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# Is the Affordable Care Act's Individual Mandate a Certified Job-Killer?\*

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**Abstract:** Opponents of the Affordable Care Act argue that its individual mandate component is a “certified job-killer.” In this paper, I develop a Real Business Cycle model with a search-based labor market to test the validity of these concerns. I integrate the individual mandate into the model and conduct a general equilibrium analysis of its effects. The simulated results show that the imposition of the individual mandate regime should result in higher levels of aggregate employment and output.

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# 1. Introduction

The recovery from the Great Recession is the slowest post-recession labor market recovery since the early 1970s. During the period 2009-2014, the U.S. economy experienced an average annual growth rate of 2.2 percent (FRED, 2016), while the unemployment rate declined only 0.5 percentage points annually (BLS, 2016). At the micro-level, employers reluctantly began to post vacancies only after several years of increased macroeconomic activity (Figure 1). Furthermore, real GDP recovered to its pre-recession peak in 2 years, but the number of employed workers did not recover to its 2008 high for approximately 5 years (Figure 2). One frequently-cited explanation for this lagged labor market recovery is the Affordable Care Act's (ACA) individual health insurance mandate. This paper builds a model that shows the individual mandate had the opposite effect.

In this paper, I derive a Dynamic Stochastic General Equilibrium (DSGE) model of the U.S. economy under the ACA's individual mandate regime, and then utilize an applied theoretical simulation to quantify its effects. The model builds upon Merz's (1995) theory of a search-based Real Business Cycle (RBC) model. I add an insurance company to her original model, which allows me to impose the individual mandate on the model economy. In doing so, this paper contributes to the growing literature of theoretical macroeconomic analyses of the ACA's effects on the U.S. economy. If the derived theory is correct, then the model's simulation should produce several results: unemployed workers should increase their search efforts in order to avoid paying for health insurance; vacancies should increase as labor supply increases; and consumption should decrease as the unemployed population must pay insurance premiums. In response, theory predicts aggregate employment will increase.

The simulated results support the theory. I find that a 1 percent increase in mandatory health care costs results in a 0.4 percent increase in aggregate employment and 0.2 percent increase in output. The shock also results in brief increases in aggregate vacancy postings, search effort, and matches between workers and

firms. Additionally, I examine the effects of other shocks in the model to test the robustness of my findings. Specifically, I introduce stochastic shocks to TFP and other labor market variables to test for appropriate comovements in the associated impulse response functions. These analyses serve as robustness checks to my findings.

I demonstrate the validity of the model through a comparative analysis of U.S. GDP, consumption, investment, and employment data and the corresponding artificial time series generated from the model. The artificial time series' comovements and volatilities sufficiently match those of the U.S. data. Thus, if my assumptions about the individual mandate are correct, then I can incorporate the individual mandate into Merz (1995) and the extended model will also appropriately replicate the data.

This paper proceeds as follows. Section 2 describes recent theoretical cost estimations of the ACA. In section 3, I present the model and its associated Social Planner Problem. I parameterize the model using empirical microeconomic evidence in Section 4. In section 5, I discuss the model's simulated results, with an initial comparison of the simulation to the data and then a discussion of the model's responses to the imposition of the individual mandate. In section 6, I draw several conclusions, discuss significant caveats to the results, and present avenues for future research.

## **2. Literature Review**

The literature focuses on estimating the costs of various ACA policies. Mulligan (2013) calculates the average increase in marginal tax rates as a result of the ACA. He examines these policies through a “wedge” framework, which is a measure of the difference between the employer's labor costs and the employee's benefits of work. On the labor supply side, he finds that for many workers, moving from full- to part-time work provides workers with approximately the same level of

disposable income. This results from lower health expenses through ACA subsidies available exclusively to part-time workers. Furthermore, Mulligan (2014a) notes that full-time workers whose employers do not provide insurance and instead pay the penalty do not qualify for ACA subsidies, which further incentivizes them to move to part-time positions. He also explains that most employers have an incentive to reduce all but their most productive employees to part-time work, because they face a weekly 60 dollar penalty per full-time worker as a result of the ACA.

Mulligan (2014b) uses a similar tax wedge analysis to isolate the effects of the ACA's individual mandate under various scenarios. These include the explicit tax on a firm's total number of full-time employees and the implicit cost of working full-time, among others. Building upon his previous work, he allows for heterogeneity of hours worked among workers who face similar parameters. On average, he finds that the individual mandate increases the average marginal earnings tax rate 1.4 percentage points, and creates a weekly full-time employment cost of 2.1 hours. Gamage (2012) performs similar theoretical analyses and finds a comparable incentive structure: low- and moderate-income households will often reject full-time jobs, and the ACA will discourage these workers from taking positions at higher income levels. On the other hand, firms will hire fewer low-income workers, lower the wages of those they do hire, and shift some low-productivity workers to part-time positions.

More recent literature focuses on the development of stylized general equilibrium models of the U.S. economy under the ACA regime. For example, Nakajima and Tüzemen (2015) derive a comprehensive general equilibrium model of the ACA's effects on the U.S. economy under the assumption of heterogeneity among workers and firms. Their model explicitly accounts for firms' decisions to hire and provide health insurance, and it distinguishes between full- and part-time work. They follow Aizawa and Fang (2013), who introduce the concept of medical expense shocks as a result of workers observing their own stochastically-evolving health

statuses. Nakajima and Tüzemen's (2015) simulated model reveals that the ACA primarily affects labor supply, with minimal labor demand effects. They predict the ACA will increase the proportion of the labor force working part-time from 15.1 to 16.4, which stems almost entirely from the ACA's tax subsidies as opposed to the individual mandate and employer penalty. They posit the aggregate effect of the ACA will be a 0.36 percent decrease in total hours worked.

