COMMENT 'A "NEWS" VIEW OF JAPAN'S LOST DECADE': MONETARY POLICY DURING JAPAN'S LOST DECADE*

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In this comment, I first propose a discussion of Braun and Waki's "Monetary Policy during Japan's Lost Decade" paper, by examining their model properties following a technological surprise. I then propose some empirical evidence suggesting that the Japanese lost decade could have been triggered by a downward revision of future TFP growth rather by an unexpected TFP slowdown. I show that a plain RBC model is unable to account for the effect of such a revision in expectation, while a sticky price model along the lines of Braun and Waki, or a flex-price model with a rich sectorial structure, give more realistic predictions. These results favour a "News" view of the 1990s in Japan. Indeed, a downwards revision of future TFP growth expectations act as a demand shock in the short term, while the actual slowdown acts as a supply shock in the medium and long term.
JEL Classification: E3

1. Introduction

In their work "Monetary Policy during Japan's Lost Decade", Toni Braun and Yuichiro Waki (2006) propose a quantitative exploration of that period. They first present a model *à la* Rotemberg (1996), with monopolistic competition, quadratic price adjustment costs and a Taylor rule. They explicitly model the zero bound on nominal interest rate. The model is fed with the actual total factor productivity (TFP) series and an increase in government expenditures. It can reasonably account for the real and nominal features of the Japanese economy in the 1990s. This work is an important step in the modeling of the Japanese depression from the viewpoint of quantitative modern macroeconomics, extending the work of Hayashi and Prescott (2002). In this note, I first examine Braun and Waki's model properties following a technological surprise. I then propose some empirical evidence suggesting that the Japanese lost decade could have been triggered by a downwards revision of future TFP growth rather than by an unexpected TFP slowdown. I show that a plain RBC model is unable to account for the effect of such a revision in expectation, while a sticky price model along the lines of Braun and Waki or a flex-price model with a rich sectorial structure give more realistic predictions. These results favour a "News" view of the 1990s in Japan, as a downwards revision of future TFP growth expectations acts as a demand shock in the short term and as a supply shock in the medium and long term.

2. Braun and Waki Account of the Lost Decade

Hayashi and Prescott (2002) have proposed a careful account of the real Japanese economy in the 1990s, that is based on the neoclassical growth model. Using a standard growth model, they found that two key elements account for the depression. The first one is a TFP slowdown—i.e. a fall in the growth rate of TFP. The second is the reduction of the working week in the late 1980s and early 1990s. When TFP is treated exogenousy (together with the GNP share of government purchases and working-age population), a standard neoclassical model accounts for most of the growth loss during the 1990s.

  Braun and Waki's (2005) contribution is to widen the picture by also considering nominal facts, namely deflation and near-zero nominal interest rates. To do so, they adopt a rather rich setup with monopolistic competition and quadratic adjustment costs of changing prices, money in the utility function and a Taylor rule. With this model, the possibility of falling into a liquidity trap is explicitly taken into account, as the nominal interest rate can be either zero or strictly positive. Then, taking as exogenous TFP and the GNP share of government purchases (as in Hayashi and Prescott (2002)), they reasonably replicate the main real and nominal facts of Japan in the 1990s.

  Such a result is very conditional the specification of an important equation of a sticky price model: the Taylor rule, specified as follows:

$$R_t = \max(0, \bar{R} + \rho_y \hat{y}_t + \rho_\pi \hat{\pi}_t) \tag{1}$$

where $\bar{R}$ is the target nominal interest rate (that is reached at the steady-state), $\hat{y}$ the output gap and $\hat{\pi}$ the inflation gap. This is a hard to calibrate equation, one that is often the Achille's heel of monetary sticky prices models. In effect, the Central Bank reaction function is not observable, and different routes can be pursued in choosing the specification and calibrating the rule. The first is to estimate it, provided that one properly instruments for money demand shocks. The second is to assume that the Central Bank is an optimizing agent which may or may not have access to a commitment technology, and to derive its (model-dependant) optimal policy. Braun and Waki do not follow either of those two routes. Concerning the coefficients ρ_y and ρ_π, they choose those values of the Taylor rule reaction coefficients that were found to be optimal by Fujiwara *et al.* (2004) using the Bank of Japan's Japanese Economic Model, when the weight on the output gap in the monetary authority's loss function is 0.08. This is definitively a good starting point but, given the importance of the Taylor rule calibration, some research should be done in order to fully discipline the calibration of the rule. The choice of $\bar{R}$ is also of great importance, as it governs how binding the non-negativity constraint is on the nominal interest rate. Again, the discipline that should govern this choice is not clear, and the authors have chosen the level so that the model does a good job in reproducing the facts. This is again a good starting point, but might be investigated further in future work.

