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Abstract

During the last years, Mexico has registered relatively large output falls. The business cycle accounting method of Chari, Kehoe and McGrattan (2007) is applied to the two most recent recessions in Mexico (including the "Tequila crisis") in order to understand what are the most important wedges driving output over the cycle and to evaluate to what extent such falls may be smoothed. First, it is found that efficiency and labor wedges may reasonably account for output fluctuations in each recession. Second, counterfactual exercises suggest that the elimination of distortions represented in terms of the efficiency wedge might result in output falls about one third of those observed in the data.
Keywords: Business cycle accounting, Tequila crisis, Total factor productivity, Mexico.
JEL Classification: E320, O410, O540.

Resumen

Durante los últimos años se han registrado caídas relativamente grandes del producto en México. La metodología de contabilidad de ciclos económicos de Chari, Kehoe y McGrattan (2007) se aplica a las dos recesiones más recientes en México (incluyendo la "crisis del Tequila") con el objeto de entender cuáles son las "brechas" más importantes para explicar las fluctuaciones del producto a lo largo del ciclo económico, y evaluar en qué medida dichas caídas pueden ser menos pronunciadas. Se encuentra que las brechas de eficiencia y de trabajo pueden explicar razonablemente bien las fluctuaciones del producto en cada recesión. Adicionalmente, ejercicios contrafactuales sugieren que la eliminación de distorsiones representadas por la brecha de eficiencia habría significado caídas del producto de sólo un tercio respecto a aquéllas registradas en los datos.
Palabras Clave: Contabilidad de ciclos económicos, Crisis del Tequila, Productividad total de los factores, México.

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1 Introduction

During the last years, GDP per capita in Mexico has registered relatively large output drops. In the 1994-1995 crisis, detrended output per capita fell about 12 percent in just 2 quarters. In the most recent business cycle (starting in 2000), the fall in detrended output per capita in Mexico has been larger than the corresponding fall in the US economy (see Figure 1). The goal of this paper is to provide a guide for researchers as to what class of frictions may allow dynamic, stochastic general equilibrium models to account for output fluctuations in Mexican data, and to assess to what extent the elimination of such frictions may lead to smoother output falls during recessions. For that purpose, the business cycle accounting method of Chari, Kehoe and McGrattan (2007) is applied to the last two business cycles in Mexico.[1] This method is appealing since a large class of frictions in general equilibrium models may be represented in terms of four wedges: efficiency, labor, investment, and government consumption wedges. These wedges are directly estimated from the data and the equilibrium conditions of the model in such a way that output fluctuations observed in the data are fully accounted for by these four wedges. The method thus allows to assess how much of the movements in output can be attributed to either a single wedge or a combination of them.

When the business cycle accounting method is applied to the last two recessions in Mexico (labeled as the "1995 recession" and the "2001 recession"), it is found that the efficiency and the labor wedge are the most promising to explain output fluctuations in each recession. Next, a series of counterfactual exercises are presented to evaluate to what extent output falls might had been lower in the absence of such frictions. The counterfactual exercises are designed so that either the efficiency or the labor wedge are the only wedges eliminated from the model used for the business cycle accounting exercise. For the 1995 recession in Mexico, counterfactual exercises under the benchmark specification of the model suggest that detrended output per capita would have fallen between 2.2 and 3.8 percent in the absence of the efficiency wedge at the trough of the recession, which compares favorably to the 12 percent fall observed in the data. Similarly, output would have fallen between 5 and 6 percent in the absence of the labor wedge at the trough of the recession. For the 2001 recession, where a 7 percent fall in detrended output per capita is registered at the trough of the recession in the data, simulated output falls at most 2.2 percent when the efficiency wedge is eliminated, and it falls at least 6 percent when the labor wedge is eliminated. These results are robust to alternative parametrizations of the model. Thus counterfactual exercises suggest that

[1] The methodological framework of this paper belongs to the tradition of "modern" business cycle theory as stated by Lucas (1977), whereby fluctuations in output, employment and other macroeconomic variables are associated with a certain typical pattern of co-movements in prices and other variables. In this class of models, economic agents set decision rules that take into account changes in the economic environment.

eliminating distortions represented in terms of the efficiency wedge is the most promising way to avoid large output falls in Mexico.

In terms of a fairly standard neoclassical growth model, the four wedges represent distortions of different kinds to the equilibrium decisions of agents operating in otherwise competitive markets.[2]This means that a large class of frictions can be represented in terms of a single wedge. For example, the efficiency wedge in the business cycle accounting method is equivalent to the total factor productivity term of the production function. However, the efficiency wedge may be reflecting distortions in relative prices of alternative sorts in more detailed, elaborated models as those of Lagos (2006), Chari et al. (2007), Restuccia and Rogerson (2007), and Erosa and Hidalgo (2007). For this reason, the four wedges do not have a unique economic interpretation. Rather, the accounting exercise performed in this paper is useful to identify promising classes of mechanisms through which primitive shocks lead to economic fluctuations. As this methodology does not intend to identify the primitive sources of shocks, the results provided in this paper do not directly imply that a shock to total factor productivity was the driving force during each recession. In fact, as the elimination of efficiency wedge distortions may lead to smoother output drops in Mexican data, the paper discusses some plausible interpretations of the efficiency wedge found in the literature.

Remarkably, the findings reported in this paper are consistent with a strand of the literature discussed by Kehoe and Prescott (2002). The authors conclude that policies affecting productivity are crucial determinants in explaining nine great depressions of the twentieth century. The difference between the class of papers discussed by Kehoe and Prescott (2002) and the one presented here is that the former is generally based on growth accounting exercises whereas this paper uses a technique -i.e., the business cycle accounting method- especially tailored for explaining macroeconomic fluctuations.

The rest of the paper is as follows. Section 2 presents the business cycle accounting method in detail. Section 3 presents the results and provides a series of counterfactual exercises. The last section discusses some interpretations of the efficiency wedge reported in the literature and its plausible relationship with the relative large output falls registered in Mexico.

[2] An alternative would be to postulate a dynamic, general equilibrium model with some type of non-convexities in order to admit equilibria that are locally non-unique or indeterminate (see, for example, Farmer and Guo, 1994). One might argue that such class of models could better characterize the Mexican business cycle. However, as is well-known these models are usually critized as the calibration necessary to obtain indeterminacy is empirically implausible. Recently, Duffy and Xiao (2007) report that RBC-style models with non-convexities exhibit equilibria that are unstable under adaptive learning dynamics, thus casting further doubt on the plausibility of this class of models to explain business cycles.

2 The Business Cycle Accounting Method

The business cycle accounting method of Chari et al. (2007) has two basic components: an accounting procedure and an equivalence result. The method usually requires three models to recover the wedges from the data and to give them an economic interpretation. The accounting procedure is based on a single model, and it serves to assess the importance of wedges to account for fluctuations in macroeconomic variables. On the other hand, the equivalence result needs at least two additional models in order to provide an economic interpretation of the wedges. For this reason, the business cycle accounting method does not uniquely determine the model most promising to study business cycle fluctuations. It does, however, provide a useful guide for researchers about the distortions that are key to explain macroeconomic fluctuations. As the purpose of this paper is to perform an accounting exercise of the business cycle for Mexico and not to provide a formal interpretation of the wedges, only a single model is presented. For a description of how the equivalence result works, the reader is referred to Chari et al. (2007).

The model below (labeled the "benchmark prototype economy") is a roughly standard neoclassical growth model with four stochastic variables or wedges: efficiency, labor, investment, and government consumption wedges. These time-varying wedges distort the equilibrium decisions of agents operating in otherwise competitive markets. They are first estimated from both the data and the equilibrium conditions of the benchmark prototype economy, and then fed back into the model to quantitatively account for the contribution of wedges to business cycle fluctuations, either separately or in combinations. For example, the importance of the efficiency wedge to explain movements in macroeconomic variables may be assessed by cancelling the contribution of the other three wedges in the model. By construction, the four wedges fully account for the observed movements in macroeconomic variables.

To see how the accounting procedure works, this section presents the benchmark prototype economy of Chari et al. (2007). It is extended to include adjustment costs for investment, as Christiano and Davis (2006) find that the accounting exercise may be sensitive to the value of Tobin's q elasticity. Later on, details about the estimation are discussed.

2.1 The Benchmark Prototype Economy

The business cycle accounting exercise considers a standard neoclassical growth model with adjustment costs. As in Chari et al. (2007), four stochastic variables are included: the efficiency wedge A_t, the labor wedge $1 - \tau_{n,t}$, the investment wedge $1/(1 + \tilde{\tau}_{x,t})$, and the government consumption wedge g_t.

Consumers in this model choose per capita consumption c_t and per capita labor l_t to maximize lifetime expected utility, given by

$$E_0 \sum_{t=0}^{\infty} \beta^t U(c_t, l_t) N_t$$

subject to the budget constraint

$$c_t + (1 + \tau_{x,t}) x_t = (1 - \tau_{n,t}) w_t l_t + r_t k_t + T_t$$

and the law of motion for capital

$$(1 + \gamma_n) k_{t+1} = (1 - \delta) k_t + x_t - \varphi \left(x_t / k_t \right) k_t, \tag{1}$$

where N_t is the period t population growing at the rate $1 + \gamma_n$, x_t is investment, w_t the wage rate, r_t the rental rate of capital, k_t the per capita capital stock, T_t the per capita lump-sum transfers, δ the depreciation rate of capital with $0 < \delta < 1$, β a discount factor satisfying $0 < \beta < 1$, and $\tau_{x,t}$ and $\tau_{n,t}$ the tax rates on investment and labor, respectively. The function $\varphi \left(x_t / k_t \right)$ represents adjustment costs for investment with properties $\varphi' > 0$ and $\varphi'' \geq 0$.

Technology in this economy is represented by a neoclassical production function of the form $F \left(k_t, (1 + \gamma)^t l_t \right)$ where the term $(1 + \gamma)^t$ is the exogenous growth rate of labor-augmenting technical progress. Thus per capita output y_t is determined by

$$y_t = A_t F \left(k_t, (1 + \gamma)^t l_t \right). \tag{2}$$

As is usual in a perfectly competitive environment, prices of each factor of production are equal to their corresponding marginal productivities, i.e., $w_t = F_{n,t}$ and $r_t = F_{k,t}$.

Finally, government in the model is represented in terms of the level of per capita expenditures g_t, where g_t fluctuates around a trend given by $(1 + \gamma)^t$. The resource constraint in this economy is thus given by

$$c_t + x_t + g_t = y_t. \tag{3}$$

Standard first-order conditions of the household problem yield

$$-\frac{U_{l,t}}{U_{c,t}} = (1 - \tau_{n,t}) A_t (1 + \gamma)^t F_{n,t}, \tag{4}$$

and

$$(1+\tilde{\tau}_{x,t})U_{c,t} = \beta E_t U_{c,t+1}\left[A_{t+1}F_{k,t+1} + (1+\tilde{\tau}_{x,t+1})\,\Gamma_{t+1}\right], \tag{5}$$

where $U_{j,t}$ denotes the derivative of U_t with respect to j, $1+\tilde{\tau}_{x,t} \equiv \frac{1+\tau_{x,t}}{1-\varphi'(x_t/k_t)}$, and $\Gamma_{t+1} \equiv \left(1-\delta-\varphi\left(\frac{x_{t+1}}{k_{t+1}}\right)+\varphi'\left(\frac{x_{t+1}}{k_{t+1}}\right)\left(\frac{x_{t+1}}{k_{t+1}}\right)\right)$. Equation (4) is the marginal rate of substitution between leisure and consumption, which is equal to the after-tax marginal product of labor. Expression (5) is the familiar Euler equation, where intertemporal consumption is a function of the investment tax rate $\tilde{\tau}_{x,t}$.[3]

In this model, the efficiency wedge A_t in (2) resembles the productivity parameter. In a similar fashion, the terms $1-\tau_{n,t}$ and $1/(1+\tilde{\tau}_{x,t})$ introduce a wedge in expressions (4) and (5) with respect to an otherwise standard neoclassical model with no distortions. These wedges resemble (but are not necessarily equal to) tax rates on labor income and investment. Finally, the government consumption wedge g_t is defined by (3).