Other literature focuses on the individual mandate's effects at the extensive margin of the labor market. Harris and Mok (2015) argue that the individual mandate primarily reduces the probability of a worker accepting a job as opposed to deciding how many hours to work, so its effects at the intensive margin should be minimal. Their initial analysis concludes that the combination of the negative substitution and positive income effects should result in a net decrease in aggregate employment of 0.01 percent. This finding comes with strong caveats. Most importantly, they posit there is a reasonable chance that workers will not respond to wage reductions stemming from the employer penalty in the same way they respond to payroll tax deductions. In this scenario, their labor market predictions would be more optimistic.

This paper provides evidence against these recent negative estimations of the individual mandate's labor market effects. I make two contributions to the literature. First, I develop a new three-agent macroeconomic model that allows me to isolate the individual mandate's effects. The literature lacks comprehensive general equilibrium analyses of the ACA, and so I provide a new foundation for conducting this research. Second, I contribute to the minimal amount of ACA-related literature that focuses on the extensive margin of the labor market.<sup>1</sup>

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<sup>1</sup> See Harris and Mok (2015) for further discussion.

### 3. Economic Theory

The model economy builds upon Merz's (1995) theory of a search-based labor market in an RBC framework.<sup>2</sup> The base model consists of an infinite number of workers and firms who attempt to match with each other in the labor market each period. I add an insurance company to the base model in order to accurately model the individual mandate's effects. The inclusion of the insurance company results in the following portrayal of the labor market. The insurance company supplies health services  $Q_t$  to the consumer. A worker's employment status determines whether she or her employer pays the insurance costs. Specifically, if a worker is employed, then her employer pays the entire premium in the form of a per-worker labor tax. For simplicity, the firm does not have the option of paying a penalty instead of the premium. If, however, a worker is unemployed, then she pays her insurance premium to comply with the individual mandate. This scenario sufficiently captures the mechanics of the ACA's individual mandate regime.

#### 3.1. Labor Supply

The individual mandate increases the cost of unemployment. If a worker is unemployed, then she must allocate her time between leisure and searching for a job, and theory predicts the higher cost of unemployment will induce her to increase her search effort. As aggregate search effort increases, the probability of an individual worker matching with a firm decreases. The model normalizes the labor force to one, so a worker who is employed in period  $t$  either works in period  $t + 1$  subject to not separating from her employer (where the exogenous separation rate is  $\psi_t \in [0, 1]$ ) or separates from her employer in period  $t$  and searches for employment in period  $t + 1$ . Search effort is endogenous.

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<sup>2</sup> See Table 1 for a full list of variables and their definitions.

### 3.2. Labor Demand

Similarly, firms must engage in a search process for workers. They post job vacancies  $V_t$  at an exogenous cost  $a$ , and do not necessarily match with workers in a given period. The model assumes that each period firms either: (1) employ one worker, (2) post a vacancy, or (3) shut down (Andolfatto, 1996). Firms with a worker in period  $t$  operate in the next period with probability  $1 - \psi_t$ . Firms without workers in period  $t$  operate in period  $t + 1$  if they match with workers in period  $t$ . Otherwise, they shut down for the period. There is an inverse relationship between the number of firms searching for workers and an individual firm's ability to find a match.

### 3.3. Matching

The number of matches in the labor market  $M_t$  depends on the quantity of posted vacancies and the aggregate search effort  $S_t$  of the unemployed population. The matching function is:

$$M_t = V_t^{1-\lambda} [S_t(1 - N_t)]^\lambda \quad (1)$$

where  $\lambda \in [0, 1]$ .<sup>3</sup>

### 3.4. Social Planner Problem

The Social Planner chooses the set  $\{C_t, N_{t+1}, K_{t+1}, S_t, V_t\}_{t=0}^\infty$  to maximize the consumer's lifetime utility function subject to the constraints in the insurance, capital, labor, and goods markets. The consumer's lifetime utility function is:

$$E_0 \sum_{t=0}^{\infty} \beta^t [\log C_t + \log(1 - N_t) + \log Q_t] \quad (2)$$

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<sup>3</sup> The matching function's constant returns to scale form is grounded in the literature. Stevens (2007) demonstrates this in a theoretical derivation of the function under constant marginal search costs, which this paper uses. Petrongolo and Pissarides (2001) also observe that most empirical studies over the last 25 years support this specification.



where  $\beta \in (0, 1)$  is the discount rate,  $E_0$  is the expectations operator conditional on period 0 information,  $C_t$  denotes consumption, and  $N_t$  refers to aggregate employment. The maximization problem is subject to six constraints.

First, the model assumes consumers always receive  $Q = 1$  units of health services in exchange for the newly-imposed mandatory health care costs  $h_t$ .<sup>4</sup> The insurance company faces an endogenous cost  $H_t$  per unit of health care provided. Because the insurance company provides one unit of health each period, I observe that the insurance company earns zero profit.

Second, the household manages the investment decision subject to the law of motion for capital:

$$K_{t+1} = (1 - \delta)K_t + I_t \quad (3)$$

where  $\delta \in [0, 1]$  is the exogenous depreciation rate of capital and  $I_t$  is investment. The household is endowed with an initial capital stock  $K_0$ .

The next two constraints are the labor market conditions, which consist of the matching function (Equation 1) and the law of motion for employment:

$$N_{t+1} = (1 - \psi_t)N_t + M_t \quad (4)$$

Aggregate employment in period  $t + 1$  depends on matches at the end of period  $t$  and the exogenous separation rate. Note that  $\psi_t$  is defined as an exogenous state variable as opposed to a parameter, which is more common in the literature.

