The fading 1990s in Japan: Driving forces behind the unemployment upsurge

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19 March 2008

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19 March 2008

Abstract

This paper sheds new light on the causes of the unemployment upsurge in Japan during the "fading 1990s", an unprecedented period of structural crisis. We estimate a labor market model and identify the main macroeconomic determinants of labor demand and labor supply decisions in last decades. We then conduct dynamic simulations and assess the relative contribution of these determinants to the evolution of unemployment from 1990 to 2002. Beyond the leading role exerted by the decline in productivity growth, we find the active and expansionary measures undertaken by the government had an overall negative effect on the labor market.

Keywords: Japan, unemployment, productivity, macroeconomic policies, chain reaction theory.

JEL Classification: E24, E60, J01.

*__Acknowledgments:__ Pablo Agnese is thankful to the Center for Globalization and Strategy at IESE Business School for financial support. Hector Sala is grateful to the Spanish Ministry of Education and Science for financial support through grant SEJ2006-14849/ECON.

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1 Introduction

What are the forces behind the sudden and prominent unemployment rise in Japan during the 1990s? Are there some distinguishing features, inherent to the Japanese labor market, which might account for its odd dynamics? Is the Japanese experience helpful to prevent a recession of this sort in other East Asian economies? These are important questions that need to be answered, and this paper intends to be a step in that direction.

The "lost decade" merited a revival in the international interest for Japan. Its labor market, though, seems to have been left as a too particular case and has received less attention from mainstream studies. Our analysis tries to fulfill this void and shed new light on the driving forces of the unemployment upsurge during the fading 1990s.

To study the Japanese labor market we take the viewpoint of the Chain Reaction theory (CRT) of unemployment, which is an alternative to the Structuralist and Institutionalist approaches[1] and, as explained in Section 2, provides a wider analytical perspective of the labor market. For example, beyond shocks and institutions as main causes of unemployment, it also considers the role of *growth drivers* (variables such as capital accumulation, productivity, or working-age population) in determining the labor market performance. Moreover, it does not rely on the existence of a natural (or non-accelerating inflation) rate of unemployment as the key analytical variable, which has already been found scarcely relevant in Japan and kept apart from the policy debate (see Nishizaki, 1997, and Hirose and Kamada, 2002).

We believe the specificities of the Japanese labor market require such a wider perspective as well as the inclusion of macroeconomic variables the existing literature has already found relevant. For example, the decline in productivity (Hayashi and Prescott, 2002, and Fukao, 2006), the explosion in the government debt (Barseghyan, 2006a), the rising long-term debt of firms in terms of their assets (Ogawa, 2003), or the demographic behavior and the aging population problem (Koga, 2006). These and other more specific labor market variables are considered in the estimation of a three-equation dynamic system comprising employment, labor supply, and the rate of unemployment as endogenous variables.

Our analysis leaves aside potential monetary causes of unemployment which have been substantiated in several studies to explain the Japanese slump.[2] The shared idea is that Japan has since long fallen into a liquidity trap from which the only way out seems to be an unorthodox monetary policy targeting high levels of inflation. In contrast to these studies, our analysis is based on a real labor market model where nominal variables play no role.

The contribution of the paper is thus twofold. First, the estimation of a time-series multi-equation model covering the last decades, with which we conduct a comprehensive

[1] See Karanassou *et al.* (2006 and 2007) for contributions on the CRT; Phelps (1994) and Phelps and Zoega (2001) on the Structuralist theory; and Nickell *et al.* (2005) on the Institutionalist approach.

[2] Krugman (1998), Svensson (2001), Hamada (2004), and Braun and Waki (2006).

macroeconomic analysis of the Japanese labor market from 1990 to 2002. In these years unemployment rose from 2.1% to a historical maximum of 5.5%. Second, the consideration of labor market variables, together with other macroeconomic variables examined in the literature, to assess their relative contributions in explaining the evolution of unemployment in those years. Some of these variables noticeably shifted from their previous paths and produced a new outcome on employment performance that, so far, has not been put to test.

The main result of the paper is the extremely influential role played by the decline in the growth rate of productivity and the overwhelming increase in government debt. These two, but specially the first one, appear as the driving forces of the rise in unemployment in Japan during the 1990s. On productivity growth it is still dubious what mechanisms made it perform so poorly in comparison to previous experience. Nevertheless, various hypotheses are discussed. On the other hand, the government debt owes its unrelenting pace to the unholy alliance between government, banks, and firms in the private sector that has characterized the economy since the postwar.

The rest of the paper is structured as follows. Section 2 presents a stylized labor market model to characterize our analytical approach. Section 3 deals with the estimation of an augmented version of this model for the Japanese economy. Section 4 evaluates how the labor demand and labor supply determinants have contributed to shape the unemployment rate trajectory in the fading 1990s. Section 5 concludes.

2 Theoretical underpinnings

The benchmark for our analysis is the Chain Reaction theory of unemployment: an interactive dynamics approach that relies on dynamic multi-equations models to study the labor market. A stylized model representative of this approach would be:

$$n_t = \alpha_1 n_{t-1} + \beta_1 pr_t - \gamma_1 w_t, \tag{1}$$

$$l_t = \alpha_2 l_{t-1} + \beta_2 z_t + \gamma_2 w_t, \tag{2}$$

where n denotes employment, l the labor force, pr labor productivity, w real wages, and z is working-age population. The autoregressive parameters are $0 < \alpha_1, \alpha_2 < 1$, while the β's and the γ's are positive constants. All variables are in logs; constant and error terms are ignored for ease of exposition; and real wages, productivity, and working-age population are assumed to be growing variables with growth rates that stabilize in the long-run. Because l and n are defined in logs, the unemployment rate, u, is approximated by

$$u_t \simeq l_t - n_t. \tag{3}$$

Microfoundations for this sort of model are provided in Karanassou *et al.* (2007). Most

important for our analysis is that this simple model allows a clear distinction with competing views of the labor market that, like the Structuralist and Institutionalist theories, rely on reduced-form unemployment models (see Blanchard and Wolfers, 2000; Phelps and Zoega, 2001; or Nickell *et al.*, 2005). In particular, because all variables in the labor demand and labor force equations (1)-(2) are $I(1)$, they need to cointegrate to match the unemployment rate stationary behavior. The cointegrating vectors implied by equations (1)-(2) are $\begin{pmatrix} 1 & \frac{-\beta_1}{1-\alpha_1} & \frac{\gamma_1}{1-\alpha_1} \end{pmatrix}$ and $\begin{pmatrix} 1 & \frac{-\beta_2}{1-\alpha_2} & \frac{-\gamma_2}{1-\alpha_2} \end{pmatrix}$. Of course, when we turn to the estimation of such equations the econometric methodology is chosen according to this characterization of the labor market.