  The following experiment shows how sticky price models with Taylor rules can give quite counter-intuitive, if not counter-factual, responses to technological shocks, in particular when the Taylor rule is combined with a zero-bound constraint on the nominal interest rate. Using the authors calibration $\bar{R} = 0.1\%$, $\rho_y = 0.4$ and $\rho_\pi = 1.7$, I solve a quasi-linearized version of the model, where all equations are log-linearized except the Taylor rule (1), that is non-differentiable because of the max operator. I simulate the model using the DYNARE algorithm[1], that solves non-linear perfect foresight models with the help of a Newton-Raphson type algorithm. I compute the response to a 10% shock to TFP, as performed in Braun
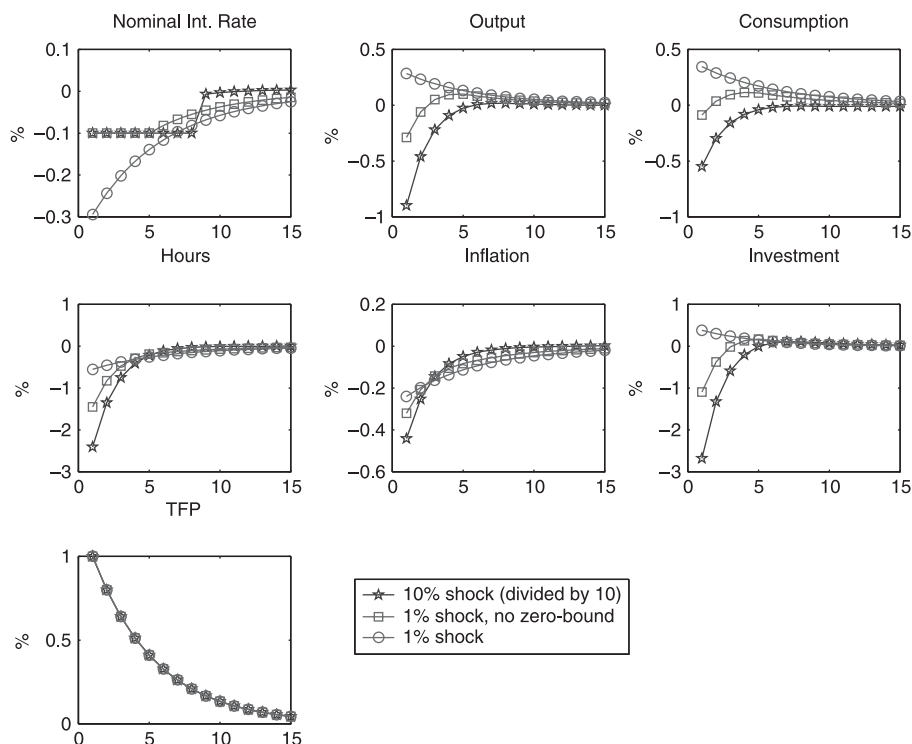
FIGURE 1.   Rescaled responses to a 10% and 1% innovation to TFP in the Braun and Waki model

Note: This figure displays the response of the Braun and Waki model to a 10% or 1% shock to TFP in period 1. Variables are in percentage deviations from steady-state, except the nominal interest rate and the inflation rate that are in absolute deviations from their steady-state level. The responses to the 10% shock have been divided by 10, except in the case of the nominal interest rate when the positivity constraint is binding.

and Waki (2005), when TFP follows an AR(1) with persistence 0.8. I also compute the response to a 1% shock in that model. As a means of comparison, I also simulate the economy for a 1% shock but without the non-negativity constraint on the nominal interest rate. As I am interested in evaluating the non-linearity introduced by the non-negativity constraint, I want to meaningfully compare responses. The responses to the 10% shock have been divided by 10, except in the case of the nominal interest rate when the non-negativity constraint is binding. If the model was linear, the rescaled 10% response and the 1% response would be identical. The responses to those shocks are presented in Figure 1.

Some observations can be made. Let us first consider the 1% shock in the model without the constraint (the line with circles). The economys response is typical for a sticky price model with accommodative enough Taylor rule: inflation and nominal interest rates go down, and output, consumption and investment go up, but hours go down. Such a response of hours might be seen as quite counterfactual. Following Gali (1999), a vast literature has discussed the reality of the counter-cyclicality of hours on impact. In Gali (1999)