Fifth, firms produce in accordance with a constant returns to scale Cobb-Douglas production function:

$$Y_t = z_t K_t^\alpha N_t^{1-\alpha} \quad (5)$$

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<sup>4</sup> In assuming perfectly inelastic demand for health care, I can isolate the macroeconomic effects of the mandatory health insurance costs in the model economy, which are paid regardless of the quality of an individual consumer's health insurance plan. The quality of the plan is irrelevant to short-term analyses, as all insurance plans available through the ACA provide a sufficient quantity of health care to maintain day-to-day activities. This assumption should produce a quantitatively larger but qualitatively comparable result to a similar model with heterogeneous consumers and insurance plans.

where  $\alpha \in (0, 1)$  and  $z_t$  denotes TFP.<sup>5</sup>

Sixth, the aggregate feasibility constraint:

$$Y_t = C_t + I_t + c_0 S_t(1 - N_t) + h_t + aV_t \quad (6)$$

where  $c_0 > 0$  is the cost of search effort for the unemployed population. This equation shows that output is spent on five resources: consumption, investment, search costs for the unemployed, aggregate health insurance premiums, and costs associated with vacancy postings.

There are also three exogenous state variables, each assumed to follow AR(1) stochastic processes: TFP, the separation rate, and health care expenditure. I define the exogenous state vector  $X_t = [z_t \ \psi_t \ h_t]^T$ . The state vector in period  $t$  is a function of the lagged state vector and the error terms:

$$X_t = PX_{t-1} + Q\epsilon_t \quad (7)$$

where  $P$  and  $Q$  are 3 x 3 diagonal matrices of coefficients. Each error term is normally distributed:  $\epsilon_z \sim N(0, \sigma_z^2)$ ,  $\epsilon_\psi \sim N(\mu_\psi, \sigma_\psi^2)$ , and  $\epsilon_h \sim N(\mu_h, \sigma_h^2)$ .<sup>6</sup>

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<sup>5</sup> This functional form is common in the macro-search literature, as it appropriately represents U.S. national accounts data. Specifically, the parameter  $\alpha$  represents the share of U.S. national income that results from capital income.

<sup>6</sup> Technically, the error term on health care expenditure as a share of U.S. output does not follow a stationary process; however, the model focuses on small linear deviations from the steady state, so analyzing its responses to small health expense shocks is appropriate.

### 3.5. Equilibrium Conditions

Let  $\sigma_t$  denote a Lagrange multiplier from the associated Social Planner Problem.<sup>7</sup>

The model economy's reduced system of first order conditions is:

$$C_t^{-1}c_0 = \sigma_t \lambda V_t^{1-\lambda} [S_t(1 - N_t)]^{\lambda-1} \quad (8.1)$$

$$aC_t^{-1} = \sigma_t(1 - \lambda)V_t^{-\lambda} [S_t(1 - N_t)]^\lambda \quad (8.2)$$

$$C_t^{-1} = \beta [\alpha C_{t+1}^{-1} z_{t+1} K_{t+1}^{\alpha-1} N_{t+1}^{1-\alpha} + C_{t+1}^{-1}(1 - \delta)] \quad (8.3)$$

$$\begin{aligned} \sigma_t = \beta [ & -(1 - N_{t+1})^{-1} + C_{t+1}^{-1} ((1 - \alpha) z_{t+1} K_{t+1}^\alpha N_{t+1}^{-\alpha} + c_0 S_{t+1})] \\ & + \beta [\sigma_{t+1} [1 - \psi_{t+1} - \lambda V_{t+1}^{1-\lambda} [S_{t+1}(1 - N_{t+1})]^{\lambda-1} S_{t+1}]] \end{aligned} \quad (8.4)$$

$$Y_t = C_t + I_t + c_0 S_t(1 - N_t) + h_t + aV_t \quad (8.5)$$

$$K_{t+1} = (1 - \delta)K_t + I_t \quad (8.6)$$

$$N_{t+1} = (1 - \psi_t)N_t + M_t \quad (8.7)$$

$$M_t = V_t^{1-\lambda} [S_t(1 - N_t)]^\lambda \quad (8.8)$$

$$Y_t = z_t K_t^\alpha N_t^{1-\alpha} \quad (8.9)$$

$$\log z_{t+1} = (1 - \rho_z) \log z + \rho_z \log z_t + \epsilon_z \quad (8.10)$$

$$\psi_{t+1} = (1 - \rho_\psi) \psi + \rho_\psi \psi_t + \epsilon_\psi \quad (8.11)$$

$$h_{t+1} = (1 - \rho_h) h + \rho_h h_t + \epsilon_h \quad (8.12)$$

where variables without time sub-scripts denote those variables' steady state values.

Equations (8.1) and (8.2) are the model economy's intratemporal conditions; these equations comprise the decision within a given time period on the optimal allocation between consumption, vacancy postings, and the search effort of the unemployed. Equations (8.3) and (8.4) are the two intertemporal conditions, representing the decision between time periods on the optimal allocation between consumption, the capital stock, the employment level, vacancy postings, and the

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<sup>7</sup> There are initially six Lagrange multipliers; however, four of them equal  $C_t^{-1}$  and the fifth equals  $\sigma_t$ .

search effort of the unemployed. This allocation strongly relies on the consumer's discount rate,  $\beta$ . The remaining equations were discussed in Sections 3.3 and 3.4.

## 4. Parameterization

I follow the literature and parameterize the model using microeconomic foundations and empirical findings. The parameter values are similar to those used in Merz (1995); however, I modify them slightly to incorporate findings from more recent literature. Let  $\Phi$  denote the vector of parameters from the model economy:

$$\Phi = \{\alpha, \beta, c_0, a, \delta, \lambda, \rho_z, \rho_\psi, \rho_h, \sigma_z, \sigma_\psi, \sigma_h\} \quad (9)$$

Table 2 contains the model's calibrated parameter values and their definitions.

The parameters  $\alpha$  and  $\beta$  represent the economy's capital income share and the consumer's discount rate, respectively. I follow recent literature and let  $\alpha = 0.36$  and  $\beta = 0.96$ , which appropriately accounts for the data at an annual rate. The depreciation rate of capital  $\delta$  is regularly set at 0.05 in accordance with Nadiri and Prucha (1996), who estimate the depreciation rate of capital in the U.S. total manufacturing sector.