2.1 The reduced-form unemployment rate equation

Let us rewrite equations (1)-(2) as

$$(1-\alpha_1 B)\, n_t = +\beta_1 pr_t - \gamma_1 w_t, \tag{4}$$

$$(1-\alpha_2 B)\, l_t = \beta_2 z_t + \gamma_2 w_t, \tag{5}$$

where B is the backshift operator. Multiplying both sides of equations (1) and (2) by, respectively, $(1-\alpha_2 B)$ and $(1-\alpha_1 B)$, and using definition (3), we obtain the reduced-form unemployment rate equation:[3]

$$\begin{aligned} u_t = {} & (\alpha_1+\alpha_2)\, u_{t-1} - \alpha_1\alpha_2 u_{t-2} + \beta_2 z_t - \alpha_1\beta_2 z_{t-1} - \beta_1 pr_t + \beta_1\alpha_2 pr_{t-1} \\ & + (\gamma_1+\gamma_2)\, w_t - (\alpha_1\gamma_2+\alpha_2\gamma_1)\, w_{t-1} \end{aligned} \tag{6}$$

Observe that growing variables enter the reduced-form equation regardless of their non-stationarity. While the unemployment rate is usually $I(0)$, explanatory variables can be either $I(0)$ or $I(1)$. This is in contrast to the Structuralist and Institutionalist theories, and their focus on non-growing variables such as institutions. Institutional variables play a role in the CRT framework, though it turns out smaller than in mainstream theories. Previous studies from the CRT, instead, highlight the relative importance of growth drivers. Particularly, capital accumulation, productivity, and demographics can add to an improved explanation of the unemployment rate and its dynamics through time (see Karanassou, Sala and Salvador, 2007, and the references therein provided).[4]

[3] This results from

$$(1-\alpha_1 B)(1-\alpha_2 B)\, u_t = \beta_2 (1-\alpha_1 B)\, z_t - \beta_1 (1-\alpha_2 B)\, pr_t + [\gamma_2 (1-\alpha_1 B) + \gamma_1 (1-\alpha_2 B)]\, w_t.$$

[4] Furthermore, it is important to note that the CRT provides precise tools for the evaluation of the shocks and their impact. And not only of temporary shocks, as it is commonly done, but also of persistent and permanent shocks. See Karanassou *et al.* (2006).

2.2 The long-run unemployment rate

Let us now rewrite equations (1)-(2) in their long-run solution forms:[5]

$$n_t^{LR} = \frac{\beta_1}{1-\alpha_1} pr_t^{LR} - \frac{\gamma_1}{1-\alpha_1} w_t^{LR} - \frac{\alpha_1}{(1-\alpha_1)} \Delta n^{LR}, \tag{7}$$

$$l_t^{LR} = \frac{\beta_2}{1-\alpha_2} z_t^{LR} + \frac{\gamma_2}{1-\alpha_2} w_t^{LR} - \frac{\alpha_2}{(1-\alpha_2)} \Delta l^{LR}. \tag{8}$$

Note that the variables maintain the subscript t, despite being a long-run solution (indicated by the superscript LR). The reason is the non-zero long-run growth rates of the exogenous variables, which we have plausibly assumed to be growing variables. In other words, both the labor demand and the labor force grow at a constant rate in the long-run.

In the long-run, the unemployment rate definition (3) becomes $u_t^{LR} = l_t^{LR} - n_t^{LR}$ and yields:

$$\begin{aligned} u_t^{LR} = & \left[\frac{\beta_2}{1-\alpha_2} z_t^{LR} - \frac{\beta_1}{1-\alpha_1} pr_t^{LR} + \frac{(1-\alpha_1)\gamma_2 + (1-\alpha_2)\gamma_1}{(1-\alpha_1)(1-\alpha_2)} w_t^{LR} \right] \\ & + \left[\frac{\alpha_1}{(1-\alpha_1)} \Delta n^{LR} - \frac{\alpha_2}{(1-\alpha_2)} \Delta l^{LR} \right] \end{aligned} \tag{9}$$

It follows that the stability of the unemployment rate in the long-run, $\Delta u^{LR} = 0$, is achieved only when the labor demand and the labor force grow at the same rate, which we call g. Using again equations (7)-(8), the condition that $\Delta l^{LR} = \Delta n^{LR} = g$ can be expressed as

$$\frac{\beta_1}{1-\alpha_1} \Delta pr^{LR} = \frac{\beta_2}{1-\alpha_2} \Delta z^{LR} + \frac{(1-\alpha_1)\gamma_2 - (1-\alpha_2)\gamma_1}{(1-\alpha_1)(1-\alpha_2)} \Delta w_t^{LR} = g.$$

Further, under this condition equation (9) becomes:

$$u_t^{LR} = \left[\frac{\beta_2}{1-\alpha_2} z_t^{LR} + \frac{(1-\alpha_1)\gamma_2 + (1-\alpha_2)\gamma_1}{(1-\alpha_1)(1-\alpha_2)} w_t^{LR} - \frac{\beta_1}{1-\alpha_1} pr_t^{LR} \right] + \left[\frac{\alpha_1 - \alpha_2}{(1-\alpha_1)(1-\alpha_2)} g \right]. \tag{10}$$