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[1]   See Juillard (1996) and http://www.cepremap.cnrs.fr/dynare for a detailed presentation.
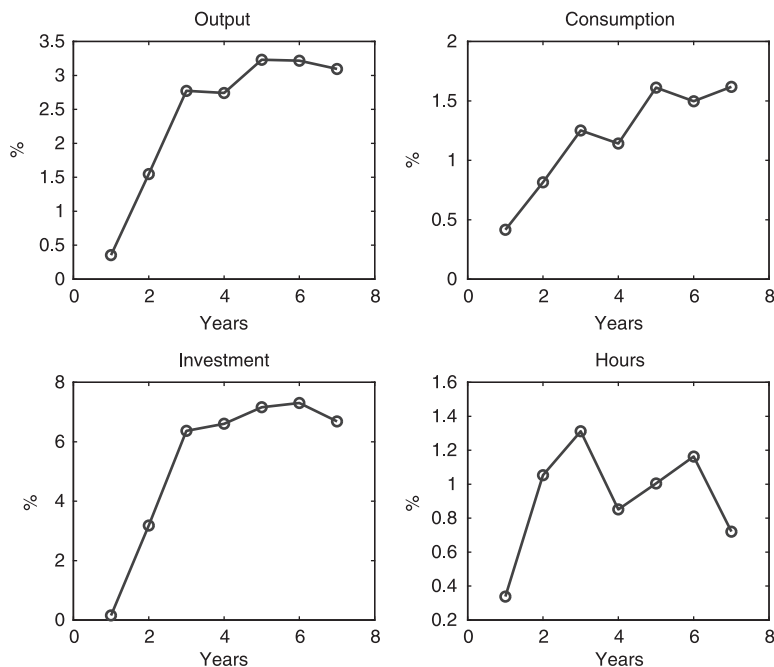
FIGURE 2.   Response to a one standard deviation permanent shock to TFP, as estimated on Japanese data

Note: Using 1960–2000 annual Japanese data, Beaudry and Portier (2005) have estimated a Vectorial Error-Correction Model with TFP and a Stock Price Index, imposing one cointegration and six lags. They use this VECM to identify a permanent shock to TFP series. The responses displayed in this figure are the point estimates of the projection of consumption, investment, output and hours on the series of permanent shocks to TFP. See Beaudry and Portier (2005) for a detailed exposition of the data and the estimation procedure.

estimates[2], instantaneous response of hours to a long-term labour productivity shock, that increases labour productivity by 1% on impact, is essentially zero for Japan. Such a response could also be compared with the response of hours to a permanent shock to TFP, as estimated vsing Japanese data by Beaudry and Portier (2005)[3]. The estimated responses are displayed in Figure 2. In these estimates, hours do not decrease on impact.

Except for the response of hours, that is at least too negative, the model responses are qualitatively correct without the non-negativity constraint. This is less so when one introduces the constraint, as can be seen on Figure 1. The model behaves in a qualitatively different way. Let us consider the response to a 1% shock (the line with squares). The constraint on the nominal interest rate binds for five periods, and the positive technological shock creates an aggregate recession, although the response of consumption is almost zero on impact and positive after. The model response is therefore completely counterfactual: in the estimated responses we obtained (see Figure 2), a technological improvement creates an aggregate expansion. Things are even worse if one assumes a bigger shock (10%). As it can be seen on the rescaled responses of Figure 1 (the line with stars),

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2   Gali's estimates correspond to permanent shocks while the model ones correspond to temporary (but persistent) shocks. In models in which leisure is a normal good, it is likely that the response of hours will be even more negative in the case of a permanent shock to productivity.

3   There reader is referred to my paper with Paul Beaudry for more details on the estimation of such responses.
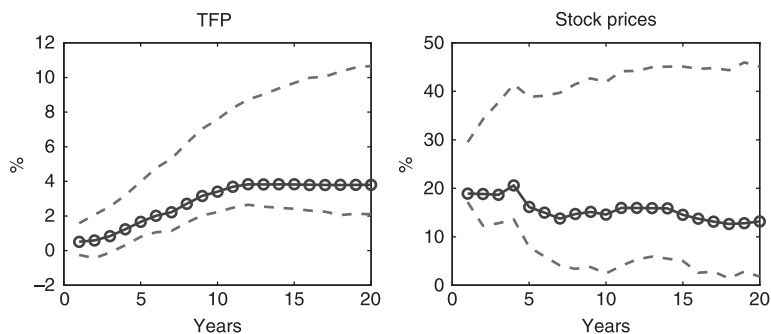
FIGURE 3.   Response to a one standard deviation permanent shock to TFP, as estimated on Japanese data

Note: Using 1960–2000 annual Japanese data, Beaudry and Portier (2005) have estimated a Vectorial Error-Correction Model with TFP and Stock Price Index, imposing one cointegration and six lags. They use this VECM to identify a permanent shock to TFP series. The responses displayed on this figure are the point estimates of the responses to permanent shocks to TFP. Dotted lines represent the 10% and 90% quantiles of the distribution of the IRF in the benchmark case (six lags), this distribution being the bayesian simulated distribution obtained by Monte-Carlo integration with 2500 replications, using the approach for just-identified systems discussed in Doan (1992). See Beaudry and Portier (2005) for a detailed exposition of the data and the estimation procedure.

the constraint binds longer and the recession is much deeper[4]. On top of that, consumption is now below its steady-state for almost all the convergence path. Such a response runs counter to economic intuition and estimated responses.

In the rest of this discussion, I try to show that an alternative story to technological surprises, the "news shocks" is a realistic view of the Japanese "lost decade".