The search and vacancy posting costs are identical to those in Merz (1995). She sets the search cost parameter  $c_0$  to 0.005 in order to generate an equilibrium unemployment level of 6.1 percent. If this value is too low, then I expect my results with respect to search effort and employment to be too large, as consumers will not respond as significantly to higher health care costs. The vacancy cost  $a$  is 0.05, which results in an equilibrium vacancy duration that matches van Ours and Ridder (1992). If this value is too low, then firms will be less inclined to hire in response to the labor supply increase, so the results with respect to vacancies will be smaller in magnitude. In either case, the qualitative results will be consistent.

The elasticity of matches with respect to unemployment  $\lambda$  is consistently found to be in the range 0.4-0.6. Blanchard and Diamond's (1990) seminal paper on

the matching function is often cited in the literature, as they find the elasticity of matches with respect to unemployment and vacancies at 0.4 and 0.6, respectively. More recently, Anderson and Burgess (2000) find comparable estimates for the unemployment elasticity in their analysis of the matching function using state-level data. Thus, I let  $\lambda = 0.4$  to be consistent with both the macro-search literature and empirical findings. It is possible that this value is slightly too low, in which case I expect my vacancy results to be slightly too high, and search effort and employment results to be slightly too low, though the qualitative results will not change.

The set of parameters that are associated with the stochastic processes,  $\{\rho_z, \rho_\psi, \rho_h, \sigma_z, \sigma_\psi, \sigma_h\}$ , have an irrelevant effect on the simulation's qualitative results. For example, higher values of  $\rho_h$  result in the same initial quantitative effect in the corresponding impulse response functions; however, the shocks' effects take longer to dissipate given the higher intertemporal correlations. I define the set of  $\rho$  parameters as  $\rho_z = \rho_\psi = 0.95$  in order to capture these variables' high levels of intertemporal correlation, and  $\rho_h = 0.9$  because the cost of health care fluctuates more over time. Furthermore, the  $\sigma$  values are also irrelevant because my goal is to measure 1 percent shocks to the cost of health insurance. Therefore, I set  $\sigma_z = \sigma_\psi = \sigma_h = 0.01$  in my analyses in Section 5.3 so that the simulated 1 standard deviation shocks correspond to 1 percent shocks to the given variables.

## 5. Simulations and Results

### 5.1. Empirical Validity

I test the validity of the base model by comparing its simulated time series to U.S. economic data. This requires the construction of simulated and actual time series for output, consumption, investment, and employment. To construct the U.S. time series, I use annual data from FRED (2016) for the period 1959:Q1-2006:Q4, which makes the data consistent with the set of parameters calibrated

in Section 4. Notably, the data series also end prior to both the Great Recession and the implementation of the ACA. I then adjust the variables so that they are comparable to the respective model variables.<sup>8</sup> Finally, I log the four U.S. time series and detrend them with the Hodrick-Prescott filter.

To construct the simulated time series, I approximate the base model by setting  $h = 0$ . I then calibrate the standard deviation on  $\epsilon_z$  to 0.4563 so that the standard deviation on the simulated output series is identical to that of the U.S. GDP series. Using the policy functions for output, consumption, investment, and employment with respect to TFP, I ultimately generate detrended time series using the Hodrick-Prescott method.

There are multiple comparisons to consider when determining a model's validity. Table 3 contains the set of standard deviations associated with the four time series. The relative second moments of consumption and employment closely match the data, while the relative volatility of investment is 4 times higher than its empirical counterpart. RBC models often overestimate the volatility of investment, so I am not concerned about this statistic.

It is also important to observe the dynamic correlations between output and the remaining three variables. As seen in the data, investment, consumption, and employment are each procyclical (Table 4). The procyclicality of consumption and investment are captured in the simulated model, while the simulated employment data are countercyclical. This issue arises in many early RBC search models (Andolfatto, 1996). The impulse response functions for TFP (Figures 5f and 5h) visually demonstrate the explanation for this negative correlation: following a positive TFP shock, employment begins to decrease in the initial periods, while output initially increases as a result of the significant investment increase (Figure 5b). Because I impose accurate assumptions about the individual mandate on Merz (1995), the results of the extended model should also be consistent with the data.

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<sup>8</sup> See Appendix B for a full explanation of this process.

## 5.2. Steady State Analyses

I derive the model economy's steady state, and then assess the changes to the set of equilibrium values under a range of equilibrium costs of health care. These changes have significant effects on the model economy's equilibrium values (Table 5). In the labor market, these increases result in higher levels of search effort and vacancy posting. These results follow the theory: the imposition of mandatory health care costs on the unemployed population increases labor supply, as the relative cost of unemployment is higher. Firms accommodate these workers by posting more job vacancies. Thus, the equilibrium increase in aggregate employment increases as mandatory health care costs rise.

Overall, steady state output increases as equilibrium levels of health care costs rise (Table 5). There are three explanations for this phenomenon (see Equation 6). First, higher health care costs are associated with increases in investment. Second, the positive labor market behavior contributes to the aggregate feasibility constraint. Third, the firm's production must also cover aggregate health care costs for all consumers, so the significant increases in  $h$  should have a strong positive effect on output. These factors outweigh the negative effect on consumption, which stems from the necessary decrease in consumption for unemployed consumers.

## 5.3. Impulse Responses

Using the model economy's steady state with  $h = 0.17$ , I find impulse response functions in accordance with shocks to the stochastic error terms. There are several notable results with regards to positive 1 percent shocks to health care expenditure above its steady state value (Figure 3). Consumption and investment initially increase -0.4 percent and -4 percent, respectively. The capital stock also declines, with its minimum value of -0.2 percent below equilibrium occurring in the tenth period. Aggregate output increases approximately 0.2 percent, which is due to the positive labor market reactions.

The labor market's response to health care shocks are significant and support the theory. Aggregate vacancies and matches both increase 5 percent in the initial periods and then revert to their steady state values within 3 periods. As expected, aggregate search effort also increases 5 percent because workers do not want to pay the higher mandatory health costs. Additionally, aggregate employment increases almost 0.4 percent (Figure 3f). This result, in conjunction with the 1 percent increase in  $h_t$ , explains the small increase in output associated with positive health expenditure shocks (Figure 3h).