The first term in brackets is the natural rate of unemployment (NRU); that is, the equilibrium unemployment rate that would be achieved in the absence of growth ($g = 0$). A strong implication drawn from the mainstream labor market theories is that in the long-run the unemployment rate equals the NRU. This is the main outcome of the standard analysis conducted via single-equation reduced-form unemployment models, where only stationary variables are considered. The NRU is thus an attractor or, in other words, the rate to which

[5] To see it more clearly, depart for the simplest dynamic equation $y_t = \alpha y_{t-1} + \gamma x_t + \varepsilon_t$. To derive the long-run solution it is convenient to rewrite it as $y_t = \frac{\gamma}{1-\alpha} x_t - \frac{\alpha}{1-\alpha} \Delta y_t + \frac{1}{1-\alpha} \varepsilon_t$. The long-run equilibrium is generally obtained by the unconditional expectation of the dynamic equation $E(y_t) = \frac{\gamma}{1-\alpha} E(x_t) - \frac{\alpha}{1-\alpha} E(\Delta y_t)$ or, equivalently, $y_t^{LR} = \frac{\gamma}{1-\alpha} x_t^{LR} - \frac{\alpha}{1-\alpha} \Delta y^{LR}$. See Karanassou *et al.* (2006), Section 2, for a full analysis on this issue.

the actual rate of unemployment converges in the long-run.

On the contrary, when growing variables are allowed to play a role in the labor market (capital accumulation, productivity, or working-age population, for example), the phenomenon of *frictional growth* emerges. This is captured by the second term in brackets, which shows that frictional growth arises from the interaction between the lagged adjustment processes in labor demand and labor supply decisions (captured by α_1 and α_2) and growth (g). Therefore, frictional growth requires two realistic conditions: the presence of adjustment costs in firms and households' activities, and economic growth.[6]

Frictional growth is thus a crucial concept because it diminishes the role of the NRU granted by mainstream theories. The more sluggish is the labor market (i.e., the more costly the adjustments are) and the faster economic growth, the further the NRU lags behind the long-run unemployment rate. This is the reason why the NRU cannot be seen any more as an attractor of actual unemployment, and thus ceases to be of paramount importance. It is in this context that the CRT approach advocates the estimation of the *dynamic contributions* of the exogenous variables to the evolution of unemployment. This is the task we undertake below, after the presentation of the estimated Japanese labor market model.

3 Empirical analysis

3.1 Data and econometric methodology

Our database contains data from various sources such as the OECD Economic Outlook, the IMF International Financial Statistics, and the Ministry of Finance of Japan. In table 1 we define the variables entering the chosen specification of the equations.[7]

With respect to the econometric strategy, the need to deal with $I(0)$ and $I(1)$ variables leads us to follow the Autoregressive Distributed Lagged (ARDL) or Bounds testing approach, developed in Pesaran and Shin (1999) and Pesaran *et. al.* (2001). Two are the main features of this approach. First, it yields consistent estimates both in the short- and long-run and constitutes an alternative procedure to the standard cointegration techniques. Second, as shown in Pesaran and Shin (1999), the ARDL can be reliably used in small samples to estimate and test hypotheses on the long-run coefficients in both cases where

[6] Frictional growth has other important implications. For example, the very common compartmentalization between labor economics (with no growing variables considered) and economic growth (with no role for the labor market) no longer holds. Moreover, the compartmentalization within labor economics in terms of the structural and the business cycle components of unemployment (the NRU being the structural component) is also ruled out. These and other features of the CRT approach are explained in depth in Karanassou *et al.* (2006 and 2007) and in some related references provided therein.

[7] We have worked with some other variables such as prices, capital stock, financial wealth, oil prices, real balances, other demand-side variables (such as private consumption or foreign demand), and other variables related to the tax system (such as social security contributions, direct taxes on households, indirect taxes, a measure of fiscal pressure, and the fiscal wedge).

the underlying regressors are $I(1)$ or $I(0)$. This is important because the ARDL approach avoids the pretesting problem implicitly involved in the cointegration analysis of long-run relationships. The standard cointegration techniques are Johansen's maximum likelihood method and the Phillips-Hansen's procedure. Pesaran and Shin (1999) show that the ARDL is "directly comparable to the semi-parametric, fully-modified OLS approach of Phillips and Hansen (1990) to estimation of cointegrating relations". When they undertake this comparison they find that the Phillips and Hansen's estimator is outperformed by the ARDL-based estimator, specially when having a relatively small sample period of analysis as ours. In particular, Pesaran and Shin show that, using the delta method or the Bewley's approach, valid standard errors can be computed for the estimated long-run coefficients. It is also important to note that the estimated ARDL equations can be reparameterized and expressed in terms of an error correction term (ECM) which, on its own, indicates cointegration of the variables in case of being negatively signed and significant.[8]

Table 1: Definitions of variables

			Source:
n	:	total employment (log)	(1)
l	:	total labor force (log)	(1)
u	:	unemployment rate $(= l - n)$	(1)
w	:	total real compensation per employee (log)	(1)
pr	:	real labor productivity $\left(= \frac{\text{GDP}}{\text{total employment}}\right)$	(1)
τ^f	:	direct taxes on business (% of GDP)	(1)
g	:	government expenditures (% of GDP)	(1)
gd	:	government debt (% of GDP)	(1)
r	:	real long-term interest rate	(1)
fi	:	firms' long-term indebtedness $\left(= \frac{\text{long-term borrowings and bonds}}{\text{assets}}\right)$	(2)
d^{97}	:	dummy (value 0 up to 1997, 1 afterwards)	(1)
u_t^d	:	$u_t * d^{97}$	
z	:	working-age population	(1)
Δ	=	Difference operator	

Sources: (1): OECD, Economic Outlook; (2) Ministry of Finance of Japan.

We thus follow the ARDL approach to determine the concrete specifications of the labor demand and supply equations, and ensure that they pass the standard battery of misspecification and structural stability tests.[9] The best specifications are selected on the basis of the standard selection criteria (Akaike and Schwarz Bayesian) and re-estimated as a system by 3SLS, so the estimates are safe from endogeneity and cross-equation correlation

[8] More details on the empirical application of this econometric methodology can be found in Karanassou, Sala and Salvador (2007) and Bahmani-Oskooee *et al.* (2008).

