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How important are shocks to the elasticity of aggregate labor supply for business cycle fluctuations? Lessons from Bulgaria (1999-2020)

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Abstract

Stochastic shocks to aggregate labor supply elasticity are introduced into a real-business-cycle setup augmented with a detailed government sector. The model is calibrated to Bulgarian data for the period following the introduction of the currency board arrangement (1999-2018). The quantitative importance of a stochastic aggregate labor supply elasticity parameter is investigated for the magnitude of the cyclical fluctuations in Bulgaria. The quantitative effect of such a stochasticity increases the variability of hours, and lowers the correlation between hours and wages, and thus is found to be quantitatively important for the labor market aspect of business cycles.

Keywords: business cycles, stochastic aggregate labor supply elasticity, Bulgaria

JEL Classification Codes: E24, E32

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1 Introduction and Motivation

The magnitude of aggregate labor supply elasticity is an old and still a controversial issue among macro-economists. Some of the controversies and debates between theorists and empiricists have to do with the fact that econometricians estimate the elasticity at micro- or group level, while the real-business-cycle (RBC) model makes use of the *aggregate* labor supply elasticity. Here we abstract away from the intricacies of aggregation issues, which may suggest that most of the volatility in the degree of labor supply responsiveness to wages at aggregate level is driven by a small group of workers that are in and out of the labor force, e.g females with children (who might also substitute between market work and working as stay-at- home parents), teen-agers, or underemployed workers, who would like to work more hours, or practice a better job. Alternatively, a change in labor supply elasticity at aggregate level could be reflecting the weakening of labor unions in Bulgaria, and the increase in the flexibility of labor markets, by making it easier to hire and fire people.[1] We will stay agnostic with respect to all these possible explanations in what follows.

What is novel in this paper is another direction: we will introduce some external variability in the aggregate labor supply elasticity parameter, and study via the use of simulations how important that is, measured in terms of the properties of the model-generated data. In a way, we do not want to put all our trust in the mean value of a parameter, but instead experiment with a time-varying specification, that would act like a range for the parameter.[2] In addition, the stochasticity in the aggregate labor supply elasticity could also capture implicitly some interesting effects, e.g. the changes in labor in- and outflows, driven by changes in the demographic structure, fertility choices, labor market policies at micro-level (such as minimum wages, job protection legislation, etc), all of which that are missing from the benchmark RBC model.[3] Therefore, this simple computational exercise could throw some

[1]One such measure in discussion is the mandatory "class/experience" premium in the wage rate, which is included as a top up to the base salary, and is conditional on the number of years of work experience.

[2]Some people may refer to our modeling approach, and maybe rightly so, as akin to a "Bayesian econometric thinking."

[3]Similarly, the sensitivity to the wage rate is affected when unemployment benefits change in termes of both their generosity and duration, the inclusion of medical benefits and pension contributions, the risk-preference for certain hazardous jobs, proximity to schools for children, availability of childcare, among

light on the promise of further study on the endogeneity of aggregate labor supply elasticity, starting from micro-foundations.[4] Furthermore, the value of aggregate labor supply elasticity is quantitatively importnat for the welfare effect of tax policies that work through the labor supply channel in the RBC model setups.[5]

This proposal is taken seriously, and this paper incorporates a stochastic aggregate labor supply elasticity in an otherwise standard real-business-cycle (RBC) model with a detailed government sector. The model is calibrated for Bulgaria in the period 1999-2020. The quantitative importance of the presence of stochastic aggregate labor supply elasticity parameter is investigated for the magnitude of the cyclical fluctuations in Bulgaria. The quantitative effect of such a stochasticity increases the variability of hours, and lowers the correlation between hours and wages, and thus is found to be quantitatively important for the labor market aspect of business cycles. This is the first study on the issue using modern macroeconomic modelling techniques, and thus an important contribution to the field. For reasonable degree of stochasticity in the labor supply elasticity, the quantitative effects are important, meaning that more research is needed to understand both volatility in labor supply responsiveness at micro-economic level, and how those propagate at aggregate level post-aggregation.