The model's responses to positive shocks to  $\psi_t$  are consistent with the theory. Figure 4 shows the impulse response functions that correspond to a positive 1 percent shock to the separation rate. These shocks have marginally negative effects on variables external to the labor market, such as consumption, investment, and output. Following the theory, most of the labor market variables largely respond to these shocks. Specifically, vacancies, matches, and search effort each increase 15 percent, and then slowly decline to their equilibrium values in more than 40 periods. Aggregate employment does not respond significantly.

It is also important to note the model's responses to positive 1 percent shocks to TFP because it serves as a robustness check to the model's predictions (Figure 5). These shocks result in nearly 1 percent increases in consumption and the capital stock, as well as a 6 percent increase in investment prior to the third period. Interestingly, the impulse response functions for consumption and the capital stock do not achieve their maximum values until the fifteenth period, and then they converge to equilibrium in a significant amount of time. Furthermore, employment initially rises 0.4 percent, while output increases 1.2 percent.

## 6. Conclusion

This paper develops a three agent search model to test the effects of the ACA's individual mandate on the lagged labor market recovery from the Great Recession.



There are several important results from the simulated model. First, I find that positive shocks to mandatory health care costs lead to increases in aggregate employment and output, which opposes recent conclusions in the literature. Second, I observe that there is a trade-off between consumption and mandatory health care expenditure, which, in conjunction with the higher cost of unemployment, provides a general equilibrium explanation for the positive correlation between equilibrium levels of health care costs and aggregate employment. Third, I simulate shocks to the labor market separation rate, and determine that these shocks have positive effects on vacancies, matches, and search effort, while having minimal effects external to the labor market. Fourth, I demonstrate the robustness of the model using shocks to TFP. The simulated variables comove appropriately and the artificial time series associated with these shocks sufficiently portray U.S. economic data.

There are several caveats to the simulated results that stem from my simplifying assumptions about the ACA. I assume homogeneity among consumers and their options for health insurance, which increases the magnitude of the model's results. Additionally, the model focuses on the short-term effects of the individual mandate, and therefore does not account for the positive long-term effects of universal health care coverage. Furthermore, the ACA also provides health insurance subsidies to the unemployed, which diminish the costs imposed on them, but this should not qualitatively affect my results.

The proposed model provides a new avenue for further cost estimations of the ACA. Future research should both assume heterogeneity and incorporate the ACA's distorting marginal labor taxes into this model. The latter is a relatively simple task that requires adding a government to the model and including taxes on labor supply in the consumer's optimization problem. Another topic for future research is a welfare analysis of the model economy. Furthermore, future research should examine the role of expectations in the model. Although the simulated results indicate there are minimal labor demand distortions stemming from the

individual mandate, the model does not fully explain the lagged labor market recovery. One explanation is firms' unwillingness to hire workers after the Great Recession until they understood the mechanics of the law. These news shocks, in conjunction with the model derived in this paper, could further explain the post-recession labor market data.

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## A. Tables and Figures

Figure 1: Aggregate U.S. Job Vacancies (2000-2015)

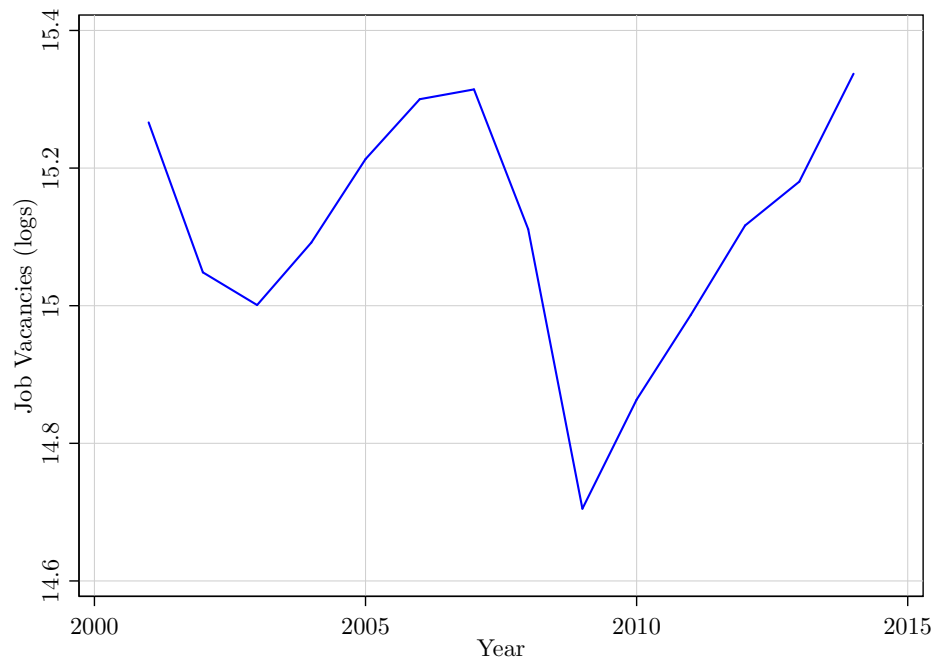


Figure 2: Real GDP and Total Nonfarm Employment (2000-2015)