As discussed by Chari et al. (2007), the appeal of this relatively simple framework is that a large class of macroeconomic models may be mapped into the benchmark prototype economy described above. For example, a model with constant technology and input-financing frictions is equivalent to a growth model with efficiency wedges. Alternatively, an economy with sticky wages and monetary shocks is equivalent to a prototype model with labor wedges. An open economy model with international borrowing and lending is equivalent to a prototype, closed economy model with a government consumption wedge, and so on.

In the benchmark prototype economy, each wedge in isolation captures the total distortion or deviation between inputs and outputs to an equilibrium condition of the model. For example, distortions in the production function captured by the efficiency wedge in (2) may arise from a series of factors. Restuccia and Rogerson (2007) interpret these distortions as differences in government policies at the plant level. Schmitz (2005) argue that such distortions may represent inefficient work practices at the firm level. Lagos (2006) model the efficiency wedge in terms of labor market policies that lead to misallocations of labor across firms. Finally, Chari et al. (2007) present a model where the efficiency wedge is derived from financing frictions that lead some firms to pay higher interest rates than do other firms. Hence the efficiency wedge in (2) is able to capture all these distortions. Therefore, if it is believed that two or more of these distortions affect the equilibrium condition (2), this method cannot identify each of them separately.

[3] This intertemporal wedge may alternatively be defined in terms of a tax on capital income $\tau_{k,t}$. Chari et al. (2006) find that the accounting procedure is not sensitive to this alternative specification of the intertemporal wedge.

2.2 Estimation method

The accounting procedure of Chari et al. (2007) may be implemented in two steps. First, wedges of the benchmark prototype economy are measured by using both the data and a detrended version of the model. Then the prototype model is simulated using the wedges already obtained to assess the contribution of wedges (either separately or in combinations) to fluctuations in variables of interest such as output, labor and investment.

The model is estimated using available quarterly data on Mexican output, hours worked, investment, and government expenditures (including the external sector) for the period 1987Q1-2006Q3. The analysis is restricted to this period as reliable quarterly data on hours worked for Mexico is only available since 1987Q1 (details about data sources and construction of variables can be found in the Appendix).

Measurement of wedges

The measurement of wedges is performed in three steps. First, functional forms for preferences and technology are set and parameter values of the benchmark prototype model are calibrated as in the business cycle literature to be consistent with macroeconomic data for Mexico. Second, a stochastic process for the wedges is estimated using the functional forms assumed and the calibration of parameter values. Finally, the four wedges are measured by using the estimated stochastic process for the wedges, available data and the equilibrium conditions of the benchmark prototype economy.

As in Chari et al. (2007), standard functional forms for preferences and technology are assumed to measure the wedges in the benchmark prototype model. In particular, preferences are of the logarithmic form $U(c, l) = \log c + \psi \log(1 - l)$, the production function is of the Cobb-Douglas type $F(k, l) = k^{\alpha} l^{1-\alpha}$, and the adjustment cost is specified in terms of the quadratic function $\varphi(x/k) = (a/2)(x/k - b)^2$.[4] This adjustment cost function is commonly used in the literature, as in Chari et al. (2007). Following Gollin (2002), the capital share parameter α is fixed to 0.35. This value is within the interval reported by García-Verdú (2005) for Mexico using data at the household level. The depreciation rate δ and the discount factor β are set to 9.1 percent and 0.961 on an annual basis, respectively, as these are the values suggested by Lubik and Teo (2005) using Bayesian estimation techniques on Mexican data. As in Chari et al. (2007), the time allocation parameter ψ is set to 2.24. This implies that Mexican households allocate about one third of their time to working activities, an observation consistent with data reported by the National Employment Survey and the National Survey of Occupation and Employment. The exogenous technology growth rate γ

[4] Chari et al. (2007) show that the business cycle accounting method is qualitatively robust to alternative specifications of production functions and preferences.

is set to 0.8 percent on an annual basis as this is the average growth rate of GDP per capita over the period of analysis. In a similar vein, population growth γ_n is set to 2.2 percent which is the average annual growth rate of population between 15 and 64 years over the period.

As for the adjustment cost function, the parameter b is set equal to the investment-capital share at the steady state, namely $b = (1+\gamma_n)(1+\gamma) - 1 + \delta$, so that adjustment costs are zero at the steady state. The value for parameter a is set to be consistent with a series of alternative values for the elasticity of investment-to-capital ratio with respect to the price of capital (henceforth "Tobin's q elasticity"). In particular, such an elasticity in the model is defined by

$$\eta \equiv \frac{d\log(x_t/k_t)}{d\log P_{k,t}} = \frac{1}{b\varphi''},$$

where $P_{k,t}$ is the market price of capital in the benchmark prototype economy determined by $P_{k,t} = 1/(1-\varphi'(x_{t+1}/k_{t+1}))$. Thus given the values for b and Tobin's q elasticity η, a value for a may be recovered.

Setting an appropriate value for Tobin's q elasticity is sometimes controversial. Using Bayesian techniques, Lubik and Teo (2005) report an elasticity point value of 3 for Mexico. Using data for the US, Christiano and Davis (2006) find that a prototype economy similar to the one presented above with a Tobin's q value of 3 underestimates the volatility in the rate of return of capital observed in the data. For this reason, these authors prefer to work with an elasticity of 1. In this regard, Bernanke et al. (1999) and Chari et al. (2007) argue that a reasonable lower bound for such elasticity should be around 2 as lower elasticity values imply implausible high adjustment costs. Given this controversy, the estimations presented in this paper consider the alternative values of 3 and 1 for Tobin's q elasticity. It is important to remark that an elasticity of 1 should be considered as an extreme value, given the quadratic adjustment cost assumed (cf. Chari et al. (2007)).

The second step is to estimate an stochastic process for the wedges. For such estimation, a vector autoregressive VAR(1) process of the form

$$s_{t+1} = P_0 + Ps_t + \varepsilon_{t+1} \tag{6}$$

is assumed. Here, the vector s_t is defined in terms of the four wedges, namely $s_t = (\log A_t, \tau_{n,t}, \tilde{\tau}_{x,t}, \log g_t)$, and the shock ε_t is i.i.d. and distributed normally with mean zero and covariance matrix V. To ensure that V is positive semidefinite, a lower-triangular matrix Q such that $V = QQ'$ is estimated. Parameters included in matrices P_0, P and V of the VAR(1) process for the wedges are then estimated using maximum likelihood methods, the log-linear decision rules of the benchmark prototype economy, and data on output, labor, investment and government consumption including net exports (see the Appendix and Chari et al. (2006) for details).

Once the stochastic process in (6) is estimated, the next step is to measure the four wedges. These wedges may be recovered from the data and the equilibrium conditions of the benchmark economy. For example, the government consumption wedge may be measured directly from the data as the sum of government expenditures and net exports so that data is consistent with the theory. To measure the remaining three wedges, let y_t^d, l_t^d, x_t^d, and k_0^d denote data on production, labor, investment and the initial capital stock, respectively, and let $y(s_t, k_t)$, $l(s_t, k_t)$, and $x(s_t, k_t)$ represent the decision rules of the model. Then the realized wedge series s_t^d solves

$$y_t^d = y(s_t^d, k_t), l_t^d = l(s_t^d, k_t), x_t^d = x(s_t^d, k_t), \tag{7}$$

with $k_{t+1} = (1-\delta)k_t + x_t^d - \varphi\left(x_t^d/k_t\right)k_t$, $k_0 = k_0^d$ and $g_t = g_t^d$. Thus the three equations (2), (4) and (5) are used to solve for the remaining three unknown elements of the vector s_t.

Contribution of wedges

After estimating the wedges, the benchmark prototype model may be simulated in order to assess, separately and in combinations, the contribution of wedges to fluctuations in variables of interest starting at some initial date. This contribution is measured by comparing the realizations of variables such as output, labor and investment arising from simulating the model to those in the data. For example, define the vector of wedges $s_{1t} = (\log A_t, \bar{\tau}_n, \bar{\tau}_x, \log \bar{g})$ so that in period t the efficiency wedge takes on its period t value while simultaneously keeping the other wedges at some constant values. The corresponding decision rules for output, labor and investment may be denoted by $y^e(s_{1t}, k_t), l^e(s_{1t}, k_t)$, and $x^e(s_{1t}, k_t)$, respectively. These decision rules along with an initial condition k_0^d, the realized wedge series s_t^d and the law of motion for capital may be used to compute sequences for output, labor and investment, denoted by y_t^e, l_t^e and x_t^e, respectively. These sequences are called the *efficiency wedge components* of output, labor and investment. These output, labor and investment components may then be directly compared to actual data to assess how well they can match the data.

Naturally, this accounting exercise may be performed in alternative ways. For example, the *labor wedge components* may be computed in a similar fashion by defining a vector $s_{2t} = (\log \bar{A}, \tau_{n,t}, \bar{\tau}_x, \log \bar{g})$, and so on. It is also possible to construct components for combined wedges. For example, the efficiency plus labor wedge components may be obtained after defining a vector $s_{5t} = (\log A_t, \tau_{n,t}, \bar{\tau}_x, \log \bar{g})$. If the four wedges are fed into the decision rules in (7) and used in combination with both the law of motion for capital and the equation $\log g_t(s_t^d) = \log g_t$, all the movements in output, labor and investment from the simulation are exactly those observed in the data by construction.

Before presenting the results, Table 1 displays the estimates of the AR(1) stochastic process of the wedges for Mexico given by (6) under alternative values for Tobin´s q elasticity. Parameters are estimated with maximum likelihood methods using the whole sample. Naturally, these parameter values are used in the accounting method for each recession.

3 Results

3.1 Benchmark model

The accounting procedure of the business cycle accounting method is now applied to study the two most recent business cycles in Mexico. The first comprises the period 1994Q4-1999Q4 (labeled as the "1995 Recession" below) as the fourth quarter of 1994 is typically associated with the start of the Tequila crisis.[5]The analysis ends in the fourth quarter of 1999 as this is the period where output per capita roughly returns to the level prevailing at the start of the crisis. The period for the second business cycle starts in 2000Q3 and follows through 2006Q3 (labeled as the "2001 Recession" below), given the available data at the time of writing. For illustrative purposes, in the figures shown below output is normalized to 100 at the beginning of each recession.

The results show that the efficiency and labor wedges are the two most promising distortions accounting for output fluctuations in each of the two most recent recessions in Mexico. The investment wedge plays a minor role in accounting for output fluctuations in the 1995 recession but essentially no role in the 2001 recession. Finally, it is shown that output due to the government wedge component is negatively correlated with output for each recession.

a. The 1995 Recession

Figure 2 shows actual output along with three measured wedges: the efficiency wedge A, the labor wedge $(1 - \tau_n)$, and the investment wedge $1/(1 + \tilde{\tau}_x)$ for the period 1994Q4-1999Q4.[6]For illustrative purposes, wedges are estimated with a Tobin's q elasticity of 3.[7]It

[5] Following the definition provided by Kehoe and Prescott (2002), the output fall registered during the 1995 crisis cannot be classified as a great depression.

[6] The government consumption wedge is not reported as it is both highly volatile (see Tables 2 and 4 below) and unable to account for output fluctuations in each recession, as described later.

[7] All the results under a Tobin's q elasticity value of 1 not reported in this paper may be available upon request.

may be noticed that actual (detrended) output per capita falls slightly more than 12 percent two quarters right after the beginning of the crisis. Thereafter it increases gradually so that it returns to its initial level after five years. Remarkably, the efficiency wedge follows closely the output drop in the data and part of its recovery during several quarters. This result is consistent with the findings of Mendoza (2006), Kehoe and Ruhl (2006), and Meza and Quintin (2006). These authors report that total factor productivity registered a large drop during the 1995 recession in Mexico and a slow recovery afterwards. On the other hand, both the labor and investment wedges follow a relatively different pattern than output in general.