[9] These are: A Lagrange multiplier test for serial correlation (SC), Ramsey's linearity test (LIN), plus heteroskedasticity (HET) and conditional heteroskedasticity ($ARCH$) tests, all distributed as $\chi^2(1)$. We also check if the residuals are normally distributed, in this case as $\chi^2(2)$, and ensure, by means of the Cusum and Cusum^2 tests, that the estimated equations are structurally stable.

problems. These are the estimates presented in table 2. Table 3 displays information on the implied ECM term and the corresponding cointegrating vectors (CVs). These are compared with the CVs that would be obtained using the Johansen framework to show that the long-run relationships between growing variables we estimate are not spurious.

3.2 Estimated equations

The labor demand equation is characterized by a large persistence coefficient (0.89), indicating strong inertia in firms' aggregate level of employment. Wages exert the expected negative influence with a short-run elasticity of -0.04 and a long-run one of -0.37 $\left(= \frac{-0.04}{1-0.89}\right)$. This implies that a 1% rise in this variable would reduce labor demand by 0.37%. The positive influence of labor productivity, outlined as a crucial variable in Hayashi and Prescott (2002), is also consistent with the theory, with short and long-run coefficients, respectively, of 0.10 and 0.91. Also as expected, direct taxation on firms' benefits exerts a negative influence on employment. Given the definition of this variable, the estimated coefficient needs to be interpreted as a semielasticity indicating that a 1 percentage point (p.p.) rise in this variable would decrease employment by 0.1 p.p. in the short-run and 0.8 p.p. in the long-run.

Table 2: Labor demand and labor supply. Japan, 1972-2006
Estimation method: 3SLS

Dependent variable: n_t		Dependent variable: l_t				
	coef. [probs.]		coef. [probs.]			
c	2.26 [0.000]	c	-0.59 [0.000]			
n_{t-1}	0.89 [0.000]	l_{t-1}	0.86 [0.000]	**Misspecification tests**		
w_t	-0.04 [0.000]	Δl_{t-1}	-0.27 [0.038]	SC[$\chi^2(1)$]	0.08 [0.775]	1.00 [0.316]
pr_t	0.10 [0.067]	w_t	0.05 [0.012]	LIN[$\chi^2(1)$]	1.16 [0.281]	0.07 [0.786]
τ^f_{t-1}	-0.09 [0.099]	r_{t-1}	0.10 [0.000]	NOR[$\chi^2(2)$]	0.83 [0.661]	5.04 [0.080]
g_{t-1}	0.06 [0.095]	u_t	-1.20 [0.000]	HET[$\chi^2(1)$]	2.03 [0.154]	1.75 [0.186]
gd_t	-0.01 [0.000]	u_t^{d97}	0.35 [0.001]	ARCH[$\chi^2(1)$]	2.49 [0.114]	0.00 [0.949]
fi_{t-1}	-0.07 [0.000]	Z_t	0.14 [*]			
Δl_t	0.98 [0.000]			**Stability tests (5% signif.)**		
				Cusum	✓	✓
$s.e.$	0.001	$s.e.$	0.004	Cusum^2	✓	✓

s.e.: standard error of regression; 5% critical values: $\chi^2(1) = 3.84$; $\chi^2(2) = 5.99$.
(*) restricted coefficient so that the long-run elasticity of l with respect to z is unity.

Beyond the standard Keynesian framework of analysis, one of Phelps' (1994) contributions was the consideration of government expenditures and public debt as relevant determinants of the labor market performance. We include these two variables on account of the close connection of the public sector in Japan with firms and financial institutions. While government expenditures (g) display a positive coefficient (0.06 in the short-run and 0.54

in the long-run), it is important to note the negative incidence of government debt (gd) on employment (-0.01 and -0.09, respectively). None of these signs come as surprising. The first one captures the direct impact of a Keynesian expansion via public consumption and public investment,[10] while the second one controls for the Japanese "burden of the debt" and the implied opportunity cost for the private sector.

More precisely, the sign of the coefficient of government debt accounts for the implied layoffs that more inefficient and "subsidized" firms have to incur to keep working. At the same time, new and productive firms are prevented to gain market share (or even enter the market) due to the supportive actions endorsed by the government towards banks which, in turn, preserve inefficient firms through bad loan practices. In short, this coefficient captures both job destruction and new job opportunities that fail to open due to inefficiencies that arise from a noncompetitive outcome. A traceable link that goes from government to banks in the form of large bailouts, and from banks to troubled companies through bad loans, has been at the center stage of Japanese postwar development. In recent times the impact of the debt on the economy has aroused interest (see Barseghyan, 2006a and 2006b, for instance), as also has the effect of inefficient firms on employment (Ahearne and Shinada, 2005, Caballero *et al.*, 2006). The existence of such firms, it is argued, prevents the competitive outcome from becoming a realizable fact.

Along with the government debt, firms' indebtedness (fi) is yet another variable relevant to firms' labor demand decisions in Japan. Massive debt outstanding in the corporate sector and bad loans in the banking sector are two sides of the same coin. The incidence of fi in the labor market has been studied in Ogawa (2003) to evaluate the consequences of *financial distress* on employment. In our macro model this variable is also significant with a short-run semielasticity of -0.07 (-0.64 in the long-run). Ogawa (2003) explains up to four channels whereby this variable should affect negatively the labor demand and provides evidence for a sample of Japanese firms in the 1990s. First, the higher cost of external finance to over-burdened debtors. Second, the differing interests between managers and shareholders when faced with bankruptcy, that make the former to cut back on labor and investment in order to raise efficiency (a disciplinary role of the debt). Third, the decrease in investment that might occur with debt overhang (this often happens when, having borrowed in foreign currency, the country is faced with a depreciation). And fourth, the effects of bad loans for banks, which can raise the cost of external finance (for banks) and thus restrain their lending capacity.

