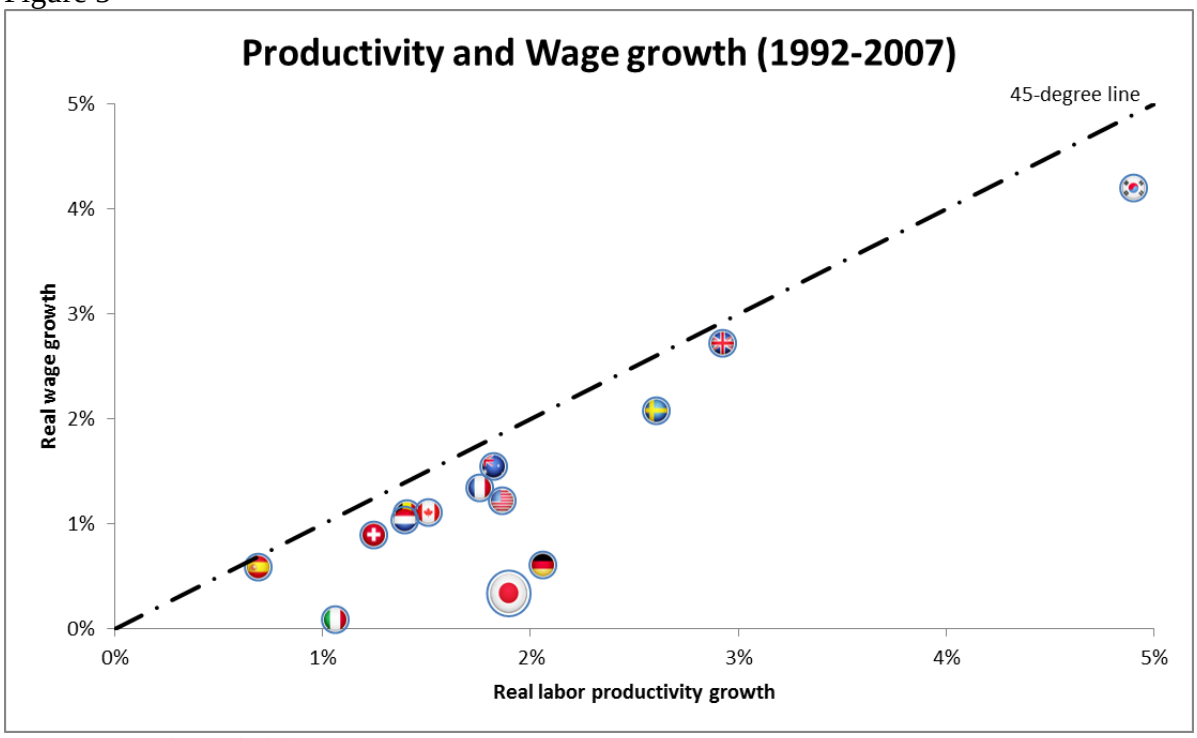
The appropriate Dixit-Stiglitz wage aggregator is:

$$W \equiv \left(\int_0^1 W_j^{1-\sigma} dj\right)^{\frac{1}{1-\sigma}} \tag{19}$$

Refer to Blanchard and Kiyotaki (1985) for detailed derivation.

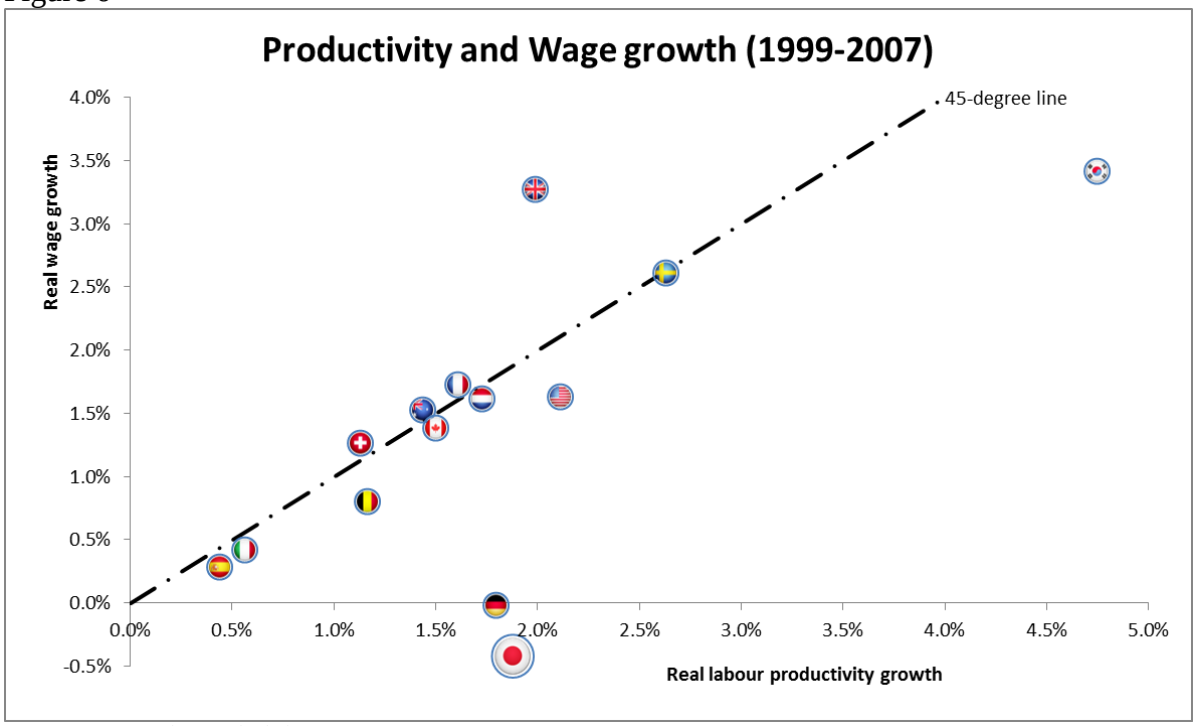
APPENDIX 2

Figure 5



Source: OECD, author's calculations.
Note: Real wages are total labor costs per hour worked deflated with the CPI. Real labor productivity is real GDP per hour worked deflated with the GDP deflator.

Figure 6



Source: OECD, author's calculations.
Note: Real wages are total labor costs per hour worked deflated with the CPI. Real labor productivity is real GDP per hour worked deflated with the GDP deflator.

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