3.   An Account of the Japanese Growth in the 1990's

In this section, I am referring to some results that I have obtained with Paul Beaudry and that are presented in more depth in Beaudry and Portier (2005). The goal is to obtain a better understanding of the way technological changes arrive and diffuse in the economy. To that end, we model a simple bivariate Vectorial Error-Correction Model (VECM) with aggregate TFP and a Stock Price Index (SP), identify the permanent shock to TFP (using a Blanchard and Quah (1989) type of long-run identification)[5], and then project the macroeconomic aggregates on the obtained series of structural innovations. The estimates of this projection have been displayed in Figure 2 and discussed in the previous section. The reason for including the Stock Price in the VECM is that it is likely to be a good variable for capturing any changes in agents' expectations about future economic conditions.

The responses of TFP and SP to a permanent shock to TFP are displayed in Figure 3.

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[4]   Let us recall that the responses have been rescaled, so that they would be identical if the model was linear.

[5]   Data are annual and cover the period 1960 to 2000. Most series are obtained from Hayashi and Prescott (2002) See also http://www.e.u-tokyo.ac.jp/~hayashi/hp/hayashi_prescott.htm for the Excel Files): TFP, GNP deflator, population aged 20–69 in millions, Total Hours, Consumption (Private consumption) and Investment (Private Fixed Capital Investment). The Hours series have been deflated by the 20–69 population series. The investment and consumption series have been deflated by both *GNP* deflator and age 20–69 population. The stock prices series is the end-year Nikkei 225 (As obtained from http://www.finfacts.com/ Private/curency/nikkei225performance.htm., deflated by the *GNP* deflator and the age 20–69 population.
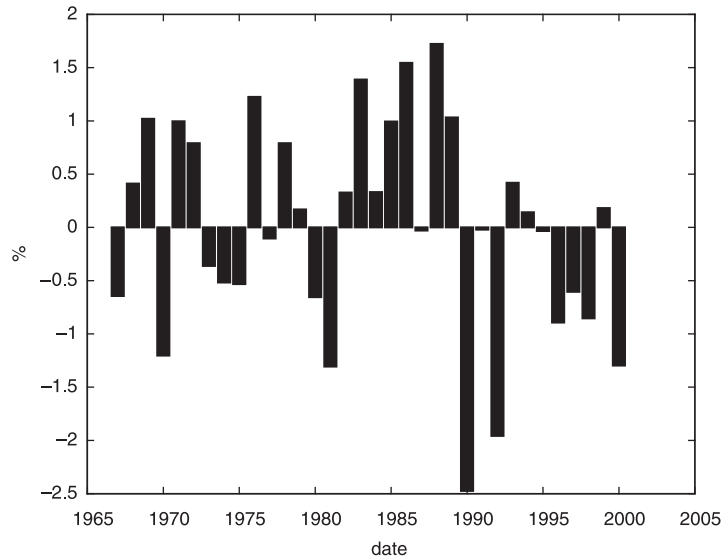
FIGURE 4.   Estimated permanent shocks to TFP

Note: Using 1960–2000 annual Japanese data, Beaudry and Portier (2005) have estimated a Vectorial Error-Correction Model with TFP and a Stock Price Index, imposing one cointegrating relation and six lags. They use this VECM to identify a permanent shock to TFP series. This is the series that is displayed here. The standard deviation of the series is normalized to 1%.

The key observation from this figure is that, whereas the stock price series immediately jumps, TFP only slowly increases to its new permanent level. Its response is not significatively different from zero for the first three to four years. This suggests that permanent changes in TFP are first reflected in stock prices before they actually increase productive capacity. Such a pattern could arise if agents have advanced information about future technological opportunities, or if productivity growth emerges as a delayed byproduct of a period-high investment activity. In either case, the result suggests that expected changes in technological opportunities, what we call "news", may be an important source of business cycle fluctuations. In Beaudry and Portier (2004b), we show that this pattern of response to permanent TFP shocks is also found for the USA.

According to Hayashi and Prescott (2002) and Braun and Waki (2005), much of the Japanese growth of the 1990's can be accounted for by the evolution of TFP, when models are used as measurement tools. Here we perform the same accounting exercise with our estimated VECM.