Finally, the change in the available labor supply for firms (Δl) provides a source of interactions between the two estimated equations (the presence of the unemployment rate

[10] Of course, government expenditures and direct taxes on firms are related to the government debt. Nevertheless, the explosion in the latter and its magnitude during a substantial part of the sample period, have little to do with the evolution of the first two variables. As will become clear subsequently, these variables capture very different phenomena.

in the labor force equation is the other source). In Karanassou *et al.* (2008), the role of Δl in the labor demand equation is rationalized as a matching effect. As Coles and Smith (1996) show, firms search primarily for new job applicants so that job matches depend more on new entrants to the labor force than on the level of the labor force. Thus the greater the number of new applicants, the greater the consequent number of matches. The coefficient of 0.98 implies that a 1% rise in Δl is almost fully translated into employment gains. Nevertheless, because it is a difference this variable does not entail a long-run elasticity of employment with respect to the labor force.

The labor force equation is standard. As in the labor demand equation, the adjustment coefficient is large (0.86) and indicates strong persistence in aggregate household's labor supply decisions. Real wages and real interest rates exert the expected positive influence with long-run coefficients, respectively, of 0.36 and 0.71. The higher the wage, the more the incentives to participate in the labor market due to the relative prices of leisure and work. In turn, higher interest rates force the households to supply a larger amount of labor because of increasing credit constraints. Note that in both cases the indirect effect on unemployment is the expected positive one.

Unemployment discourages the labor force, but less so after 1997 as indicated by u^{d97}, which is included to solve the structural stability problems of the estimated coefficients (note that from 1997 the coefficient of u is -0.85=-1.20+0.35). The higher the unemployment rate, the less people searching actively for a job and the lower the sensitiveness of the labor force to the growing unemployment problem. This change in 1997 reflects the sudden stabilization in the participation rate, indicative of the growing amount of discouraged workers. Finally, working-age population is the labor supply driving-force. It captures the important demographic influences on the labor market with a unit long-run elasticity not rejected by the data.

3.3 Model diagnosis

To further check the validity of the estimated model we use the Johansen procedure to confirm that our long-run relationships comprise indeed cointegrating vectors (see Table 3). First, the maximal eigenvalue and trace statistics indicate that the variables involved in the equations are cointegrated. Second, we estimate a VAR featuring the main characteristics of the estimated equations (same order, same sample period and variables, and inclusion of unrestricted intercepts and no trends) and obtain the cointegrating vectors (CVs). Third, we test whether the long-run relationships implied by our model conform with the ones obtained using Johansen's method. It is a likelihood ratio (LR) test, distributed as a $\chi^2(.)$, that restricts Johansen's CVs to take the corresponding ARDL values.[11] These restrictions

[11] The $I(1)$ variables in the model are n, w, pr and z. Therefore, we test two restrictions in each equation (note that this test is conducted on the unrestricted estimate of the labor supply equation). For the sake of

are not rejected at conventional critical values, a result that adds to the negative and significant sign of the ECM term in both equations.

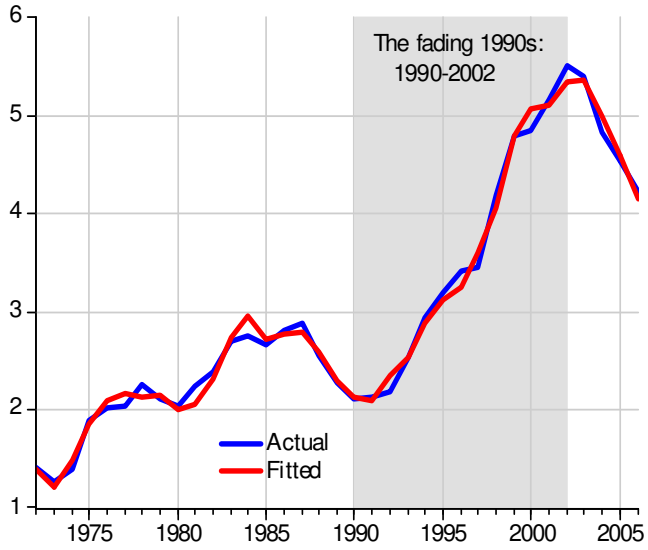
Table 3: Validity of the long-run relationships

	ARDL		Johansen		LR test
	ecm_{t-1}		CV		
$[E1]$		$\begin{pmatrix} n & w & pr \end{pmatrix}$		$\begin{pmatrix} n & w & pr \end{pmatrix}$	
	-0.11[0.000]	$\begin{pmatrix} 1.0 & 0.37 & -91 \end{pmatrix}$	1	$\begin{pmatrix} 1.0 & 0.42 & -0.90 \end{pmatrix}$	3.74 [0.154]
$[E2]$		$\begin{pmatrix} l & w & z \end{pmatrix}$		$\begin{pmatrix} l & w & z \end{pmatrix}$	
	-0.15[0.004]	$\begin{pmatrix} 1 & -0.28 & -1.18 \end{pmatrix}$	1	$\begin{pmatrix} 1 & -0.05 & -1.35 \end{pmatrix}$	4.09 [0.130]

CV = number of cointegrated vectors; 5% critical values for the LM test: $\chi^2(2) = 5.99$.

Finally, as shown in figure 1, it is important to note that our model tracks closely the actual evolution of unemployment, despite being computed from a multi-equation model with various sources of interactions across equations and not directly estimated. This figure is also interesting because it depicts the magnitude of the unemployment problem that came with the fading 1990s. Our next objective is to use this model to shed some light on the causes that made the unemployment path unusually higher in those years.