The statistical analysis of the wedges is provided in Table 2 assuming a Tobin's q elasticity value of 3.[8]Data is detrended with the HP filter. Part A provides the standard deviation and cross correlation of wedges with respect to output. For example, the first entry shows that the efficiency wedge fluctuates relatively less than output and that such wedge is positively correlated with contemporaneous output. This is also true for the labor wedge. The investment wedge also fluctuates less than output and leads the cycle. Finally, fluctuations in the government wedge are about six times larger than output fluctuations, and this wedge is negatively correlated with contemporaneous output. Part B of Table 2 reports cross correlations between wedges. For example, the efficiency and labor wedges are positively correlated, both contemporaneously and for several leads. In a contemporaneous sense, the efficiency wedge is also positively correlated with the investment wedge but negatively correlated with the government consumption wedge.

The decomposition of output fluctuations in terms of wedges is presented in Table 3, assuming an elasticity value of 3. For example, the first entry in Part A simply states that the efficiency wedge component of output fluctuates relative less with respect to actual output, and it is positively correlated with contemporaneous output. A similar qualitative result is found for output due to either the labor or the investment wedge component, although the former explains a higher fraction of output volatility in the data. The exception is the government consumption wedge component, as simulated output is negatively correlated with contemporaneous output. Part B of Table 3 shows that all cross correlations that do not involve output due the government consumption wedge are positive.

The conclusion derived from Table 3 is that the efficiency wedge is the most promising to explain output fluctuations during the Tequila crisis in the sense that exhibits the highest contemporaneous correlation with output combined with a substantial explanation of output

[8] As a matter of comparison, properties of the wedges and the output components for the entire sample (i.e., 1987Q1-2006Q3) may be found in Tables 6 and 7 respectively, assuming a Tobin's q elasticity of 3. Perhaps not surprising, these results are very similar in a qualitative sense to those found for the 1995 and 2000 recessions (see below).

variability. Along these lines, the labor wedge is also promising although it displays a slightly lower correlation with output. The investment wedge is less important than the other two in the sense that it only contributes to explain less than 20 percent of output variability. Finally, output due to the government consumption wedge is simply inconsistent with actual data. These results suggest that the efficiency and the labor wedge can substantially explain output fluctuations in Mexico for this particular period.[9]

Given the results of Table 3, Figures 3 and 4 present data on output along with the predictions of the model due to efficiency and labor wedge components under alternative values of Tobin's q elasticity, respectively. Consider first the results from Figure 3. Consistent with the results reported in Table 3, simulated output due to the efficiency wedge component follows actual data relatively close regardless of the value for Tobin's q elasticity. In fact, this wedge explains between 70 and 81 percent of the output fall at the trough of the recession, depending on the parametrization of the adjustment cost function. Figure 4 now presents the results when only the labor wedge component is in effect. Depending on the value of Tobin's q elasticity, the labor wedge is able to explain between 51 and 58 percent of the output fall at the trough of the recession.

b. The 2001 Recession

The focus now is to study fluctuations in macroeconomic variables during the most recent business cycle in Mexico which comprises the period 2000Q3-2006Q3. First, Figure 5 shows data on output and the evolution of efficiency, labor and investment wedges assuming a Tobin's q elasticity of 3. Here, detrended output exhibits a fall of 7 percent at the trough of the recession. As for the case of the 1995 recession, the efficiency wedge follows actual output closely, at least for the first 4.5 years. The labor wedge initially fluctuates around its initial level, and improves significantly around the second half of 2004. Finally, the investment wedge moves in opposite direction to output in general.

Table 4 provides a statistical description of Figure 5 under a Tobin's q elasticity of 3. Not surprisingly, the efficiency wedge is highly positive correlated with output and fluctuates relatively less. In contrast, the labor wedge fluctuates relatively more than output and has a lower contemporaneous correlation with output. Contrary to the results presented in Table 2, the investment wedge is now negatively correlated with output for several leads and lags. In addition, the government consumption wedge still exhibits a negative correlation with output and a relatively large volatility. Part B of Table 4 illustrates that contemporaneous cross correlations between wedges are just barely positive or even negative.

[9] Chari et al. (2007) report that the efficiency and the labor wedge can substantially explain the cyclical properties of US output. Kersting (2008) finds that the labor wedge plays a significant role to explain output fluctuations in the UK economy.

To provide an analysis about the importance of each wedge in isolation to explain output fluctuations, Table 5 presents the properties of the output components for the period 2000Q3-2006Q3. In general, the results are similar to those reported for the 1995 recession. Namely, output due to the efficiency and labor wedge (each in isolation) continue to significantly explain output fluctuations in terms of variability and cross correlations. The major difference now is that output due to the investment wedge is negatively correlated with actual output for several leads and lags. Thus the investment wedge is unable to explain output fluctuations in the 2001 recession. A similar statement still applies to the government consumption wedge.

Given the results of Table 5, Figures 6 and 7 present data on output along with predictions from the efficiency and labor wedge components, respectively, under alternative values for Tobin's q elasticity. Figure 6 illustrates that the efficiency wedge component is able to explain between 73 and 78 percent of the output fall at the trough of the recession. Remarkably, this result is very similar to the one reported for the 1995 recession. On the other hand, Figure 7 is consistent with the results from Table 5 in the sense that output from the labor wedge component is less correlated with actual output and more volatile, especially after 2005. At the trough of the recession, the labor wedge component now only explains between 11 and 17 percent of the output fall, a fraction substantially lower as compared to the 1995 recession.

3.2 A variable capital utilization framework

A potential drawback of the business cycle accounting exercise presented above is that it assumes a fixed capital utilization. The reason is that the efficiency wedge may be incorrectly measured if capital utilization is assumed to be exogenous in the model. For example, Gertler et al. (2007) report that most of the variation in measured productivity during the Korean crisis of 1997 is due to capital utilization. Similarly, Meza and Quintin (2006) and Mendoza (2006) find that capital utilization accounts for between 25 to 30 percent of the fall in total factor productivity during the 1995 recession in Mexico. These results suggest that the measurement of the efficiency wedge may be substantially affected once endogenous capital utilization is allowed in the benchmark prototype economy. This change may in turn potentially affect the relative contribution of wedges to macroeconomic fluctuations. In fact, Chari et al. (2007) report that adding variable capital utilization to the analysis shifts the relative contributions of efficiency and labor wedges to output fluctuations.

To address this issue, the specification of Chari et al. (2007) is followed. The idea is to replace the production function of the benchmark prototype economy by $y_t = A_t(k_t h_t)^\alpha (n h_t)^{1-\alpha}$, where n is the number of workers employed and h_t is the length of the workweek. Hence total labor input is given by $l_t = nh_t$. If the number of workers is constant, all the variation in labor is due to the workweek h_t. Under this specification, the services of capital, $k_t h_t$, are proportional to the product of the stock k_t and labor input l_t, so that the flow of capital services is affected by variations in the labor input l_t. Normalizing the number of workers employed n to 1, the production function in the benchmark prototype economy may be expressed as

$$y_t = A_t k_t^{\alpha} l_t.$$

As expected, allowing for variable capital utilization induces some changes in the measured efficiency wedge in each recession. Nevertheless, the efficiency wedge component of output does not substantially change once endogenous capital utilization is taken into account (not shown). Figure 8 presents actual and simulated output due to the efficiency wedge component under fixed and variable capital utilization for each recession, assuming a Tobin's q elasticity of 3. Part A of Figure 8 shows that the efficiency wedge roughly explains the same fraction of the output fall at the trough of the 1995 recession regardless of whether capital utilization is fixed. In terms of the 2001 recession, the efficiency wedge explains a lower fraction of the output fall at the trough of the recession, but still a substantial one (about 65 percent). The conclusion derived from Figure 8 is that the model with variable capital utilization does not substantially change the relative contribution of the efficiency wedge component for explaining the output fall at the trough of the recession.

A similar exercise is performed for the labor wedge component. As for the efficiency wedge case, the labor wedge component remains about the same under the endogenous capital utilization framework (not shown). Figure 9 presents actual and simulated output for each recession, again assuming $\eta = 3$. Now the labor wedge is able to explain a larger fraction of the output fall at the trough of the 1995 recession, but for the 2001 recession such a fraction remains essentially unchanged. Thus as Chari et al. (2007) report for the US, allowing for variable capital utilization changes the response of output to the efficiency and labor wedge components, but this alternative specification does not modify the earlier finding that output fluctuations may be reasonably explained in terms of efficiency and labor wedges.[10]

[10] Simulations were also performed under no adjustment costs for investment (i.e., assuming a Tobin's q elasticity of infinity). In such a case, the efficiency and labor wedges are also able to substantially account for movements in output for each recession and for alternative specifications on capital utilization. In fact, these findings are even reinforced in the sense that the investment wedge is unable to account for output fluctuations in each recession when η goes to infinity.

3.3 Counterfactual exercises

As shown previously, the efficiency and labor wedges may reasonably explain output fluctuations in each of the recessions considered, whereas the investment and government consumption wedges seem to play either a minor or no role. Given this result, the goal now is to perform a series of counterfactual exercises to evaluate to what extent the absence of either efficiency or labor frictions would have led to smoother output drops. In this sense, the exercise may provide an insight as to what class of distortions may be responsible for the relatively large output drops during recessions in Mexico.[11]

Consider first the analysis of simulated output under the counterfactual that the efficiency wedge is eliminated. This implies that movements in output are due to the remaining three wedges. Figure 10 presents actual and the corresponding simulated output in each business cycle for alternative values of Tobin's q elasticity under fixed capital utilization. For the 1995 recession, the counterfactual shows that output would have fallen between 2.2 and 3.8 percent in the absence of efficiency wedge distortions at the trough of the recession, in comparison to the 12 percent fall observed in the data. As for the 2001 recession, the absence of frictions in the efficiency wedge also implies a much milder recession as output falls at most 2.2 percent. This compares favorably to the 7 percent output fall at the trough of the recession.

Figure 11 presents the counterfactual exercise of eliminating the efficiency wedge under alternative specifications on capital utilization for each recession. To simplify the exposition, only the results with an elasticity value of 3 are presented. The fall in simulated output at the trough of the recession is about the same for each specification in the 1995 recession, and slightly larger under the variable capital utilization framework in the 2001 recession.

Now it is time to consider a series of counterfactual exercises when only the labor wedge is eliminated. Figure 12 presents actual and simulated output when only the labor wedge is turned off in the prototype economy under alternative Tobin's q elasticities. For the 1995 recession, simulated output falls between 5 and 6 percent at the trough of the recession. Even though these numbers imply an output fall about half of the actual fall in the data, they are larger than those reported in Part A of Figure 10. In terms of the 2001 recession, simulated output is not able to significantly improve upon actual data as it falls between 6 and 6.5 percent at the trough of the recession.

To complete the series of counterfactual exercises, Figure 13 exhibits actual and predicted output in the absence of the labor wedge component under two specifications for capital utilization. As before, simulations are performed with a Tobin's q elasticity value of 3. It

[11] See section 4 for details.

may be observed that simulated output under the variable capital utilization only falls 3.2 percent at the trough of the 1995 recession, but it falls 5.5 percent at the trough of the 2001 recession.

Overall, the counterfactual exercises shown in Figures 10 - 13 suggest that removing distortions captured by the efficiency wedge is more important than removing distortions captured by the labor wedge in order to avoid large output falls along the business cycle in Mexico.[12]This conclusion is robust to alternative values for the Tobin's q elasticity and alternative specifications on capital utilization.

4 Discussion

So far the business cycle accounting method of Chari et al. (2007) applied to Mexican data has presented evidence about the most important wedges driving movements in output per capita in Mexico along the business cycle. In addition, the counterfactual exercises suggest that not only the efficiency wedge is important for explaining output fluctuations in Mexico but it may be also crucial to avoid large output falls along the business cycle. Given that the efficiency wedge may be consistent with a full set of distortions arising from different sources, this section discusses some plausible interpretations of the efficiency wedge found in the literature[13]

Recently there have been several efforts in trying to understand what kind of distortions are captured by the efficiency wedge, i.e., distortions that occur either within or across firms which cause an inefficient use of factor inputs. One possibility is that the efficiency wedge may represent relative price distortions. For example, deteriorations in the terms of trade that typically accompany sudden stops make imported intermediates more expensive, thus acting like a decrease in TFP. In this regard, Kehoe and Ruhl (2006) present a model calibrated to match some stylized facts of the sudden stop registered in Mexico during the 1995 recession. However, when the model is subject to a sudden stop shock, the authors find that deteriorations in the terms of trade do not show up as changes in TFP because standard national accounting definitions of GDP hold relative prices constant.