Figure 4 displays the series of estimated permanent shocks to TFP, that I interpret as news about the long-run level of TFP. We observe in this Figure that two large negative shocks hit the Japanese economy in 1990 and 1992. According to the responses evident from Figure 3 those two shocks are negative innovations to the stock market and downward revisions of the long-run level of TFP. We now consider the following counterfactual exercise, that is taken from Beaudry and Portier (2005): starting from the actual value of the series in 1989, we compute the path of TFP and SP as expected in 1989, together with what would have happen if, between 1990 and 2000, all the permanent shocks to TFP had taken their realized values except in 1990 and 1992, when the shocks are set to zero. The
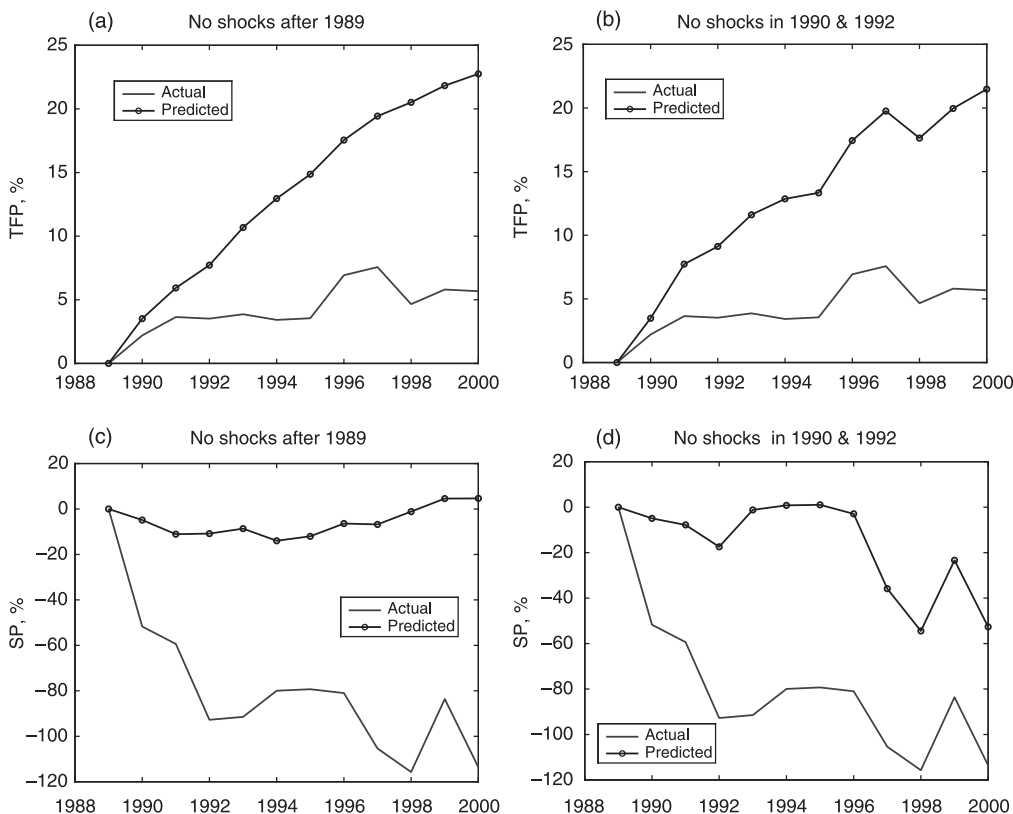
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FIGURE 5. Historical decomposition of the 1990s, (*TFP*, *SP*) VECM, Japanese annual data

Note: This figure plots the decomposition of TFP and SP into movements explained by some various combinations of the permanent shock to TFP. In panels (a) and (c) are compared the actual path of the series with the path expected in 1989 (in other words what would have happen absent of all shocks after 1989). In panels (b) and (d) are compared the actual series and the series obtained with all shocks except the permanent shocks in 1990 and 1992. Results are obtained from the (TFP, SP) VECM, with six lags and one cointegrating relation.

resulting paths are displayed in Figure 5. Panels (a) and (c) compare the actual path of TFP and SP with the expected one in 1989. TFP in 2000 is about 20 percentage points below the level that was expected in 1989, SP about 120 percentage points below. Panels (b) and (d) show what would have been the path of TFP and SP the 1990 and 1992 shocks. Two observations can be made. First, most of what did happen to TFP in the 1990s is the consequence of these two shocks. As displayed in Panels (a) and (d), the counterfactuals are far from the actual series and close to that expected in 1989. In 2000, 20 percentage points out of the 23 in the difference between the actual TFP series and that expected in 1989 are explained by the 1990 and 1992 shocks. Second, the same results hold to a lesser extent for the stock prices: about a half (60 percentage points) of the distance between the actual *SP* series and that expected in 1989 is explained by the 1990 and 1992 shocks, the other half being mainly explained by the 1995 and 1996 shocks.

What do we learn from this exercise? Two stock market shocks occurred at the beginning of the 1990s. They were possibly the consequence of bad news about future TFP, and
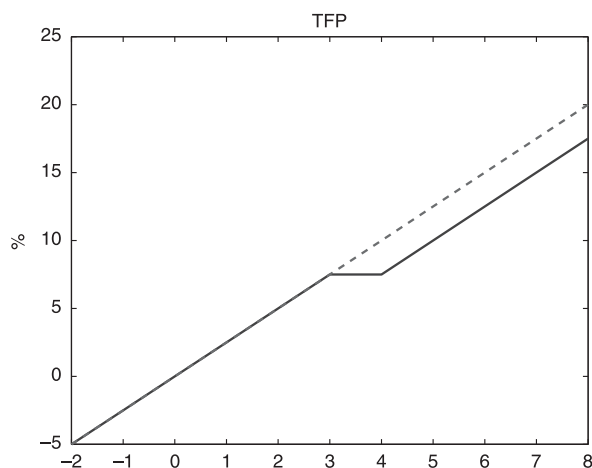
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FIGURE 6.   The TFP shock

Note: The dashed line represents the expected path of TFP before the news shock. The news shock, that occurs at period zero, reveals to the agent that TFP will now follow the solid line path.

they explain most of the TFP changes in the 1990s and about half of the stock market variations. This accounting exercise says nothing about the cause of these two shocks. The resolution of this question is still a puzzle for analysts of the Japanese economy. We now turn to the modelling of such shocks.