Figure 1. Actual and fitted values



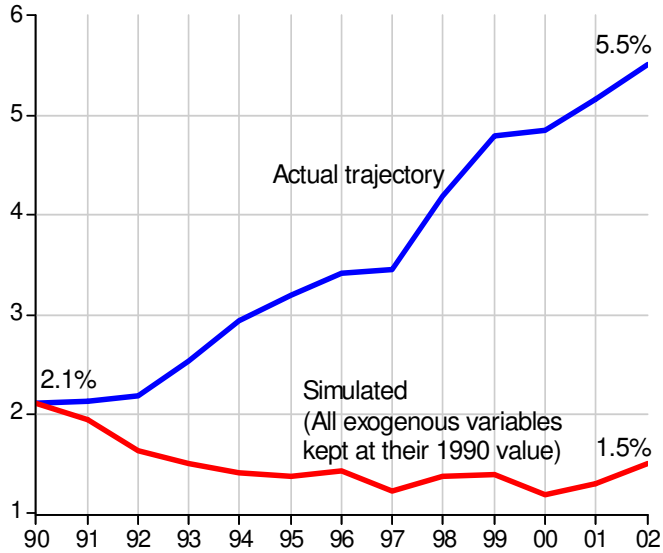
brevity we just present the final results of this exercise. Underlying this table there is sizable information, which is available upon request. In particular, that of the unit root tests and the whole cointegration analysis using Johansen's method.

4 Dynamic contributions: The 1990s at a glance

To what extent this trajectory would have changed had a particular variable followed a different path? We conduct dynamic simulations that aim at disentangling the relative contribution of the model's explanatory variables to this rising path. For example, if direct taxes on firms had stayed at its 1990 value, 5.6% of GDP, instead of falling to 2.9% in 2002, it is interesting to ask how the rate of unemployment would have evolved. This is a simple, transparent, and informative way to analyze the driving forces behind the upward trajectory of Japanese unemployment in those years. By no means, however, this should be taken as an assessment of what would have actually happened had this or that variable behaved differently than it actually did (in which case we would run afoul of the Lucas Critique).

The actual and simulated evolution of each exogenous variable, and the corresponding actual and simulated evolution of the unemployment rate, are plotted in the Appendix (figures A1 and A2, respectively). The information contained in these figures is summarized in table 4. Figure 2 presents the evolution of unemployment when all explanatory variables are simultaneously fixed at their 1990 values. Observe that in such scenario unemployment would have declined slightly to 1.5% in 2002, a value representative of the period before the oil price shocks. Instead, it reached an historical maximum of 5.5%.

Figure 2. Unemployment effects of the exogenous variables



According to our simulations the rise in unemployment was not a 'labor market problem'. Mainstream accounts of the labor market performance emphasize the role of wage-push factors, in particular of labor market institutions, that generate real wage rigidities and hamper

adjustments in the demand and supply of labor. In Japan, on the contrary, the decreasing growth rate of real wages was the most important offsetting force (by 1.6 percentage points) of the unusual unemployment rise in the 1990s. Reasonably, this coincided with a strong and continuous decline in the rate of organization of labor unions and the noticeable reduction in the workweek length (average hours worked per week). According to the 2006 Basic Survey on Labour Unions provided by the Ministry of Health, Labour and Welfare, the organization rate of unions came down from 25% in 1990 to 20% in 2002. The labor market is notably heading towards a strong deunionization in recent times. On the other hand, the new workweek length set by the revision of the Labor Standards Law in 1988 brought the amount of hours down from 44 to 40 during the period 1988-1993. More, average annual hours worked dropped from 2000 to 1800 for the period 1990-2002 (OECD, 2007).

The major cause behind the sudden increase in unemployment was the sharp decline in productivity growth, which considered alone accounts for a 5 percentage points rise in the unemployment rate. In the absence of such a decline, unemployment would have remained at levels below 1% during most of the 1990s. Hence, our model allows us to rationalize the steep rise in unemployment during the "lost decade" mainly as productivity-led.

This result is in accordance with several recent studies relying in productivity slowdown as the major cause for the recent stagnation in Japan. Hayashi and Prescott (2002), for example, believe the 1990s can be explained as a low productivity growth problem alone. Since the financial system did not break down, they argue a neoclassical growth model might well account for the Japanese lost decade of growth. Fukao and Kwon (2006), in turn, stress the lack of ability for the private sector to reallocate resources from less efficient to more efficient firms. This "low metabolism", they argue, seems to be an important cause for the productivity slowdown in the lost decade. Finally, Miyagawa *et al.* (2006), in studying the pro-cyclicality of measured productivity, conclude that policies to revive the Japanese economy should focus on promoting productivity growth.

There are different hypotheses that explain the sharp decline of productivity growth in Japan. First, the end of Japan's catching up process has led capital accumulation, labor reallocation, and investment in human capital to cease being the prime sources of growth (see Kim and Lau, 1994 and 1996). This has allowed productivity to become the real growth driver until recent times, when Japan arguably reached a first-class membership in the industrialized world. The problem with this argument is that a decade of slump almost surely cannot be explained by growth theory alone. Japan has not only stopped catching up, but has also lost considerable ground relative to industrial leaders. Further, growth theory restraints itself from explaining frictions in financial intermediation, something we try to grasp with the inclusion of firms' indebtedness in the labor demand equation. Second, the overinvestment process that took place in the 1980s due to overrated asset and land prices could have translated into a productivity slowdown after the bubble burst on the last day

of 1989. Third, the crowding out of capital exerted by persistent increases in government debt has brought down the rate of return on capital, leading to a decline in investment and productivity growth rates (Barseghyan, 2006a). Finally, the "zombie firms" hypothesis has been laid out to help understand the relation between Japanese banks and their borrowers. It suggests that inefficient insolvent borrowers (the "zombies") have benefited from poor banking practices and, therefore, have prevented more productive companies from gaining market share. This, consequently, has shut down an important source of productivity gains for the economy (Ahearne and Shinada, 2005), since the competitive outcome where "zombies" lay off workers and lose market share is frustrated (Caballero *et al.*, 2006; and Kobayashi, 2007).