Distortions in relative prices that may be represented in terms of the efficiency wedge may

[12] This result does not imply that labor distortions are not important. As discussed below in detail, labor market distortions may well reflect distortions represented in terms of the efficiency wedge (see, for example, Lagos (2006)).

[13] This view is reminiscent of the "mushroom process" pointed out by Harberger (1998) whereby TFP improvements may stem from different sources. For this reason, the results reported here should be interpreted with caution. For example, the finding that the efficiency wedge can reasonably explain the output fall in Mexico during the 1995 crisis does not imply that a large shock to TFP was the driving force of such fall as the efficiency wedge may be consistent with distortions in relative prices as detailed below.

arise as a result of policy distortions as well. In a related strand of the literature, Restuccia and Rogerson (2007) present a model with heterogenous production units that only differ in the level of TFP at the plant level. In a version of the model, the authors introduce policy distortions whose effect is to create heterogeneity in the prices faced by individual producers. These distortions do not imply changes in aggregate prices or aggregate factor accumulation. As a result of policy distortions, there is a reallocation of resources across plants that may lead to decreases in output and TFP of almost 30 percent.

The type of policy distortions studied by Restuccia and Rogerson (2007) are sufficiently general so that several interpretations may be offered. For example, the heterogeneity in prices faced by individual firms may be the result of financial frictions. In Chari et al. (2007), these frictions take the form of moral hazard problems at the firm level in the sense that smaller firms are charged with a higher interest rate on loans than larger firms in order to pay for an intermediate input in advance of production. In Erosa and Hidalgo (2007), financial frictions are represented by the ability of the lender to enforce contract payments from entrepreneurs who need to borrow in order to operate their technologies at optimal scales. In their model, an increase in enforcement may lead to a decrease in the price of intermediate goods and a rise in the wage rate. In a similar vein, Bergoeing et al. (2002) consider a model where the government favors some firms with low interest rate loans whereas the remaining firms must pay a tax on the interest rate for loans. In all these cases, the reallocation of resources as a result of the price distortion leads to a fall in TFP.[14]

An alternative set of price distortions is considered by Lagos (2006). He presents a model with frictional labor markets and firms subject to idiosyncratic shocks. In his model, labor market policies may affect the aggregate level of TFP because policy induces changes in the productivity composition of active units (i.e., workers and firms), and aggregate TFP is related to the average productivity of these active units. Among the labor market policies considered are employment subsidies, hiring subsidies and firing taxes which may be interpreted as firing restrictions. The author finds that hiring subsidies increase the level of TFP whereas employment subsidies and firing taxes decrease it. In the first case, the intuition is that hiring subsidies stimulate job creation. This increases labor market tightness and thus raises TFP. On the other hand, employment subsidies and firing taxes make firms more tolerant of low productivity realizations at a time when these policies simultaneously distort the job-creation and job-destruction rates. This in turn lowers the average productivity of active firms. Along these lines, Heckman and Pagés (2003) provide some evidence that in-

[14] Remarkably, the model of Bergoeing et al. (2002) is used to understand the substantial differences in output performance between Chile and Mexico over the last 25 years. The authors argue that the relative low level of TFP in Mexico may be explained in terms of inefficiencies in the banking sector and poorly designed bankruptcy laws.

demnity costs for dismissals (i.e., firing taxes) are about three times larger in Mexico than the OECD average.

This discussion leads to the idea that the class of policy distortions mentioned above might act as a propagation mechanism whereby output falls may be exacerbated in the presence of a shock. More generally, this idea may suggest that the relatively large output falls registered in Mexico during the last years might have been less pronounced in the absence of such policy distortions. Of course, a detailed model is required to give a proper answer to this conjecture. This constitutes an interesting area to explore in future research.

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Appendix

This appendix briefly discusses how variables are constructed as well as data sources. This construction is based on the suggestions by Chari et al. (2006).

Output is real GDP minus real taxes less subsidies on production. Ideally, services from consumer durables and depreciation from consumer durables (appropriately deflated) should be added to GDP so that the data is consistent with the theory. However, there is no information about capital stock for consumer durables in Mexico so these two components are not taken into account. Investment is real gross domestic investment, including inventories and real consumption expenditures on durable goods. Government consumption is defined as the sum of real government consumption plus real net exports of goods and services. All NIPA series are from INEGI, the National Institute of Statistics. Output, investment and government consumption are divided by the population between 15 and 64 years. Population is calculated using data from OECD and the National Employment Survey.

Labor is defined in terms of working hours per capita (employment $\times$ working hours divided by population between 15 and 64 years). Employment is the number of occupied population aged between 15 and 64 years as defined by the National Survey of Occupation and Employment for the period 2005Q1 onward. The remaining series of employment are calculated from an estimated index of employment. This index is constructed from estimates of total employment for personnel between 15 and 64 years using information from the National Employment Survey and the National Survey of Urban Employment, following the suggestions of Neumeyer and Perri (2005). Working hours are average working hours per week for the occupied population as reported by the National Employment Survey for the period 2000Q2-2004Q4 and by the National Survey of Occupation and Employment for the period 2005Q1 onward. For the remaining quarters, series are estimated using an index constructed with information on average working hours per week in the manufacturing sector from the Monthly Industrial Survey.

Table 1

Parameters of Vector AR(1) Stochastic Process under Alternative Tobin's q Elasticities Estimated Using Maximum Likelihood with Mexican Data, 1987Q1-2006Q3[a]

A. Tobin's q Elasticity = 3

Coefficient matrix P on lagged states

1.066 (0.889,1.243)	-0.423 (-0.828,-0.019)	-0.052 (-0.192,0.087)	0.089 (0.013,0.164)
0.102 (-0.030,0.234)	0.661 (0.389,0.934)	-0.044 (-0.146,0.058)	0.055 (0.002,0.109)
0.187 (-0.058,0.432)	0.159 (-0.379,0.698)	0.832 (0.666,0.999)	-0.017 (-0.117,0.083)
0.451 (-0.139,1.042)	0.513 (-0.597,1.624)	-0.296 (-0.777,0.185)	0.880 (0.641,1.119)

Coefficient matrix Q where $V = QQ'$

0.022 (0.017,0.026)	0	0	0
0.003 (-0.004,0.010)	0.022 (0.016,0.028)	0	0
0.011 (-0.003,0.026)	0.005 (-0.020,0.029)	0.024 (0.016,0.033)	0
-0.014 (-0.058,0.031)	0.121 (0.091,0.151)	0.040 (0.020,0.060)	0.037 (0.020,0.054)

Means of states = [0.473 (0.422,0.525), 0.408 (0.371,0.445), 0.397 (0.294,0.500), -1.739 (-1.947, -1.531)]

B. Tobin's q Elasticity = 1

Coefficient matrix P on lagged states

1.010 (0.937,1.083)	-0.359 (-0.593,-0.125)	-0.017 (-0.052,0.018)	0.081 (0.035,0.127)
0.070 (0.007,0.132)	0.684 (0.498,0.870)	-0.025 (-0.061,0.011)	0.056 (0.020,0.093)
0.229 (0.061,0.397)	0.202 (-0.400,0.804)	0.883 (0.790,0.976)	-0.045 (-0.170,0.079)
0.279 (-0.043,0.601)	0.379 (-0.519,1.277)	-0.145 (-0.326,0.036)	0.918 (0.722,1.114)

Coefficient matrix Q where $V = QQ'$

0.022 (0.018,0.025)	0	0	0
0.002 (-0.003,0.008)	0.023 (0.018,0.027)	0	0
-0.013 (-0.038,0.011)	0.037 (0.013,0.061)	0.057 (0.043,0.070)	0
-0.015 (-0.050,0.021)	0.123 (0.098,0.148)	0.032 (0.019,0.044)	0.043 (0.034,0.053)

Means of states = [0.482 (0.445,0.519), 0.407 (0.381,0.433), 0.423 (0.345,0.501), -1.720 (-1.860,-1.580)]

[a] To ensure stationarity, a penalty to the likelihood function proportional to $max(|\lambda_{\max}| - 0.995, 0)^2$ is added as in Chari et al. (2007), where $\lambda_{\max}$ is the maximal eigenvalue of P. Numbers in parenthesis are 90 percent confidence intervals for a bootstrapped distribution with 500 replications. To ensure that the variance-covariance matrix V is positive definite, Q is estimated rather that $V = QQ'$.

Table 2

PROPERTIES OF THE WEDGES WITH TOBIN'S Q ELASTICITY = 3, 1994:4-1999:4 *

A. Summary Statistics						
	Standard Deviation Relative	Cross Correlation of Wedge with Output at Lag k=				
Wedges	to Output	-2	-1	0	1	2
Efficiency	0.76	-0.25	0.59	0.95	0.44	-0.38
Labor	0.83	-0.18	0.21	0.59	0.54	0.21
Investment	0.80	0.40	0.67	0.38	-0.14	-0.16
Government Consumption	5.94	0.23	-0.63	-0.94	-0.54	-0.12

B. Cross Correlations					
	Cross Correlation of X with Y at Lag k=				
Wedges (X,Y)	-2	-1	0	1	2
Efficiency, Labor	0.20	0.53	0.34	0.01	-0.22
Efficiency, Investment	-0.10	-0.16	0.28	0.67	0.21
Efficiency, Government Consumption	-0.11	-0.47	-0.84	-0.45	0.35
Labor, Investment	-0.20	0.06	0.11	0.15	0.49
Labor, Government Consumption	0.01	-0.38	-0.67	-0.52	-0.20
Investment, Government Consumption	-0.50	-0.44	-0.42	0.09	0.29

*Statistics based on logged and HP-filtered series.

Table 3

PROPERTIES OF THE OUTPUT COMPONENTS WITH TOBIN'S Q ELASTICITY = 3, 1994:4-1999:4 *

A. Summary Statistics						
	Standard Deviation Relative	Cross Correlation of Wedge with Output at Lag k=				
Output Components	to Output	-2	-1	0	1	2
Efficiency	0.75	-0.27	0.59	0.94	0.45	-0.33
Labor	0.77	-0.25	0.50	0.86	0.56	0.18
Investment	0.17	0.35	0.70	0.47	-0.09	-0.20
Government Consumption	0.59	0.30	-0.53	-0.86	-0.52	-0.35

B. Cross Correlations					
	Cross Correlation of X with Y at Lag k=				
Output Components (X,Y)	-2	-1	0	1	2
Efficiency, Labor	0.15	0.51	0.69	0.31	-0.30
Efficiency, Investment	-0.18	-0.12	0.36	0.66	0.16
Efficiency, Government Consumption	-0.30	-0.44	-0.77	-0.34	0.34
Labor, Investment	-0.32	-0.04	0.35	0.31	0.51
Labor, Government Consumption	-0.24	-0.53	-0.95	-0.50	-0.09
Investment, Government Consumption	-0.51	-0.22	-0.34	0.09	0.43

*Statistics based on logged and HP-filtered series.

Table 4

PROPERTIES OF THE WEDGES WITH TOBIN'S Q ELASTICITY = 3, 2000:3-2006:3 *

A. Summary Statistics						
	Standard Deviation Relative	Cross Correlation of Wedge with Output at Lag k=				
Wedges	to Output	-2	-1	0	1	2
Efficiency	0.84	0.29	0.58	0.84	0.57	0.34
Labor	1.42	0.45	0.45	0.43	0.45	0.51
Investment	1.44	-0.46	-0.59	-0.83	-0.61	-0.53
Government Consumption	7.54	0.04	-0.23	-0.22	-0.31	-0.42

B. Cross Correlations					
	Cross Correlation of X with Y at Lag k=				
Wedges (X,Y)	-2	-1	0	1	2
Efficiency, Labor	0.21	0.24	-0.07	0.24	0.17
Efficiency, Investment	-0.28	-0.45	-0.79	-0.38	-0.31
Efficiency, Government Consumption	-0.14	-0.12	0.10	-0.10	0.27
Labor, Investment	-0.28	-0.33	-0.39	-0.40	-0.31
Labor, Government Consumption	-0.50	-0.43	-0.68	-0.25	-0.26
Investment, Government Consumption	0.28	0.35	0.03	0.21	-0.25

*Statistics based on logged and HP-filtered series.