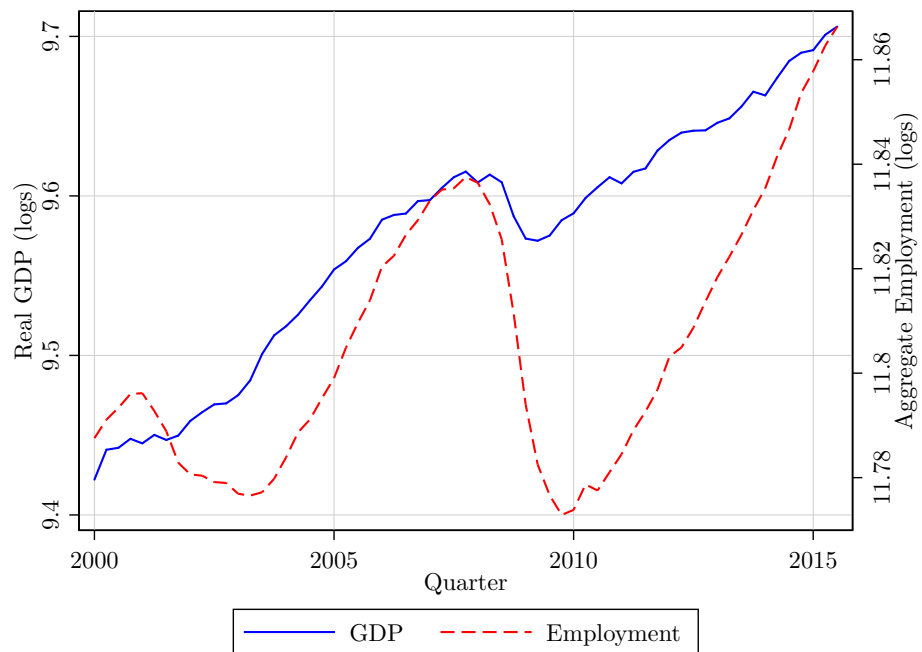


Table 1: Variable Descriptions

Parameter	Description
$Y$	Output
$C$	Consumption
$I$	Investment
$S$	Search Effort
$V$	Vacancies
$K$	Capital Stock
$N$	Employment
$M$	Matches
$Q$	Quantity of Health Services
$z$	TFP
$h$	Insurance Premium Cost
$H$	Marginal Cost of Health Services
$\psi$	Matches Separation Rate

Table 2: Calibrated Parameters

Parameter	Description	Value
$\alpha$	Capital Income Share	0.36
$\beta$	Discount Factor	0.96
$c_0$	Worker's cost of search	0.005
$a$	Cost of Vacancy Post	0.05
$\delta$	Capital Depreciation Rate	0.022
$\lambda$	Matching Function Parameter	0.40
$\rho_z$	$z_t$ Intertemporal Correlation	0.95
$\rho_\psi$	$\psi_t$ Intertemporal Correlation	0.95
$\rho_h$	$h_t$ Intertemporal Correlation	0.90

*Notes:* The parameter values are calibrated in Section 4.

Table 3: Volatilities between U.S. and simulated economies

Statistic	Observed Data	Simulated Data	Statistic	Observed Data	Simulated Data
$\sigma_Y$	1.935	1.935	$\sigma_Y/\sigma_Y$	1.000	1.000
$\sigma_I$	4.888	15.807	$\sigma_I/\sigma_Y$	2.526	8.169
$\sigma_C$	0.677	1.946	$\sigma_C/\sigma_Y$	0.350	1.006
$\sigma_N$	0.505	1.082	$\sigma_N/\sigma_Y$	0.261	0.559

*Notes:*  $\sigma$  represents the standard deviation of the associated time series.

Table 4: Dynamic correlations between output and other model variables

Variable	Data Source	k				
		-2	-1	0	1	2
$I$	Simulated	0.547	0.523	0.628	-0.317	-0.371
	Observed	-0.297	0.300	0.966	0.191	-0.507
$C$	Simulated	-0.581	-0.521	0.435	0.495	0.523
	Observed	-0.572	-0.466	0.223	0.359	0.246
$N$	Simulated	0.701	0.647	-0.350	-0.403	-0.438
	Observed	-0.468	-0.059	0.722	0.594	-0.086

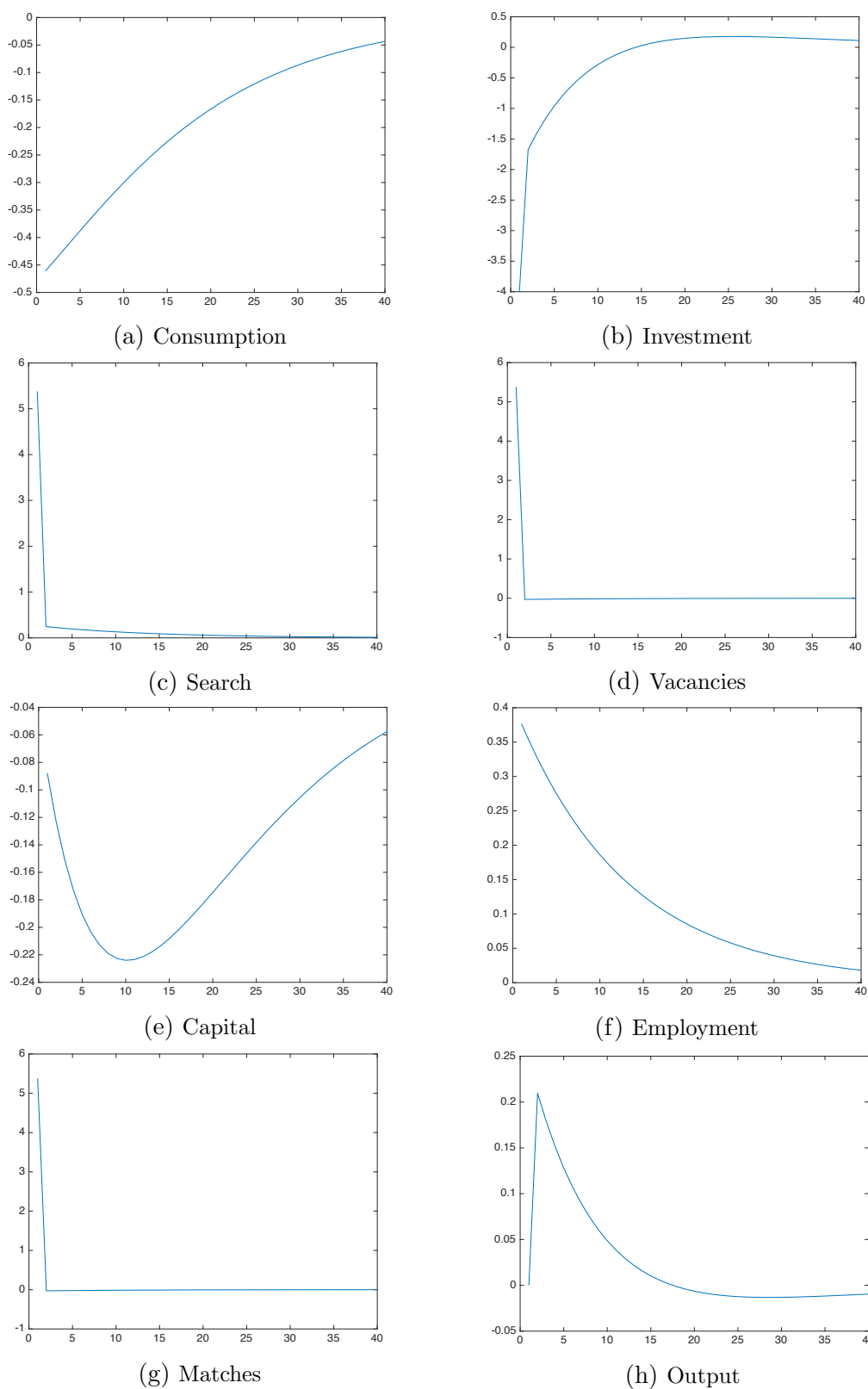
*Notes:* The table's values are the correlations between the variable in period  $t$  and output in period  $t - k$ .