Table 4: Variable changes and unemployment effects[12]

	u	Δw	Δpr	τ^f	g	gd	fd	r	Δz
Actual values:									
1990	2.1	2.2	3.1	5.6	20.5	68.6	24.1	4.6	0.5
2002*	5.5	0.4	1.0	2.9	24.0	153.6	25.9	2.8	0.0
Difference**	3.4	-1.8	-2.1	-2.7	3.5	85.0	1.8	-1.8	-0.5
Contributions to unemployment (percentage points):									
Δu	-	-1.6	5.1	-0.4	-0.4	2.6	0.0	-0.2	-0.5
Magnitude of complementarities/substitutabilities (percentage points):									
Total contributions (sum of individual contributions)								4.6	
Joint contributions (all variables kept at their 1990 value)								4.0	
Magnitude of substitutabilities								0.6	

*: For differences $(\Delta w, \Delta pr, \Delta z)$, average growth in 1991-2002
**: Expressed in percentage points.

The reaction from the government to the fading 1990s is embedded both in the increased spending as well as in the soaring national debt.[13] In our model this reaction is captured via traditional fiscal policy instruments, such as government expenditures and direct taxes on firms. Receding real interest rates reflect, accordingly, the expansionary monetary policy implemented in the 1990s. These three variables contributed together to a 1 percentage point (p.p.) reduction in unemployment (0.4 p.p. the first two and 0.2 p.p. the latter).

[12]Total dynamic contributions (sum of individual contributions) amount to 4.6 percentage points, while joint contributions (that is, when all variables are kept at their 1990 values) amount to 4.0 percentage points in terms of unemployment. The difference between those two (0.6) stands for the substitutabilities between the exogenous variables.

[13]Whether it was right on time or with some delay remains a disputed matter. Barseghyan (2006b), for example, claims the Japanese slump in the 1990s was mainly due to the existence of non performing loans combined with a delay in the government bailout. In other words, the slump could have been subdued had the government stepped in more rapidly.

This expansionary effect on the economy, however, was much lower than the distortions brought about by the huge national debt and the rapid pace it followed. Our simulations indicate that this rising path accounts for 2.6 percentage points increase in unemployment, making the debt a significant contributor to the final net increment in unemployment.

The Japanese government is well known for its deep meddling with the private sector since postwar. It has, for long time, fed a strong alliance with big financial conglomerates that easily embodied the "culture of harmony" laid out by a deep-rooted Confucian culture. But whether it be the result of Confucianism or crony capitalism, the Japanese government indebtedness has gone well beyond the goals of an expansionary fiscal policy, just to deliver a noncompetitive outcome that harms employment in the end.

The cumulative debt appears, thus, as a burden and not as the result of some specific expansionary fiscal policy, which in our model is captured via the traditional fiscal policy channels (government expenditures and the tax system). The fact that government spending has barely budged (in the range of 20% to 24% of GDP since 1970) while gross government debt reached the astounding amount of 180% in 2006 at a pace of 7% growth for the previous ten years, provides a first rough indication of this burden.[14] It is hard to think the debt burden would leave the labor market unaffected. Particularly, in what refers to creation of new and more efficient firms (and, therefore, employment) that would have turned up if the extinction of most inefficient ones had not been prevented through government bailout. This fact comes at a substantial opportunity cost, in terms of job creation, and adds up to the already harming effect of inefficient firms laying off workers to remain competitive.

Of course, this is not to say that the government debt should not be seen as a plausible (and sometimes powerful) Keynesian tool for reactivation; quite the contrary, it should be seen as such when strictly used as a short-run Keynesian device. Many doubt, however, about the effectiveness of fiscal policy in Japan during the 1990s (Krugman, 1998; Ihori *et al.*, 2003; Hamada, 2004). Besides, banks, conglomerates, and government have formed up a tightly intertwined network characterized by an uneasy lending-borrowing dynamics. In fact, Japanese banks own large shares of their corporate borrowers, and thus there is little financial advantage in corporate debt foreclosure (Fukao, 2003). It seems the government has somehow diverted useful resources that otherwise had been helpful in supporting new efficient firms entering the industry.[15] Further, since the economy has suffered dearly in terms of productivity growth, it seems as if the bailouts had turned out an unfair reward to a less efficient private sector. In fact, one is left to wonder if the aggressive bailing out

[14]Indeed, excessive bailouts targeting a financial sector already damaged by the bubble crisis were commonplace during the mid-1990s. For instance, during 1997 a $232.5 billion bank bailout was introduced to prop up the financial sector.

[15]It should also be noted that, since the beginning of industrialization, the national banking regime in Japan has solely grown to achieve efficiency for financing export production. Japanese exporting firms never had to compete for capital or credit the way their American peers, for instance, used to. Credit is rife and easy for such firms, and usually at a rate that guarantees their competitiveness in the export market. Arguably, this is also why Japan is not that well equipped to finance new entrepreneur ventures.

conducted by the government in the 1990s might have harmed the economy's productivity to a greater extent.[16]

With respect to firm's financial indebtedness, our simulation shows a null effect. This is due to the mild increase of this variable in our period of analysis, which is in contrast to the steep rise it experienced in the second half of the 1980s and early 1990s. Of course, this result does not preclude a relevant role of financial distress, specially at the root of the crisis, but this assessment requires a longer historical perspective than the one taken here.

Rapid aging population is another important issue well deserving the government's attention in later years, despite its relieving effect on unemployment. Indeed, the growth rate of working-age population went down in the 1990s, at the same time that the aggregate participation rate stabilized around 78% in the second half of the 1990s and early 2000s. According to our model this contributed to reduce unemployment by 0.5 percentage points despite the damaging consequences for future generations. The speed at which the growth rate of working-age population has been gradually decreasing to reach negative values in last years posits a true challenge to the maintenance of the welfare system. Alarming figures by the Statistic Bureau of the Ministry of Internal Affairs show the radical change in the population pyramid that it is to be expected in future years. While 1950 presented the standard broad-based pyramid (35% at the 0-14 years range), the projection for year 2050 delivers an almost exactly inverted chart (near 40% for 65 years and over). This is an important issue the country will have to address as it could otherwise lead to labor shortages in the future, once the unemployment problem is solved. Opening the labor market begins to be seen as an alternative, considering the registered alien population accounts for only less than 2% of total population, one of the world's lowest.