Table 5

PROPERTIES OF THE OUTPUT COMPONENTS WITH TOBIN'S Q ELASTICITY = 3, 2000:3-2006:3 *

A. Summary Statistics						
	Standard Deviation Relative	Cross Correlation of Wedge with Output at Lag k=				
Output Components	to Output	-2	-1	0	1	2
Efficiency	0.75	0.22	0.59	0.84	0.58	0.40
Labor	1.36	0.33	0.50	0.50	0.51	0.54
Investment	0.27	-0.46	-0.60	-0.82	-0.62	-0.58
Government Consumption	1.05	0.11	-0.10	-0.06	-0.20	-0.38

B. Cross Correlations					
	Cross Correlation of X with Y at Lag k=				
Output Components (X,Y)	-2	-1	0	1	2
Efficiency, Labor	0.23	0.30	0.17	0.33	0.11
Efficiency, Investment	-0.18	-0.45	-0.74	-0.42	-0.31
Efficiency, Government Consumption	-0.16	-0.06	0.07	-0.04	0.26
Labor, Investment	-0.20	-0.42	-0.47	-0.51	-0.40
Labor, Government Consumption	-0.50	-0.32	-0.84	-0.20	-0.26
Investment, Government Consumption	0.28	0.32	0.09	0.12	-0.28

*Statistics based on logged and HP-filtered series.

Table 6

PROPERTIES OF THE WEDGES WITH TOBIN'S Q ELASTICITY = 3, 1987:1-2006:3 *

A. Summary Statistics

Wedges	Standard Deviation Relative to Output	Cross Correlation of Wedge with Output at Lag k= -2	-1	0	1	2
Efficiency	0.76	0.50	0.74	0.91	0.73	0.48
Labor	0.97	0.51	0.58	0.62	0.60	0.51
Investment	1.00	-0.02	0.02	-0.09	-0.10	-0.15
Government Consumption	7.23	-0.42	-0.66	-0.74	-0.66	-0.54

B. Cross Correlations

Wedges (X,Y)	Cross Correlation of X with Y at Lag k= -2	-1	0	1	2
Efficiency, Labor	0.40	0.49	0.32	0.41	0.40
Efficiency, Investment	-0.16	-0.16	-0.23	-0.03	-0.07
Efficiency, Government Consumption	-0.41	-0.54	-0.59	-0.52	-0.31
Labor, Investment	-0.04	0.06	0.01	0.01	0.13
Labor, Government Consumption	-0.50	-0.59	-0.71	-0.56	-0.40
Investment, Government Consumption	-0.10	-0.11	-0.26	-0.13	-0.02

*Statistics based on logged and HP-filtered series.

Table 7

PROPERTIES OF THE OUTPUT COMPONENTS WITH TOBIN'S Q ELASTICITY = 3, 1987:1-2006:3 *

A. Summary Statistics

Output Components	Standard Deviation Relative to Output	Cross Correlation of Wedge with Output at Lag k= -2	-1	0	1	2
Efficiency	0.76	0.48	0.74	0.91	0.74	0.51
Labor	1.00	0.53	0.72	0.78	0.71	0.59
Investment	0.22	-0.01	0.04	-0.04	-0.05	-0.11
Government Consumption	0.83	-0.33	-0.55	-0.62	-0.58	-0.52

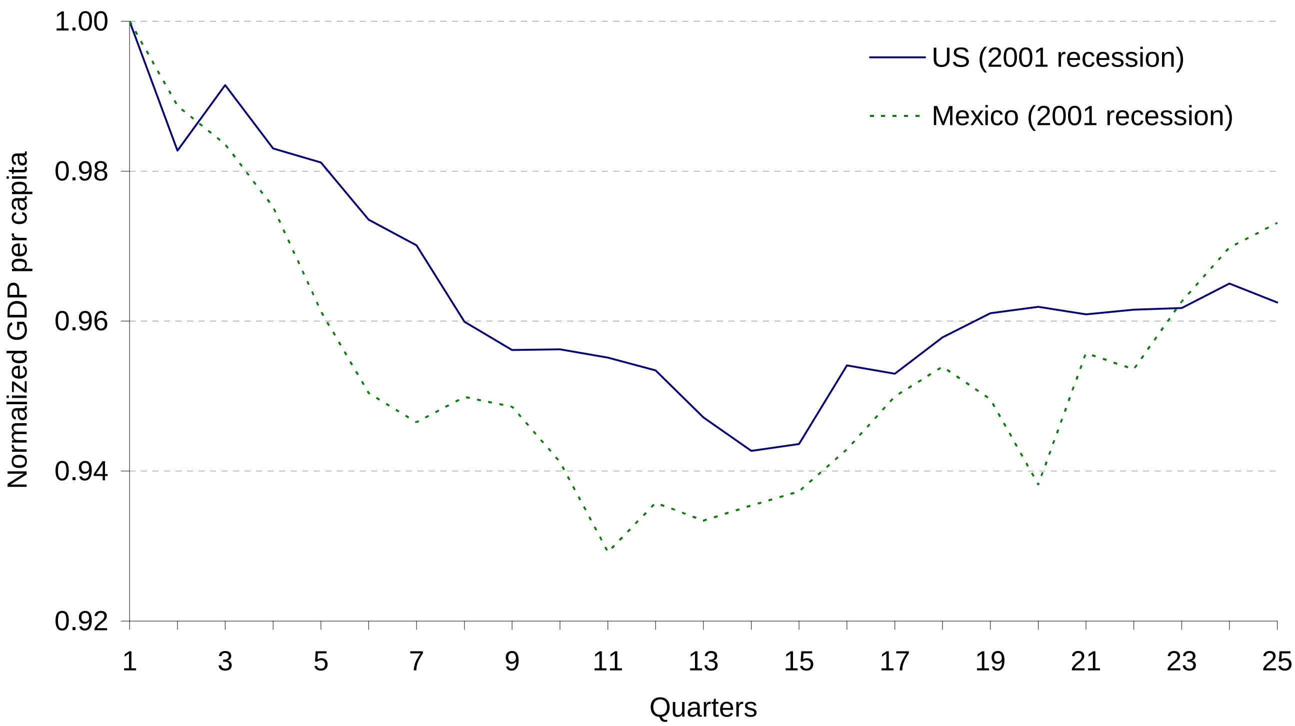
B. Cross Correlations

Output Components (X,Y)	Cross Correlation of X with Y at Lag k= -2	-1	0	1	2
Efficiency, Labor	0.45	0.61	0.61	0.59	0.44
Efficiency, Investment	-0.12	-0.10	-0.17	-0.02	-0.06
Efficiency, Government Consumption	-0.40	-0.51	-0.56	-0.46	-0.28
Labor, Investment	-0.02	0.06	0.06	0.01	0.08
Labor, Government Consumption	-0.55	-0.67	-0.91	-0.62	-0.40
Investment, Government Consumption	-0.11	-0.07	-0.19	-0.15	-0.04

*Statistics based on logged and HP-filtered series.