Table 5: Comparison of Steady States Under Varying Levels of  $h$

	Steady States					
	$h = 0.00$	$h = 0.10$	$h = 0.17$	$h = 0.20$	$h = .30$	$h = 0.40$
$Y$	1.12	1.18	1.23	1.25	1.32	1.38
$C$	0.98	0.94	0.91	0.89	0.85	0.81
$I$	0.14	0.15	0.15	0.16	0.16	0.17
$S$	0.16	0.18	0.19	0.20	0.22	0.24
$V$	0.01	0.01	0.02	0.02	0.02	0.02
$K$	6.32	6.70	6.96	7.07	7.44	7.82
$N$	0.42	0.45	0.46	0.47	0.50	0.52
$M$	0.03	0.03	0.03	0.03	0.03	0.04

*Notes:* Each column corresponds to the set of steady state values under the associated equilibrium value of  $h$ , holding the parameter values constant in each simulation. Steady state  $\psi$  and  $z$  are equal to 0.07 and 1, respectively.

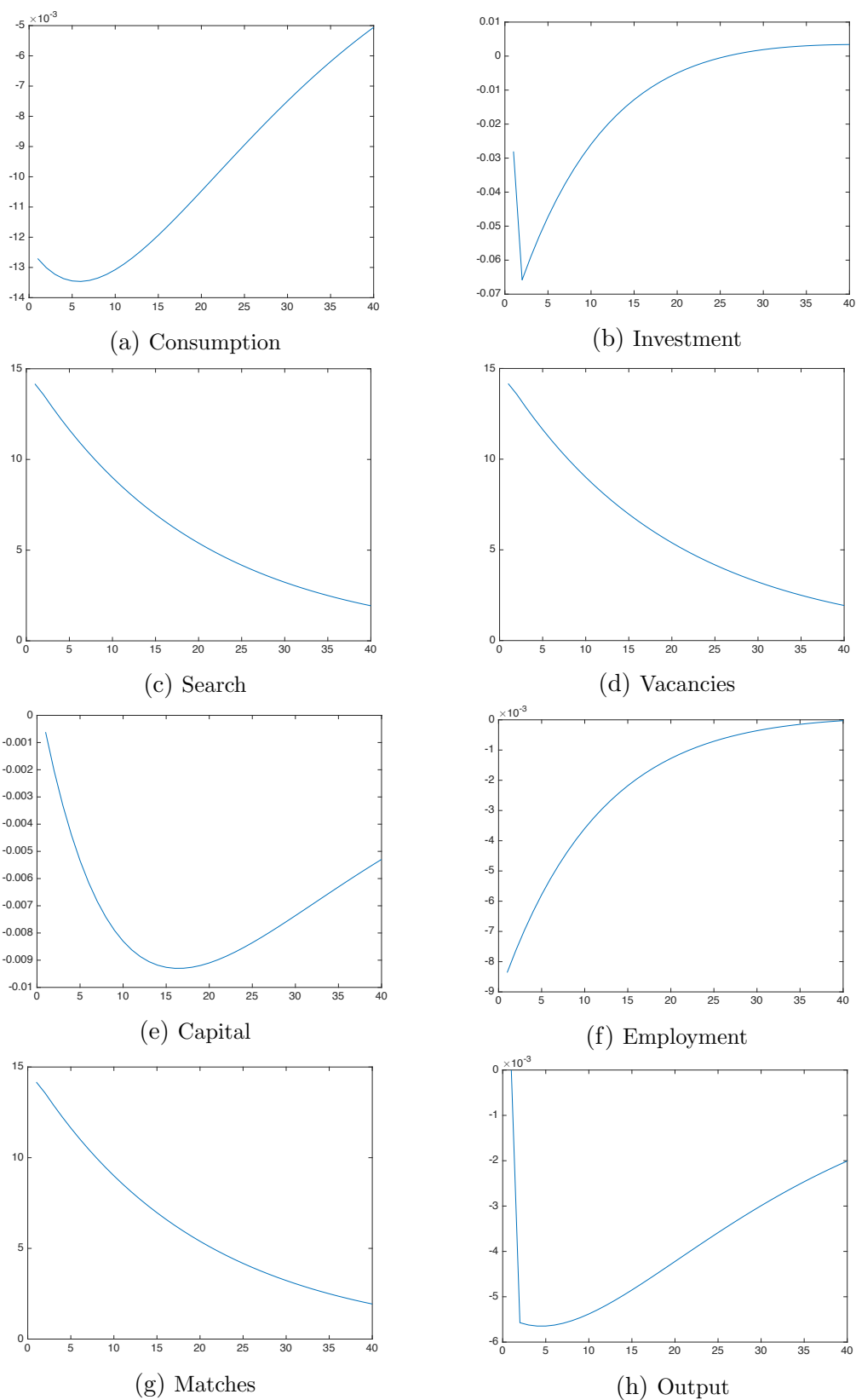
Figure 3: Impulse response functions associated with  $\epsilon_h$



*Notes:* The impulse responses are associated with 1 percent shocks to the error term on health care expenditure. The y-axes are measured in percent deviations from steady state, and the x-axes denote time periods from the initial shock.