4.   Towards a "News" view of the Lost Decade

As Braun and Waki (2005) made it clear, the Japanese lost decade has some very peculiar real and nominal features. On the real side, it is a depression: output, investment and consumption are depressed, hours are low and TFP growth is slow. On the nominal side, it is a period of deflation, with negative inflation rates and almost zero nominal interest rates. Since the analysis of the Great Depression of the Thirties, we know that such periods are challenging for macroeconomic analysis. The depression can be the consequence of a negative supply shock, but then it should not imply deflation. The deflation can be the consequence of a negative demand shock, but it should then not decrease TFP—at least not for such a long period of time. Accounting for both depression and deflation is therefore a difficult task, as one seems to need *at the same time* a negative TFP shock and a negative "autonomous" demand one.

   As Hayashi and Prescott (2002) are only concerned with the real facts, their argument mainly hinges on a negative TFP growth shock. Since Braun and Waki (2005) also consider the nominal dimension of the economy, they add an endogenous monetary policy and an increase in government expenditure that acts as a negative demand shock because of its crowding out effect. What our empirical evidence has suggested is that one could bring a single shock explanation of the period. The 1990 and 1992 news about future lower levels of TFP (three to four years down the road) act as negative demand shocks (on impact) and as negative supply shocks (later). The question is then whether or not standard models can replicate the pattern of responses to these shocks that we have found in the data and that was illustrated in Figure 2. It is out of the scope of this discussion to develop a fully
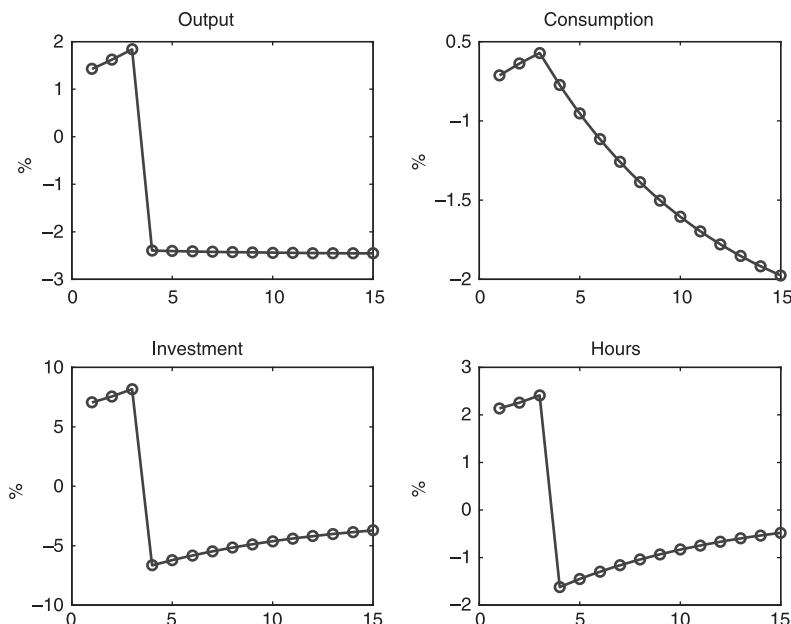
FIGURE 7. Response of a plain RBC model to the news shock

Note: This is the response of a plain RBC model to the shock displayed on Figure 6: in period zero, agents learn that, with certainty, TFP growth will be zero in period 3. All variables are expressed in relative deviations from their steady-state level.

convincing calibrated model of the Japanese economy, and I want to illustrate my point with a simple example.

I consider economies in which exogenous TFP grows deterministically at 2.5% per year, as in Braun and Waki (2005). I then assume that in period zero, agents learn that, with certainty, TFP growth will be zero in period 3, so that the pattern of TFP is the one shown in Figure 6. I make here two extreme assumptions. The first is that there is no slow diffusion of the shock. In Beaudry and Portier (2004b), we study an analytical model with a more realistic diffusion process. The second is that the news brings some information with certainty. In Beaudry and Portier (2004b), we deal with a more realistic probabilistic structure.

Let us first consider a plain RBC model of the type used by Hayashi and Prescott (2002). I assume that instantaneous utility is given by $\log C_t + \eta(1 - L_t)$, and the resource constraint of the economy is $C_t + I_t = AK_t^{1-\alpha}(A_t L_t)^{\alpha}$. The law of motion of capital is $K_{t+1} = I_t + (1 - \delta)K_t$. The length of a period is set at a quarter. The parameters ($\alpha, \delta, \eta, \beta, \gamma$) are set to values commonly accepted in the literature. I then simulate the model to compute the response to the news shock.