Figure 1
Detrended US and Mexico GDP per capita

A. Linear Trend



B. Hodrick - Prescott Filter

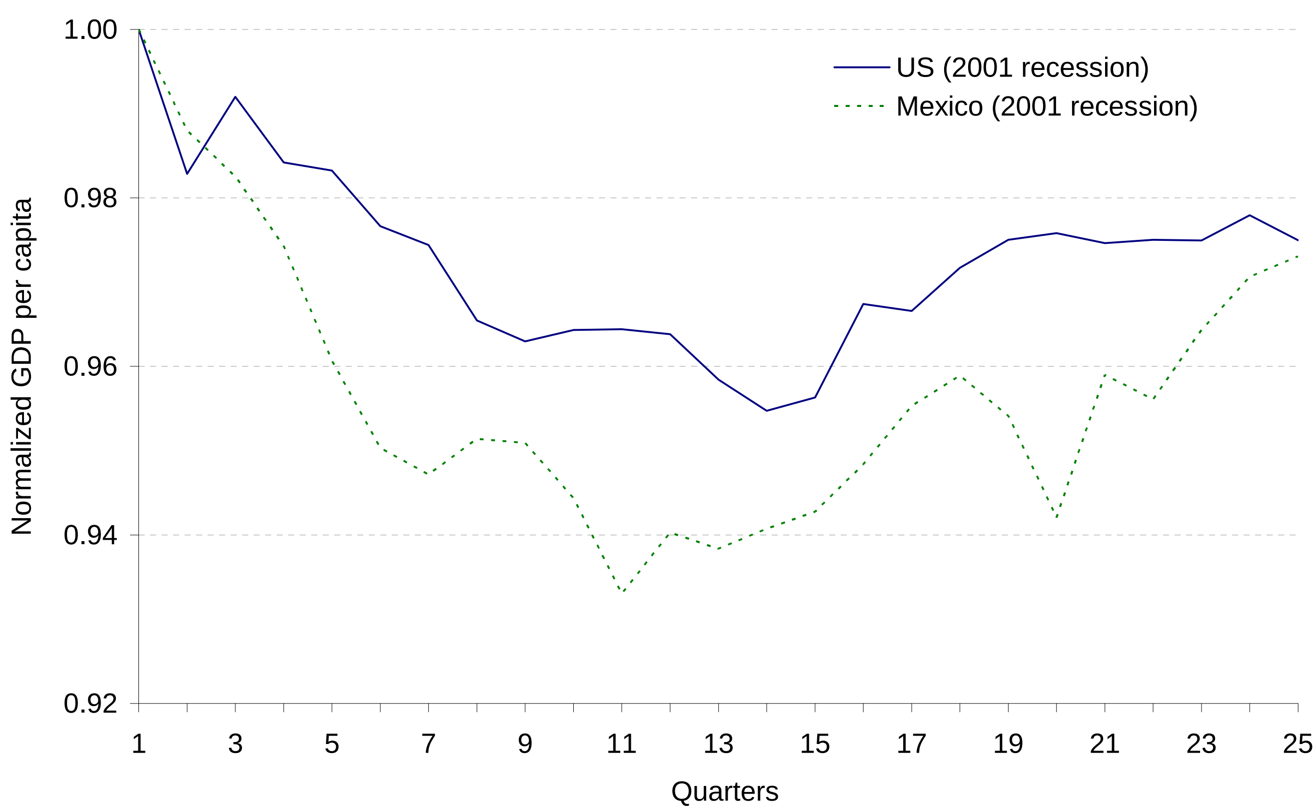


Figure 2
Output and Measured Wedges: Tobin's q Elasticity = 3

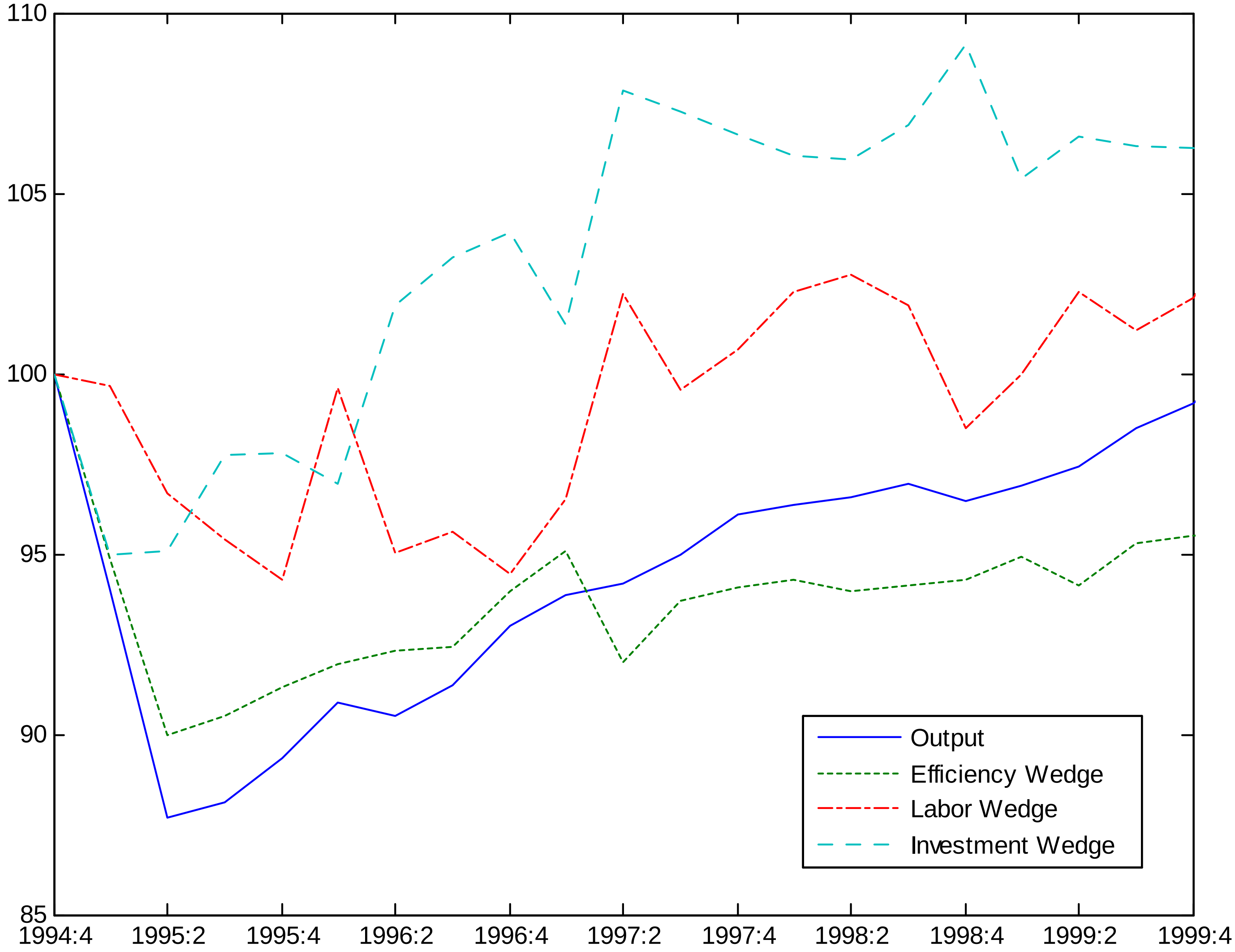


Figure 3
Output and Predictions of Model with Just the Efficiency Wedge

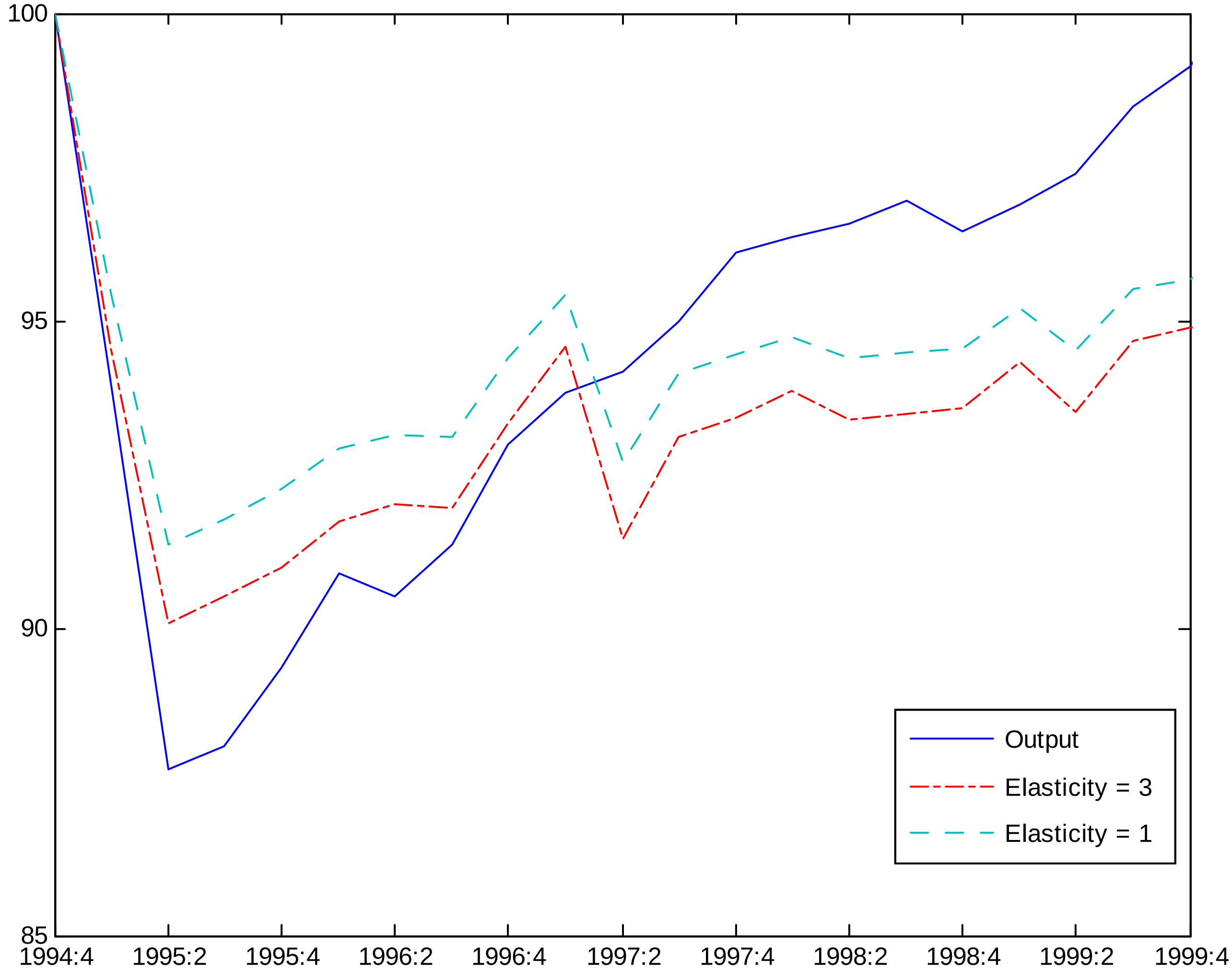


Figure 4
Output and Predictions of Model with Just the Labor Wedge

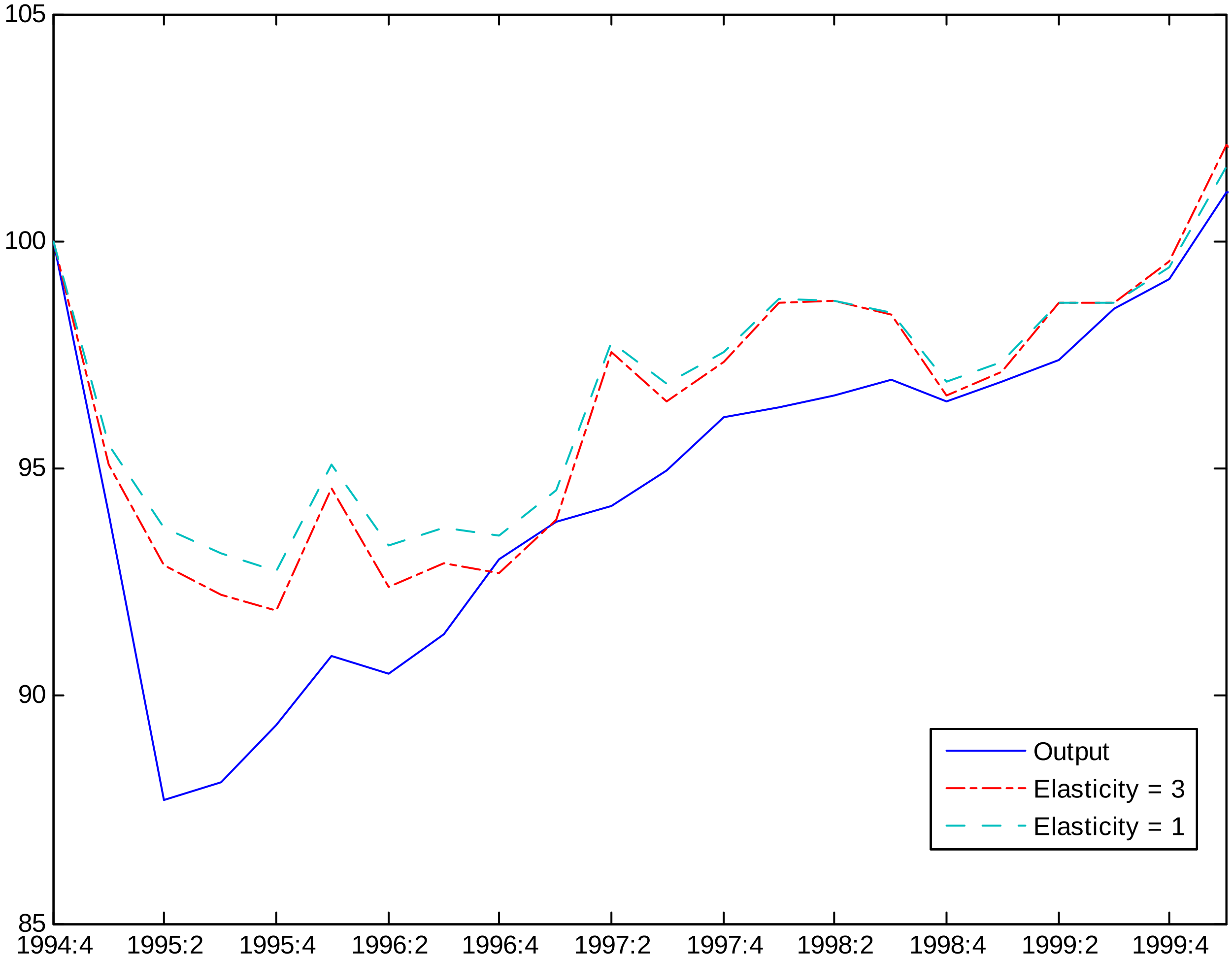


Figure 5
Output and Measured Wedges: Tobin's q Elasticity = 3