The rest of the paper is organized as follows: Section 2 describes the model framework and defines the decentralized competitive equilibrium system, Section 3 discusses the calibration procedure, and Section 4 presents the steady-state model solution. Sections 5 proceeds with the out-of-steady-state dynamics of model variables, and compared the simulated second moments of theoretical variables against their empirical counterparts. Section 6 concludes the paper.

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many other considerations. These are all difficult to be captured by a single parameter in a highly-stylized representative-agent macroeconomic model.

[4] There is already some work utilizing heterogeneous-agent dynamic stochastic general equilibrium models. This direction, however, is beyond the scope of the current paper.

[5] For a survey of different tax reforms in Bulgaria and their effect on the business cycle, the reader is referred to Vasilev (2017a), Vasilev (2015b), Di Nola *et al* (2019), as well as the references therein.

2 Model Description

There is a representative households which derives utility out of consumption and leisure. The time available to households can be spent in productive use or as leisure, with the labor supply elasticity parameter being subjected to random shocks. The government taxes consumption spending, levies a common proportional (”flat”) tax on labor and capital income in order to finance wasteful purchases of government consumption goods, and government transfers. On the production side, there is a representative firm, which hires labor and capital to produce a homogeneous final good, which could be used for consumption, investment, or government purchases.

2.1 Households

There is a representative household, which maximizes its expected utility function

$$\max E_0 \sum_{t=0}^{\infty} \beta^t \left\{ \ln c_t - \gamma \frac{h_t^{1+\phi_t}}{1+\phi_t} \right\} \tag{2.1}$$

whereE_0 denotes household's expectations as of period 0, c_t denotes household's private consumption in period t, h_t are hours worked in period t, $0 < \beta < 1$ is the discount factor, $0 < \gamma < 1$ is the relative weight that the household attaches to leisure, and $1/\phi_t$ is the stochastic labor supply elasticity, which will vary over time.

The household starts with an initial stock of physical capital $k_0 > 0$, and has to decide how much to add to it in the form of new investment. The law of motion for physical capital is

$$k_{t+1} = i_t + (1-\delta)k_t \tag{2.2}$$

and $0 < \delta < 1$ is the depreciation rate. Next, the real interest rate is r_t, hence the before-tax capital income of the household in period t equals $r_t k_t$. In addition to capital income, the household can generate labor income. Hours supplied to the representative firm are rewarded at the hourly wage rate of w_t, so pre-tax labor income equals $w_t h_t$. Lastly, the household owns the firm in the economy and has a legal claim on all the firm's profit, π_t.

Next, the household's problem can be now simplified to

$$\max E_0 \sum_{t=0}^{\infty} \beta^t \left\{ \ln c_t - \gamma \frac{h_t^{1+\phi_t}}{1+\phi_t} \right\} \tag{2.3}$$

s.t.

$$(1+\tau^c)c_t + k_{t+1} - (1-\delta)k_t = (1-\tau_t^y)[r_t k_t + \pi_t + w_t h_t] + g_t^t \tag{2.4}$$

where where τ^c is the tax on consumption, τ^y is the proportional income tax rate on income ($0 < \tau^c, \tau^y < 1$), and g_t^t denotes government transfers. The household takes the tax rates $\{\tau^c, \tau^y\}_{t=0}^{\infty}$, government spending categories, $\{g_t^c, g_t^t\}_{t=0}^{\infty}$, profit $\{\pi_t\}_{t=0}^{\infty}$, the realized technology process $\{A_t\}_{t=0}^{\infty}$, prices $\{w_t, r_t\}_{t=0}^{\infty}$, and chooses $\{c_t, h_t, k_{t+1}\}_{t=0}^{\infty}$ to maximize its utility subject to the budget constraint.[6]