Figure 7 illustrates a claim that we have made in Beaudry and Portier (2004c): a standard RBC model cannot account for an aggregate recession after bad news about future productivity. As it can be seen in Figure 7, output, investment and hours increase in the interim period between the news and the decrease in TFP growth. The bad news creates a boom, only consumption decreases on impact. If the TFP slowdown had been mainly anticipated at the beginning of the 1990s, as shown in our empirical exercise, then a plain RBC model cannot account for the lost decade.
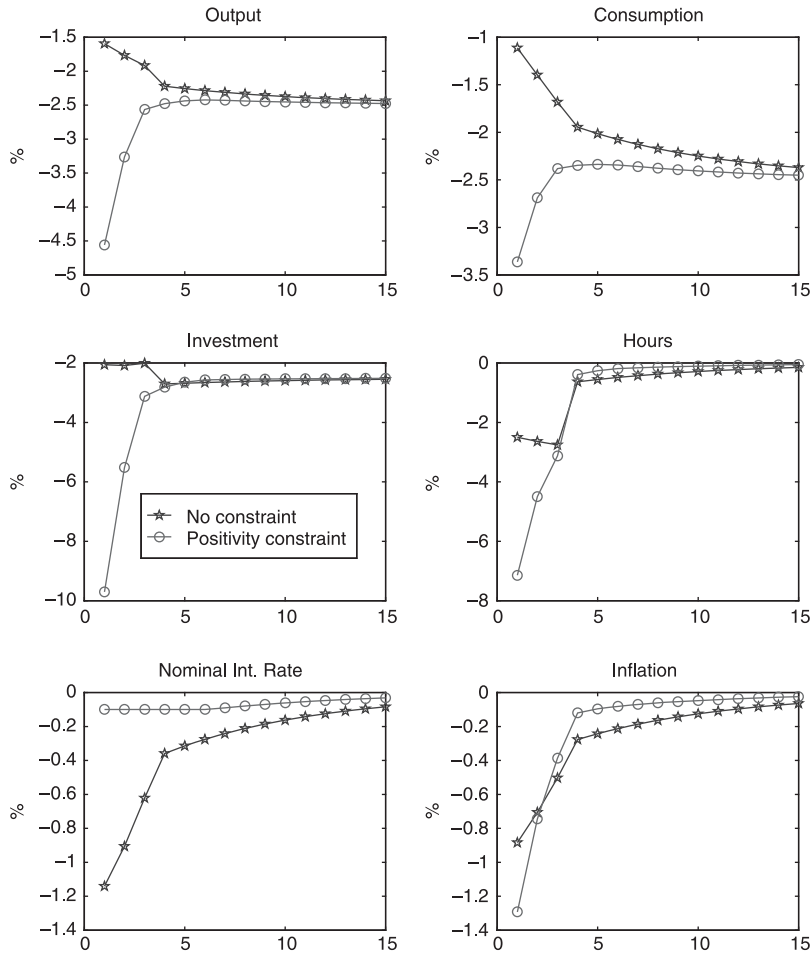
FIGURE 8.   Response of the Sticky Prices Model of Braun and Waki (2005) to the news shock

Note: This is the response of Braun and Waki (2005) model to the shock displayed in Figure 6: in period zero, agents learn that, with certainty, TFP growth will be zero in period 3. All variables are expressed in relative deviations from their steady-state level, except for the nominal interest rate and the inflation rate which are in absolute deviation from their steady-state level.

Braun and Waki (2005) sticky price model does a good job in accounting for the real and nominal facts following the news shock, as shown in Figure 8.

With only one shock that acts as a demand shock in the short run and as a supply one in the medium and long run, I replicate both the depression and the deflation. This result is in line with Beaudry and Portier (2004b) and Beaudry and Portier (2004c) that both show theoretically that sticky prices model can display such expectation-driven business cycles. Note that, as already highlighted by Braun and Waki, imposing a non-negativity constraint on the nominal interest makes the recession more severe. The response of the economy is now qualitatively in line with the estimates, whereas they were not when a technological shock was modelled.

As I already mentioned earlier, the limitation of such models is that the response of the economy is very conditional to the Taylor rule specification. If sticky prices are the
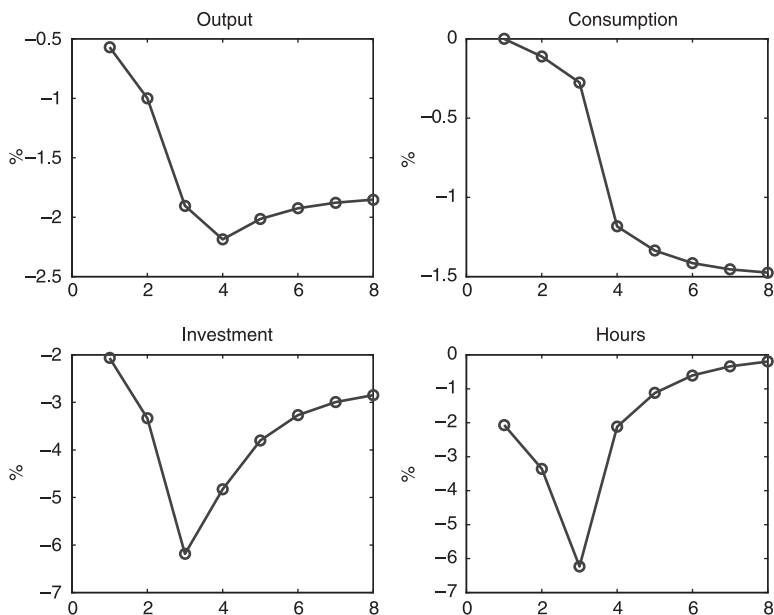
FIGURE 9. Response of the Pigou model to the news shock