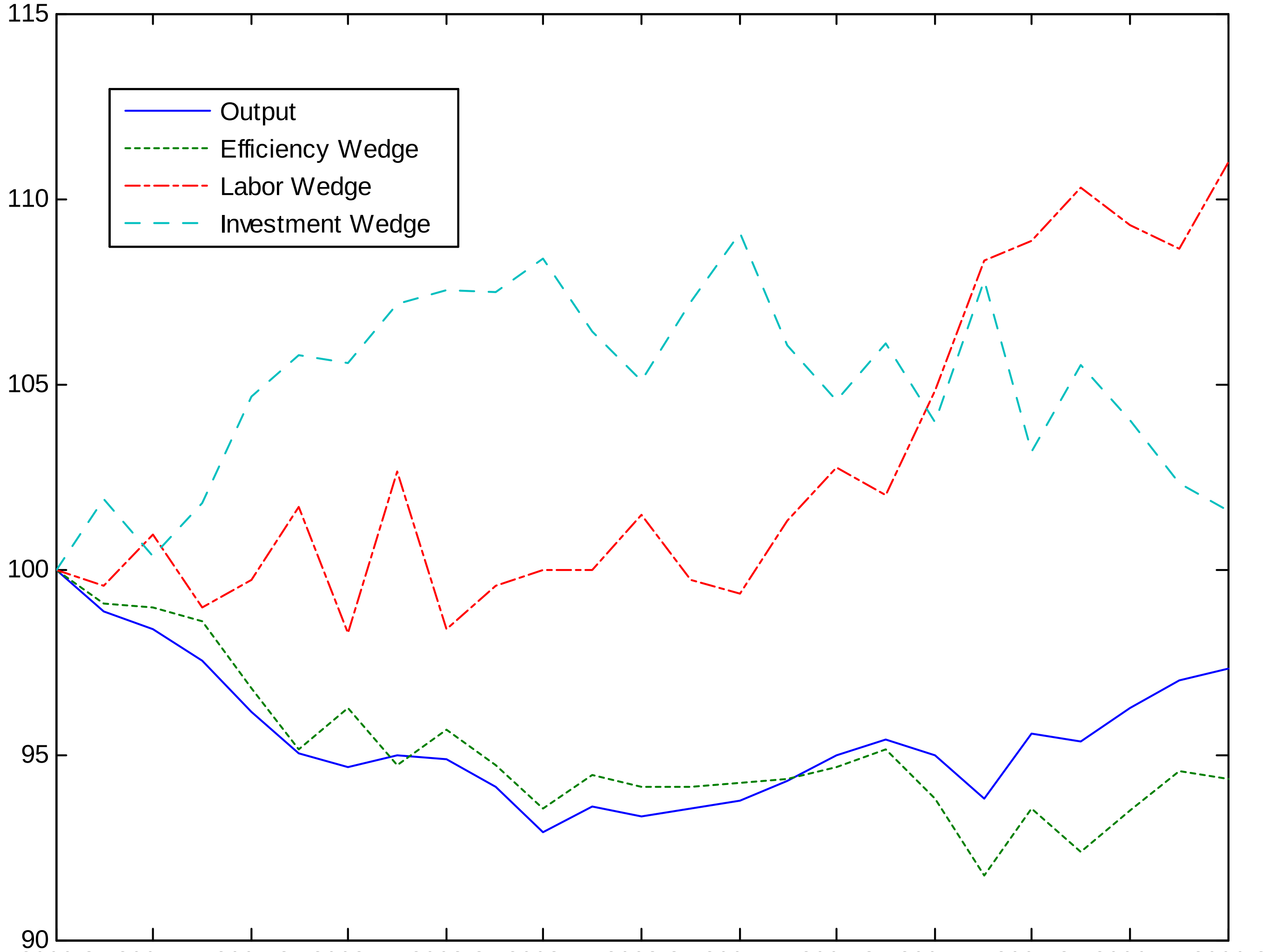


Figure 6
Output and Predictions of Model with Just the Efficiency Wedge

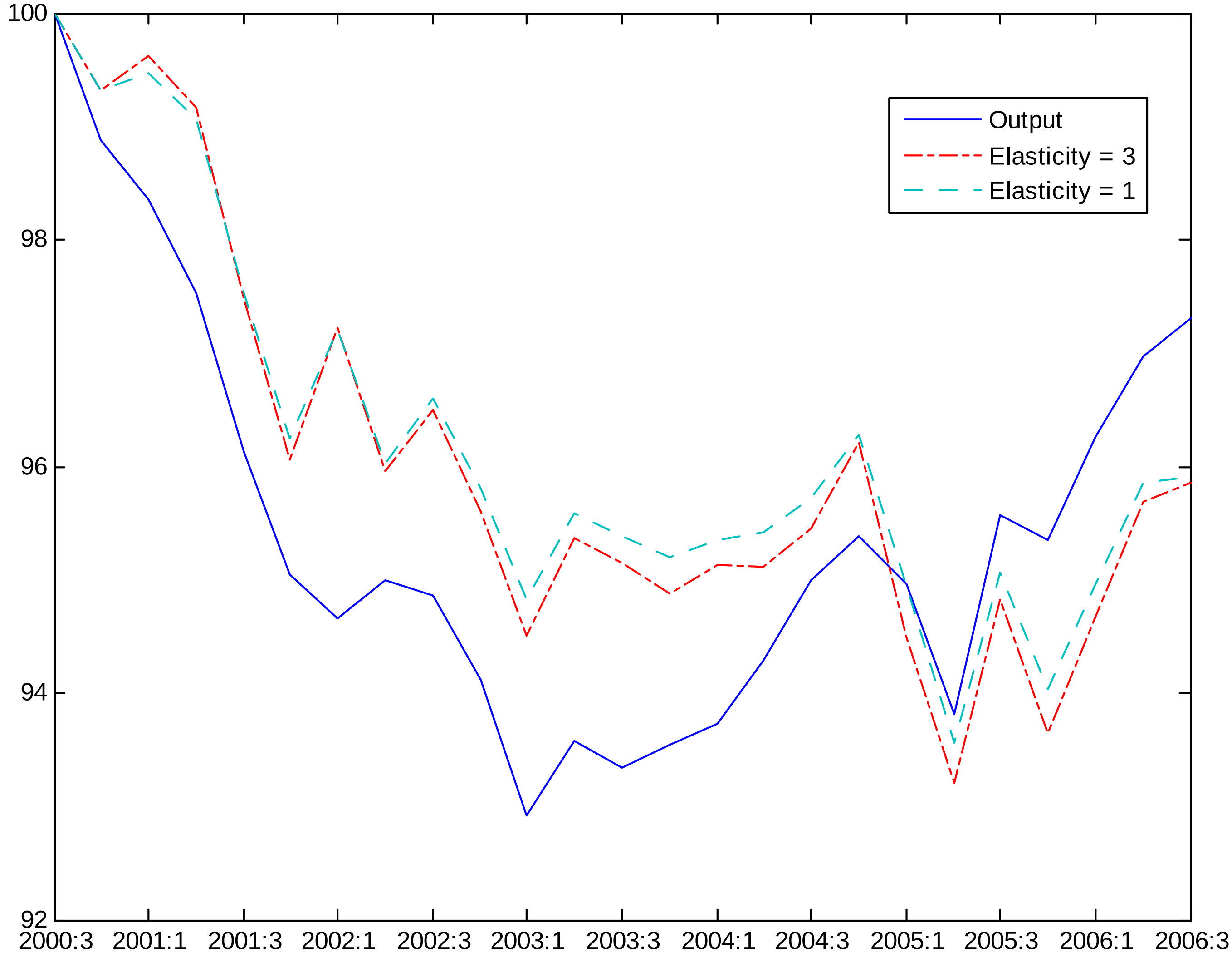


Figure 7
Output and Predictions of Model with Just the Labor Wedge

Figure 8
Output and Predictions of Model with Just the Efficiency Wedge and Two Capital Utilization Specifications

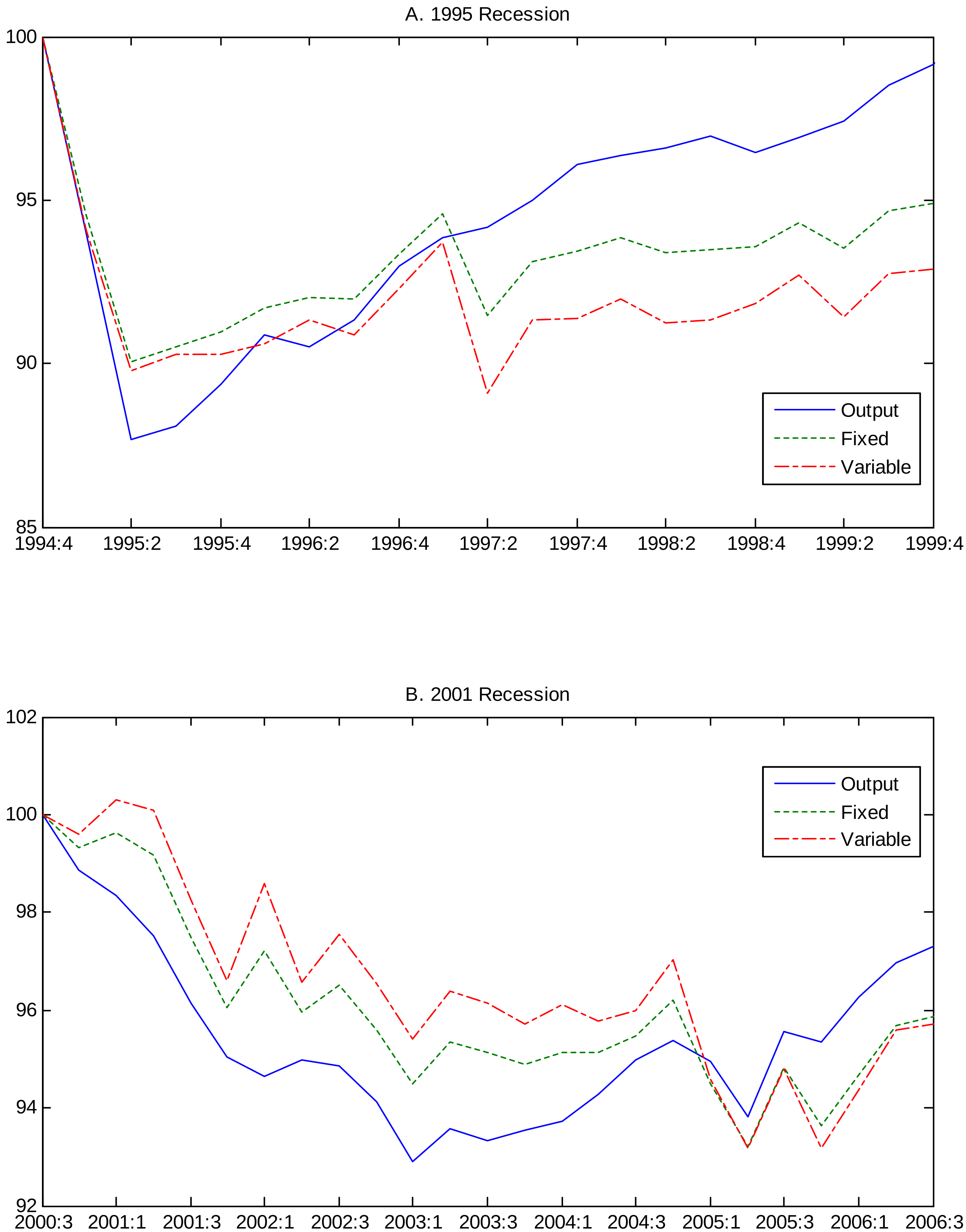


Figure 9
Output and Predictions of Model with Just the Labor Wedge and Two Capital Utilization Specifications