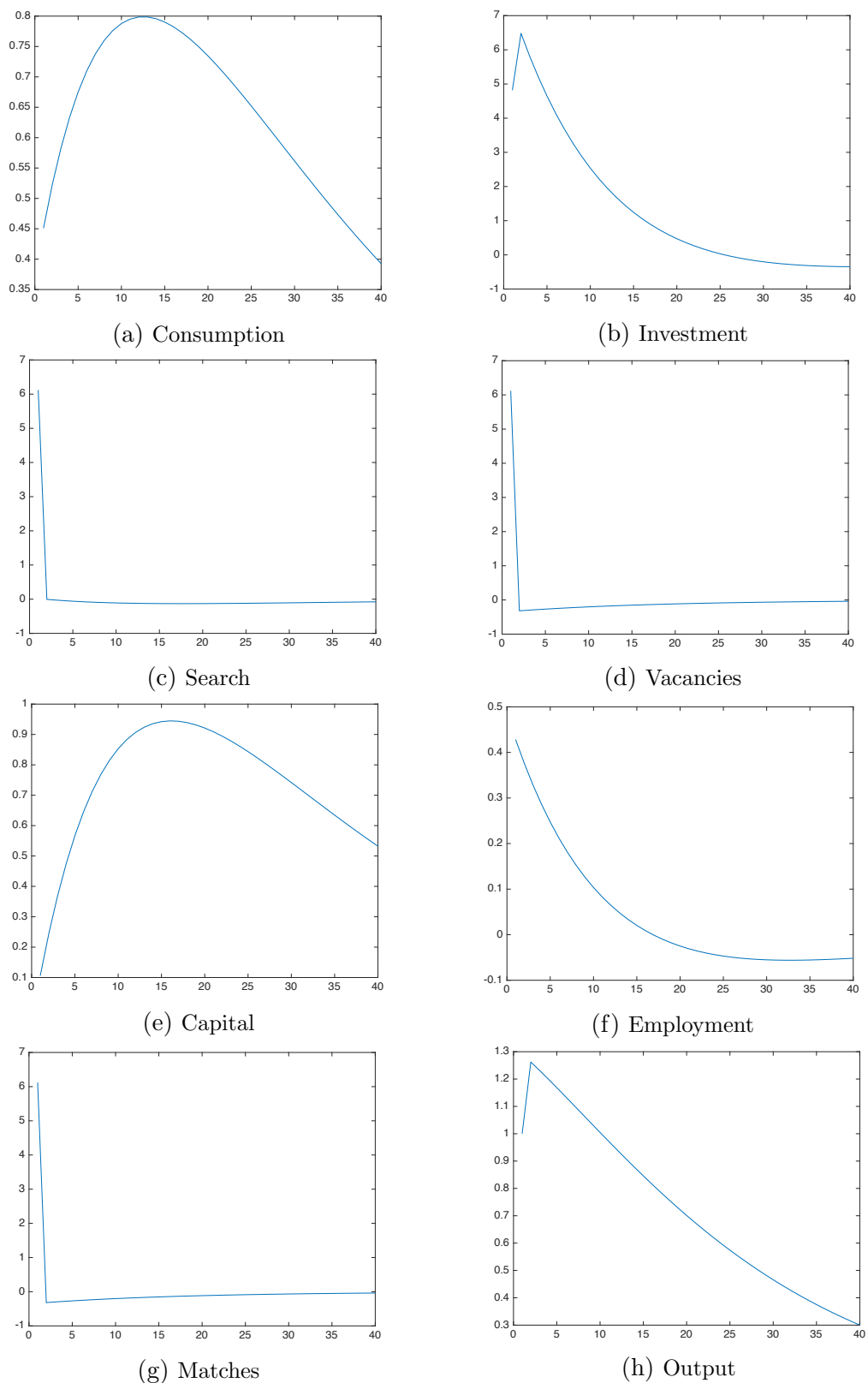


Figure 4: Impulse response functions associated with  $\epsilon_\psi$



*Notes:* The impulse responses are associated with 1 percent shocks to the error term on the labor market's separation rate. The y-axes are measured in percent deviations from steady state, and the x-axes denote time periods from the initial shock.

Figure 5: Impulse response functions associated with  $\epsilon_z$



*Notes:* The impulse responses are associated with 1 percent shocks to the error term on TFP. The y-axes are measured in percent deviations from steady state, and the x-axes denote time periods from the initial shock.

## B. Data Appendix

I construct time series of output, consumption, investment, and employment using annual U.S. data from Federal Reserve Economic Data (2016) during the period 1959:Q1-2006:Q4. The variables are constructed as follows:

1. The data series for output consists of real GDP (GDPC1) less government expenditure (GCEC1) and net exports (NETEXP), as the model is closed and has no government.
2. I define consumption as the sum of services consumed (PCES), non-durable goods consumed (PCND), and 4 percent of durable goods consumed (PCEDG). I multiply the latter by 4 percent because that is the rate used in the literature at which durable goods are consumed annually.
3. In the model, employment is measured as a rate, so I define the employment time series as the annual civilian employment rate for all persons in the U.S. ages 25-54 (LREM25TTUSA156N).
4. The investment time series consists of the sum of Real Investment (GPDICA) and Durables consumed (PCEDG).