Note: This is the response of the Pigou model of Beaudry and Portier (2004a) to the shock displayed in Figure 6: in period zero, agents learn that, with certainty, TFP growth will be zero in period 3. All variables are expressed in relative deviations from their steady-state level.

only distortion, then an optimal monetary policy should aim at undoing their effect, and the model allocations would therefore be close to the ones of a plain RBC model, which we have shown to give counter-factual predictions.

A potential route to circumvent this problem is the one that we have followed with Paul Beaudry in Beaudry and Portier (2004a) and Beaudry and Portier (2004c). Within the class of optimal flex-price growth models, we have shown that a richer productive structure, with more than one sector, may be able to generate an aggregate recession following TFP bad news. Here I illustrate this claim with a model that we have presented in more detail in Beaudry and Portier (2004a), and that I will refer to as the Pigou model. I consider a stylized economy composed of three sectors: a final consumption goods sector, a non-durable goods (or intermediate good) sector and a durable goods sector. The durable good sector is best thought of as the construction industry with the stock of the durable good representing plant and housing infrastructure. The final good, denoted C_t, is produced as CES composite of the non-durable good (or service) X_t and the stock of infrastructure K_t:

$$C_t = (aX_t^v + (1-a)K_t^v)^{\frac{1}{v}}, \quad v \le 0.$$

The non-durable good X_t is produced using labour according to:

$$X_t = \theta_{x,t} l_{x,t}^{\alpha_x} \; \tilde{l}_x^{(1-\alpha_x)}, \quad 0 < \alpha_x \le 1$$

where $\theta_{x,t}$ is the state of technology in the non-durable goods sector and $l_{x,t}$ is the level of employment in this sector. $\tilde{l}_x$ represents a fixed factor that is required in production. The

introduction of the fixed factor assures that overall returns to scale are constant, but forces returns to scale in the variable factor to be decreasing.

The capital good accumulates according to:

$$K_{t+1} = (1 - \delta)K_t + I_t$$

where δ is the rate of depreciation and I_t is investment which is provided by the construction sector. Production in the construction sector depends on the state of technology in this sector, $\theta_{k,t}$, the levels of employment $l_{k,t}$ and a fixed factor $\tilde{l}_k$.

$$I_t = \theta_{k,t} l_{k,t}^{\alpha_k} \; \tilde{l}_k^{(1-\alpha_k)}, \; 0 < \alpha_k \leq 1.$$

The elasticity of substitution between K_t and X_t in the final goods sector is no greater that one.

The preference side of the model is standard, and instantaneous utility is given by $log(C_t) + v_0(\tilde{\iota} - l_t)$ where C_t is the level of consumption of the final good, $\tilde{\iota}$ is the endowment of labour available in each period and l_t represents worked hours.

The response of this economy to the TFP news shock is displayed in Figure 9. Note that this economy displays an aggregate recession following the bad news, and is likely to give an accurate description of the Japanese lost decade. Extending the model to account for the nominal features of the data is still work to be done.

5.   Conclusion

We have shown in this discussion that there exist converging elements in favour of a news view of the lost decade, namely a view in which the downwards revision of future productivity growth expectations, followed by an actual slowdown of productivity, can explain both the depression and the deflation. It is interesting to put this idea in perspective with the conclusions of Hayashi and Prescott (2002). As they wrote in the conclusion of their study,

> "In examining the virtual stagnation that Japan began experiencing in the early 1990s, we find that the problem is not a breakdown of the financial system [. . .]. The problem is low productivity growth. [. . .] We said very little about the "bubble" period of the late 1980s and early 1990s, a boom period when property prices soared, investment as a fraction of GDP was unusually high, and output grew faster than in any other years in the 1980s and 1990s. We think the unusual pickup in economic activities, particularly investment, was due to an anticipation of higher productivity growth that never materialized. To account for the bubble period along these lines, we need to have a model where productivity is stochastic and where agents receive an indicator of future productivity."[6]

As we have shown in this work, a plain RBC model is unlikely to produce a recession following such a downwards revision of expectations. A careful treatment of news and expectations in a model along the lines of Braun and Waki (2005) seems to me an interesting area for future work.

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[6]   See Hayashi and Prescott (2002), pp. 227–228.

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