The first-order optimality conditions as as follows:

$$c_t \; : \; \frac{1}{c_t} = \lambda_t(1+\tau^c) \tag{2.5}$$

$$h_t \; : \; \gamma h_t^{\theta_t} = \lambda_t(1-\tau^y)w_t \tag{2.6}$$

$$k_{t+1} \; : \; \lambda_t = \beta E_t \lambda_{t+1} \left[1 + [1-\tau^y]r_{t+1} - \delta \right] \tag{2.7}$$

$$TVC \; : \; \lim_{t\to\infty} \beta^t \lambda_t k_{t+1} = 0 \tag{2.8}$$

where λ_t is the Lagrangean multiplier attached to household's budget constraint in period t. The interpretation of the first-order conditions above is as follows: the first one states that for each household, the marginal utility of consumption equals the marginal utility of wealth, corrected for the consumption tax rate. The second equation states that when choosing labor supply optimally, at the margin, each hour spent by the household working for the firm should balance the benefit from doing so in terms of additional income generates, and the cost measured in terms of lower utility of leisure (taking into consideration the stochastic labor supply elasticity). The third equation is the so-called "Euler condition," which describes how the household chooses to allocate physical capital over time. The last condition is called the "transversality condition" (TVC): it states that at the end of the horizon, the value of physical capital should be zero.

[6]Note that by choosing k_{t+1} the household is implicitly setting investment i_t optimally.

2.2 Firm problem

There is a representative firm in the economy, which produces a homogeneous product. The price of output is normalized to unity. The production technology is Cobb-Douglas and uses both physical capital, k_t, and labor hours, h_t, to maximize static profit

$$\Pi_t = A_t k_t^{\alpha} h_t^{1-\alpha} - r_t k_t - w_t h_t, \tag{2.9}$$

where A_t denotes the level of technology in period t. Since the firm rents the capital from households, the problem of the firm is a sequence of static profit maximizing problems. In equilibrium, there are no profits, and each input is priced according to its marginal product, *i.e.*:

$$k_t \ : \ \alpha \frac{y_t}{k_t} = r_t, \tag{2.10}$$

$$h_t \ : \ (1-\alpha) \frac{y_t}{h_t} = w_t. \tag{2.11}$$

In equilibrium, given that the inputs of production are paid their marginal products, $\pi_t = 0$, $\forall t$.

2.3 Government

In the model setup, the government is levying taxes on labor and capital income, as well as consumption, in order to finance spending on wasteful government purchases, and government transfers. The government budget constraint is as follows:

$$g_t^c + g_t^t = \tau^c c_t + \tau^y [w_t h_t + r_t k_t] \tag{2.12}$$

Income tax rate and government consumption-to-output ratio would be chosen to match the average share in data, and consumption taxation is progressive. Finally, government transfers would be determined residually in each period so that the government budget is always balanced.

2.4 Dynamic Competitive Equilibrium (DCE)

For a given process followed by technology $\{A_t\}_{t=0}^{\infty}$ and the inverse of the labor supply elasticity $\{\phi_t\}_{t=0}^{\infty}$, the tax rates $\{\tau^c, \tau^y\}$, and the initial capital stock $\{k_0\}$, the decentralized dynamic competitive equilibrium is a list of sequences $\{c_t, i_t, k_t, h_t\}_{t=0}^{\infty}$ for the household, a sequence of government purchases and transfers $\{g_t^c, g_t^t\}_{t=0}^{\infty}$, and input prices $\{w_t, r_t\}_{t=0}^{\infty}$ such that (i) the household maximizes its utility function subject to its budget constraint; (ii) the representative firm maximizes profit; (iii) government budget is balanced in each period; (iv) all markets clear.

3 Data and Model Calibration

To characterize business cycle fluctuations in Bulgaria, we will focus on the period following the introduction of the currency board (1999-2019). Quarterly data on output, consumption and investment was collected from National Statistical Institute (2021), while the real interest rate is taken from Bulgarian National Bank Statistical Database (2021). The calibration strategy described in this section follows a long-established tradition in modern macroeconomics: first, as in Vasilev (2016), the discount factor, $\beta = 0.982$, is set to match the steady-state capital-to-output ratio in Bulgaria, $k/y = 13.964$, in the steady-state Euler equation. The labor share parameter, $1 - \alpha = 0.571$, is obtained as in Vasilev (2017d), and equals the average value of labor income in aggregate output over the period 1999-2018. This value is slightly higher as compared to other studies on developed economies, due to the overaccumulation of physical capital, which was part of the ideology of the totalitarian regime, which was in place until 1989. Next, the average labor and capital income tax rate was set to $\tau^y = 0.1$. Similarly, the average tax rate on consumption is set to its value over the period, $\tau^c = 0.2$.