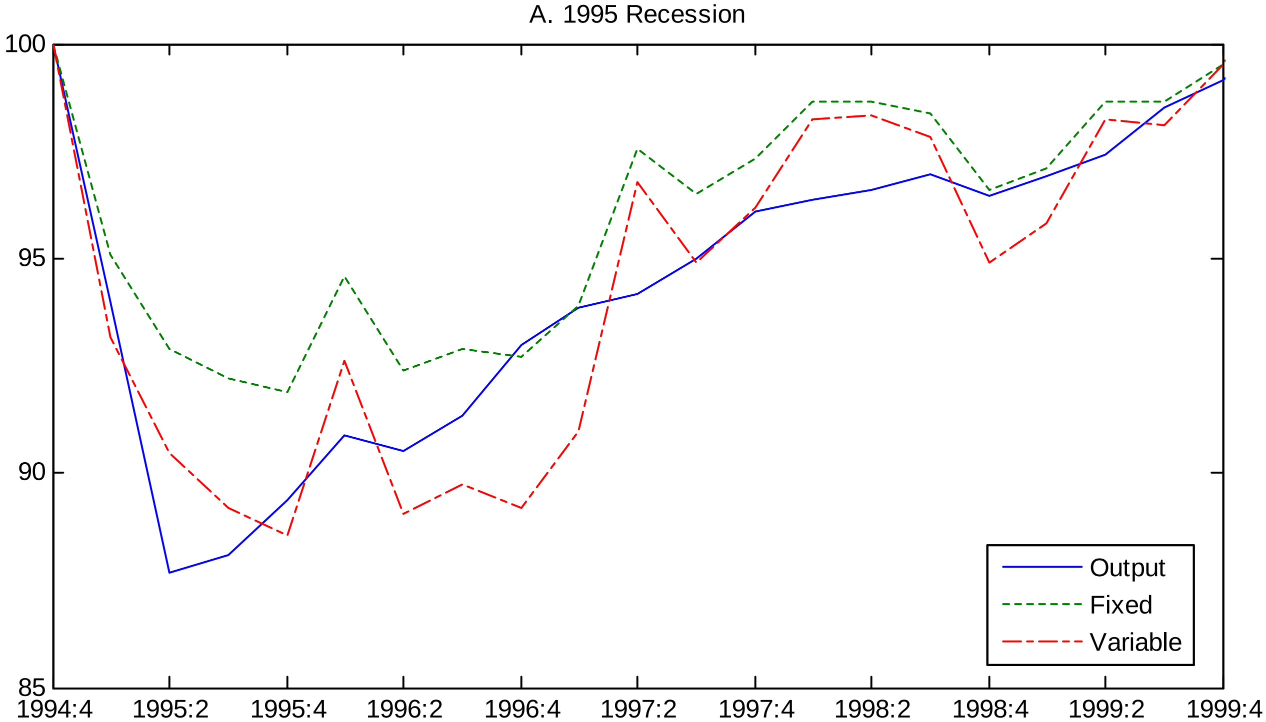


Figure 10
Output and Predictions of Model with No Efficiency Wedge

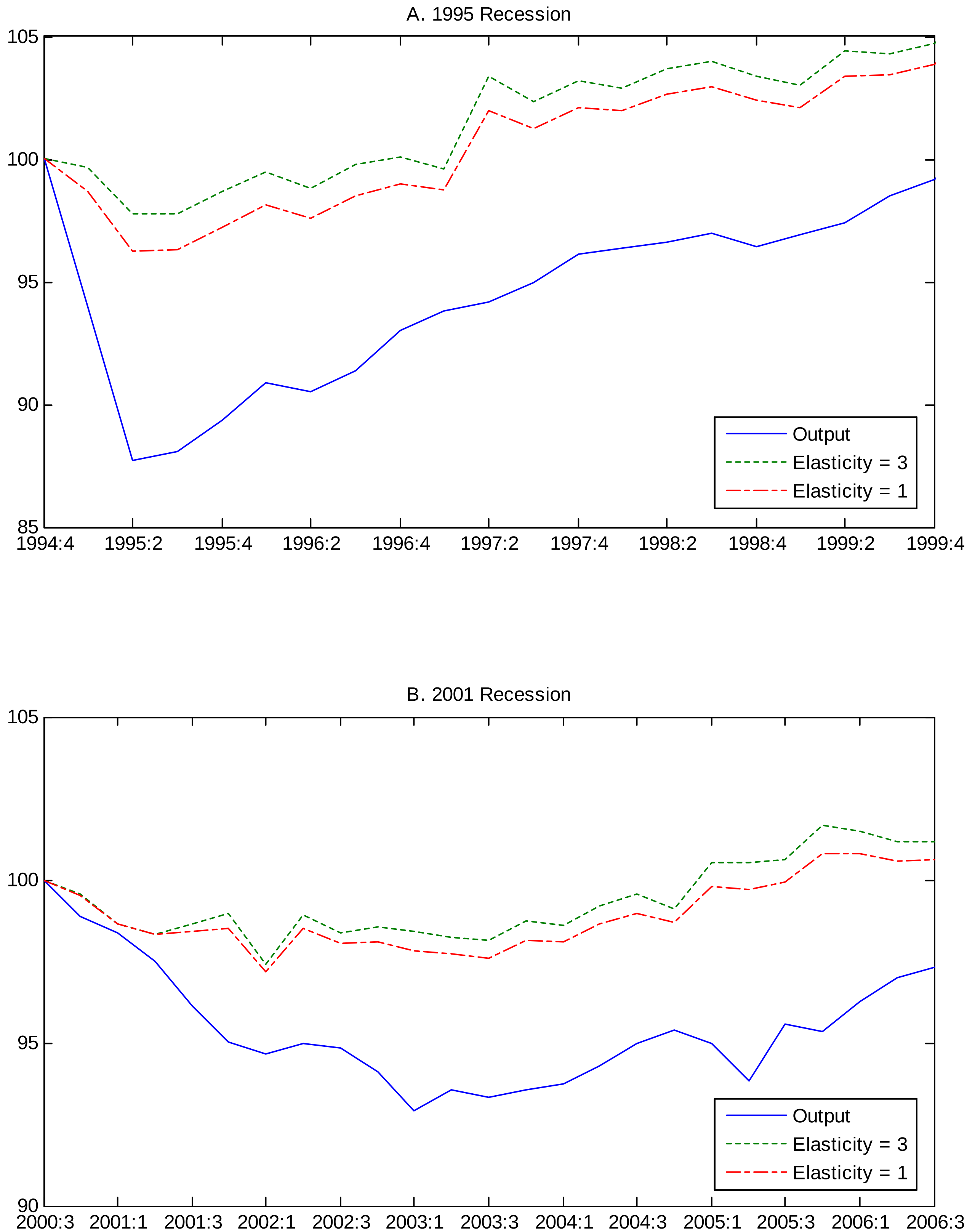


Figure 11
Output and Predictions of Model with No Efficiency Wedge and Two Capital Utilization Specifications

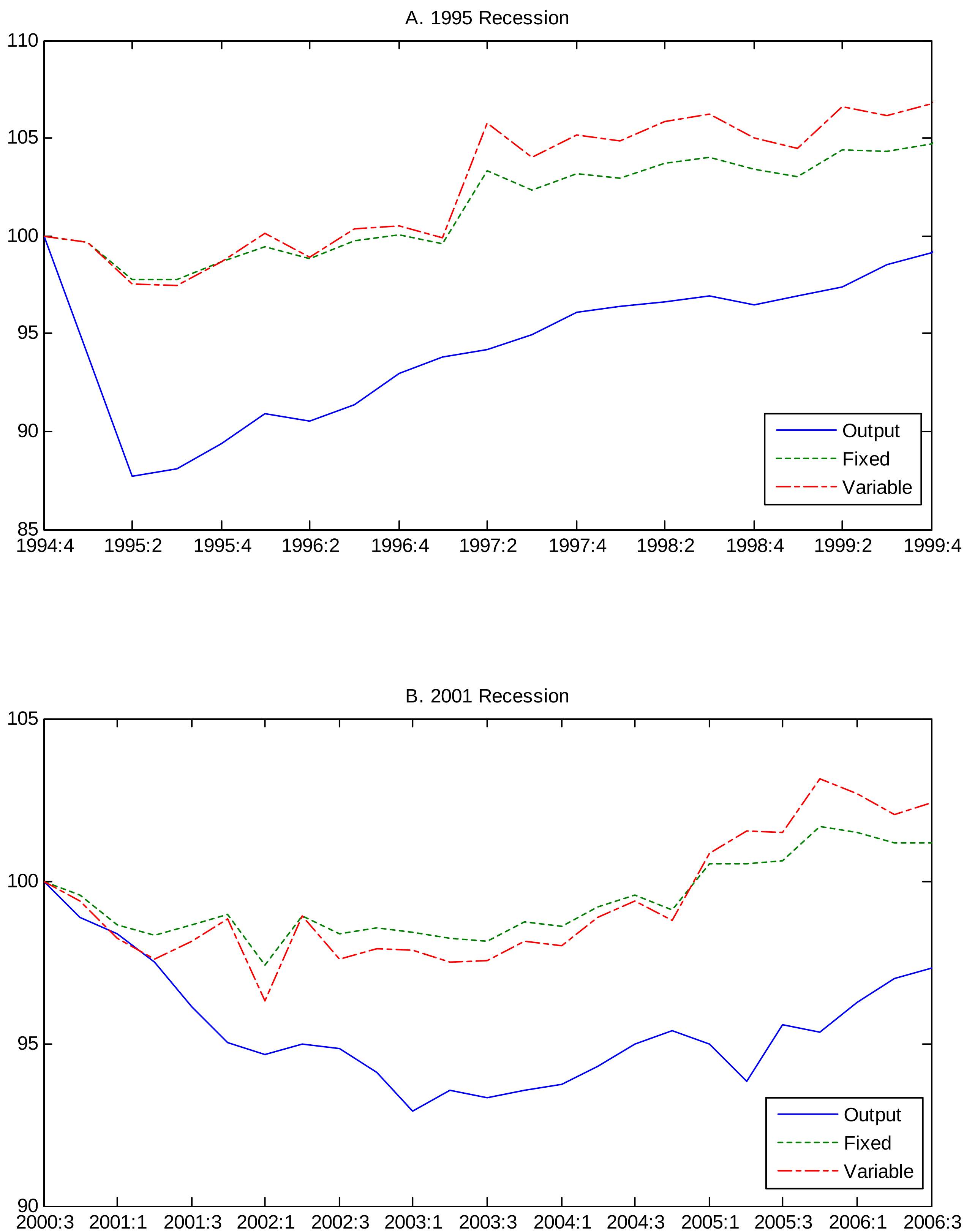


Figure 12
Output and Predictions of Model with No Labor Wedge

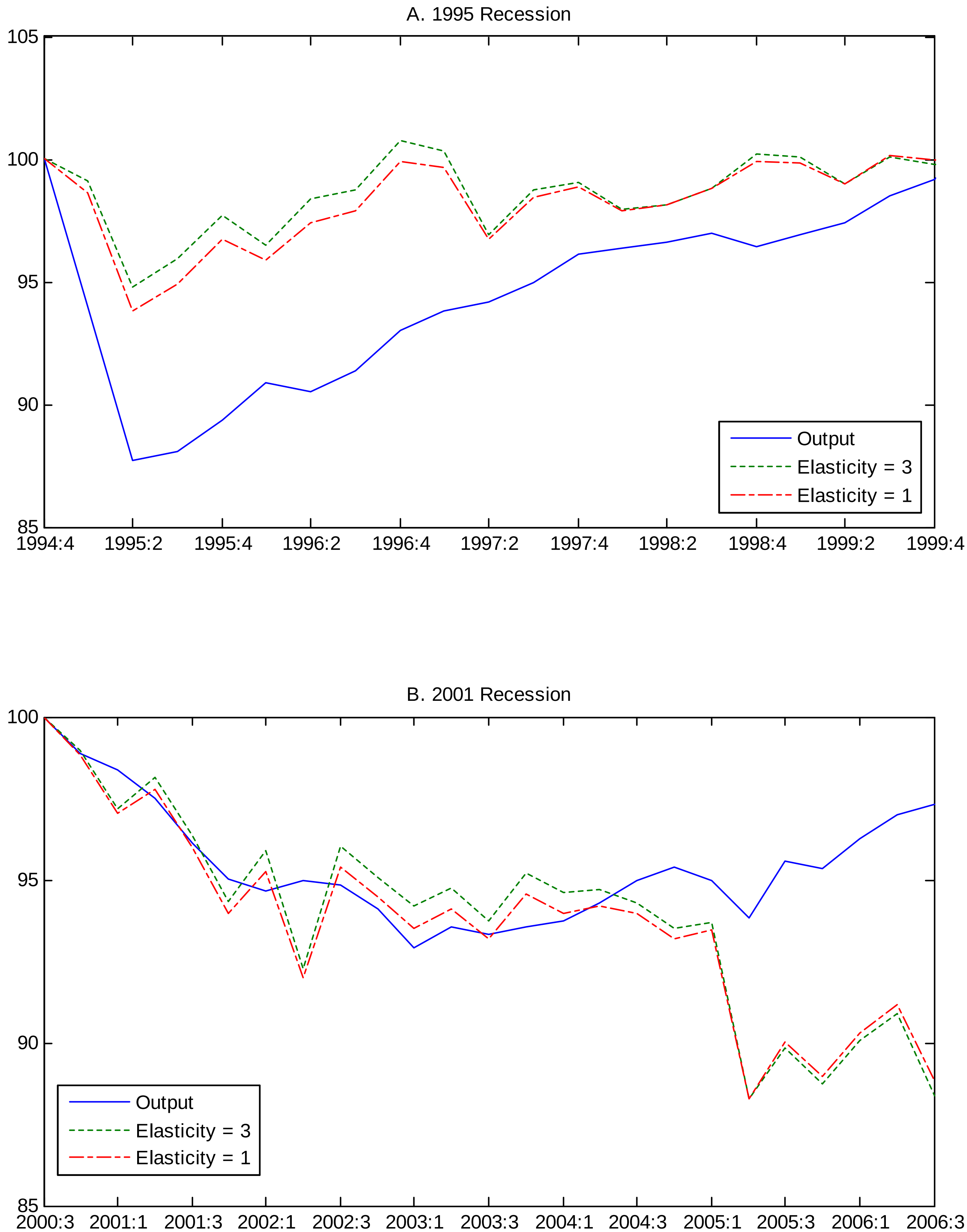


Figure 13
Output and Predictions of Model with No Labor Wedge and Two Capital Utilization Specifications