5 Conclusions

We have analyzed the Japanese labor market from a macroeconomic perspective taking the Chain Reaction Theory as theoretical benchmark. This choice admits a wider analytical perspective than the mainstream theories allow for. It permits to go beyond the role of institutions and consider a set of labor market macroeconomic determinants that have been found (sometimes in isolation) relevant to explain the 1990s slump. The novelty of our analysis is to consider these macroeconomic determinants jointly and together with standard labor market variables, and let them contend to explain the unemployment upsurge in the fading 1990s.

We find that the steep rise in unemployment during the "lost decade" was essentially a productivity-led phenomenon. The steep rise in government debt plays also a major role by supporting inefficient firms which nevertheless incurred in job layoffs, and by preventing

[16] The study of such connection is beyond the scope of this paper and left for future research.

new job opportunities to emerge. In particular, the low productivity growth rate and the increasing debt account, respectively, for 5.1 and 2.6 percentage points (p.p.) rise in the unemployment rate for 1990-2002. These effects are, to some extent, offset by dynamic contributions going in the opposite direction: (i) real wages, which stand out as the strongest force (with a contribution of -1.6 p.p.); (ii) expansive fiscal policies (-1.0 p.p.); and (iii) demographics (-0.5 p.p.). The variable representing the financial distress in the private sector shows no significant contribution during this period.

Our analysis seems to leave room for the "zombie firms" hypothesis, where less productive firms prevent new efficient competitors from entering the market. This mechanism entails a serious opportunity cost in terms of jobs that fail to open, whereas it allows inefficient firms to keep working and spare unneeded workers. Within this setting "zombie firms" are indirectly debt-financed through massive government bailout, which aims at keeping bad loan practices between banks and insolvent borrowers. The result is a noncompetitive performance of the labor market that affects efficiency and, hence, employment.

Japanese authorities have to address the debt problem before it becomes a real deterrent to growth. In easing this burden in the short run and giving up its role as lender of last resort for compromised banks, the government might increase efficiency and create new job opportunities that would help the economy back to the right path once again. Such decisions should come jointly with strong measures boosting productivity. Arguably, not only has Japan fallen into a liquidity trap, but seems to have stumbled into a low productivity trap as well.

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Figure A1. Actual and 1990 values of the exogenous variables

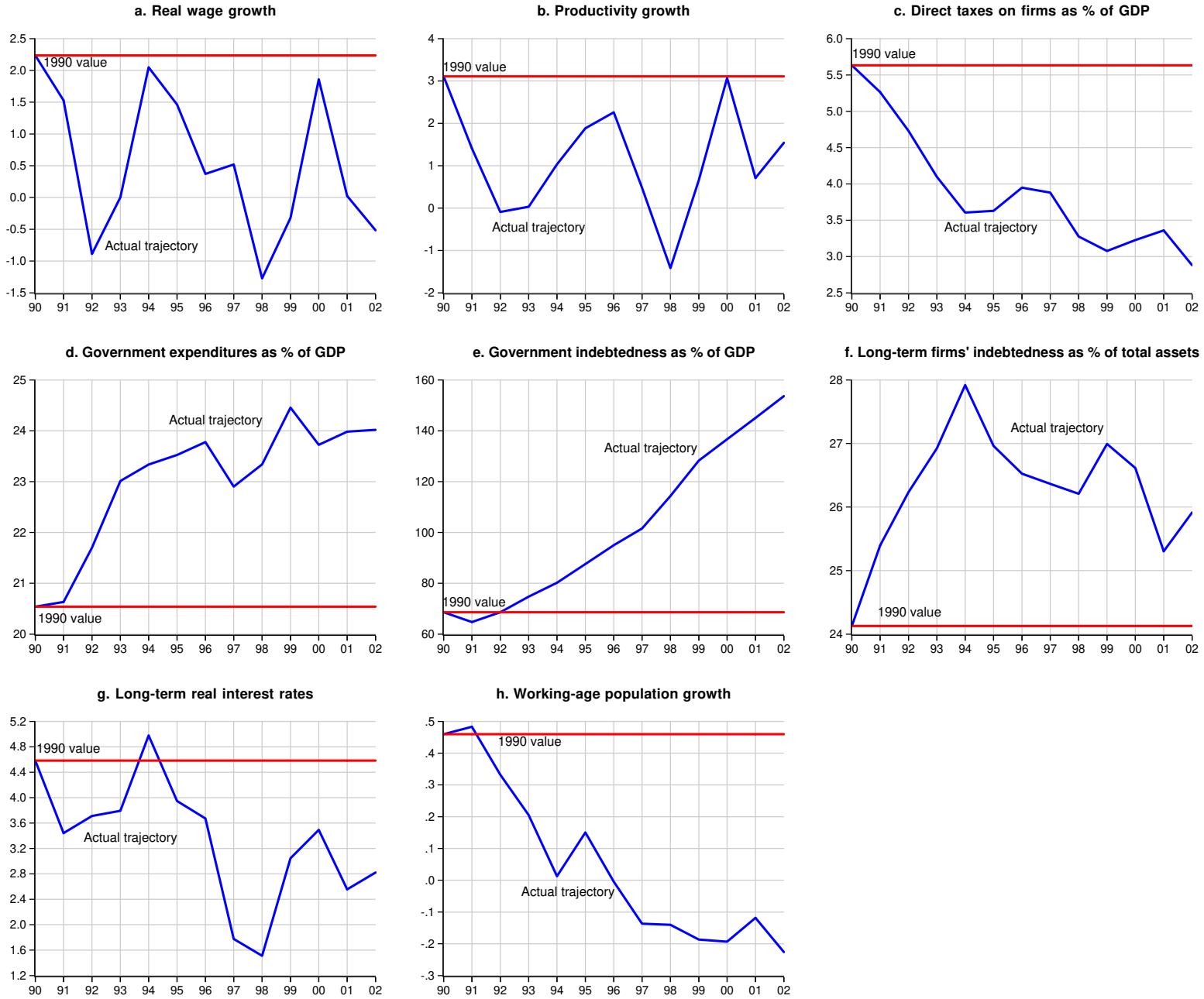

Figure A2. Unemployment contributions of the exogenous variables