Next, the relative weight attached to the utility out of leisure in the household's utility function, γ, is calibrated to match that in steady-state consumers would supply one-third of their time endowment to working. This is in line with the estimates for Bulgaria (Vasilev 2017a) as well over the period studied. For the benchmark case, we set $\phi = 1$, i.e., a quadratic disutility of leisure. Next, the depreciation rate of physical capital in Bulgaria, $\delta = 0.013$, was taken from Vasilev (2016). It was estimated as the average quarterly depreciation rate over the period 1999-2014. Finally, the process followed by the TFP process is estimated from the detrended series by running an AR(1) regression and saving the residuals. We use similar moments for the labor supply elasticity process.[7] Table 1 below summarizes the values of all model parameters used in the paper.

Table 1: Model Parameters

Parameter	Value	Description	Method
β	0.982	Discount factor	Calibrated
α	0.429	Capital Share	Data average
γ	0.873	Relative weight attached to leisure	Calibrated
δ	0.013	Depreciation rate on physical capital	Data average
ϕ	1.000	Inverse labor supply elasticity (LSE)	Set
τ^y	0.100	Average tax rate on labour and capital income	Data average
τ^c	0.200	VAT/consumption tax rate	Data average
ρ_a	0.701	AR(1) persistence coefficient, TFP process	Estimated
ρ_θ	0.701	AR(1) persistence coefficient, LSE process	Set
σ_a	0.044	st. error, TFP process	Estimated
σ_θ	0.044	st. error, LSE process	Set

4 Steady-State

Once the values of model parameters were obtained, the steady-state equilibrium system solved, the "big ratios" can be compared to their averages in Bulgarian data. The results are reported in Table 2 below. The steady-state level of output was normalized to unity (hence the level of technology A differs from one, which is usually the normalization done in other studies), which greatly simplified the computations. Next, the model matches consumption-to-output and government purchases ratios by construction; The investment ratios are also closely approximated, despite the closed-economy assumption and the absence of foreign trade sector. The shares of income are also identical to those in data, which is an artifact of the assumptions imposed on functional form of the aggregate production function. The

[7] The idea behind that is to make the two shock processes of equal "strength," which is useful when we disentangle the effect of each process on aggregate allocations, and their business cycle properties in particular.

after-tax return, where $\bar{r} = (1-\tau^y)r - \delta$ is also relatively well-captured by the model. Lastly, given the absence of debt, and the fact that transfers were chosen residually to balance the government budget constraint, the result along this dimension is understandably not so close to the average ratio in data.

Table 2: Data Averages and Long-run Solution

Variable	Description	Data	Model
y	Steady-state output	N/A	1.000
c/y	Consumption-to-output ratio	0.648	0.674
i/y	Investment-to-output ratio	0.201	0.175
k/y	Capital-to-output ratio	13.96	13.96
g^c/y	Government consumption-to-output ratio	0.151	0.151
wh/y	Labor income-to-output ratio	0.571	0.571
rk/y	Capital income-to-output ratio	0.429	0.429
h	Share of time spent working	0.333	0.333
$\bar{r}$	After-tax net return on capital	0.014	0.016

5 Out of steady-state model dynamics

Since the model does not have an analytical solution for the equilibrium behavior of variables outside their steady-state values, we need to solve the model numerically. This is done by log-linearizing the original equilibrium (non-linear) system of equations around the steady-state. This transformation produces a first-order system of stochastic difference equations. First, we study the dynamic behavior of model variables to an isolated shock to the total factor productivity process, and an isolated shock to the aggregate labor supply elasticity. Next, we fully simulate the model to compare how the second moments of the model perform when compared against their empirical counterparts.

5.1 Impulse Response Analysis

This subsection documents the impulse responses of model variables to a 1% surprise innovation to technology. The impulse response functions (IRFs) are presented in Fig. 1. As a result of the one-time unexpected positive shock to total factor productivity, output increases upon impact. This expands the availability of resources in the economy, so uses of output - consumption, investment, and government consumption also increase contemporaneously.

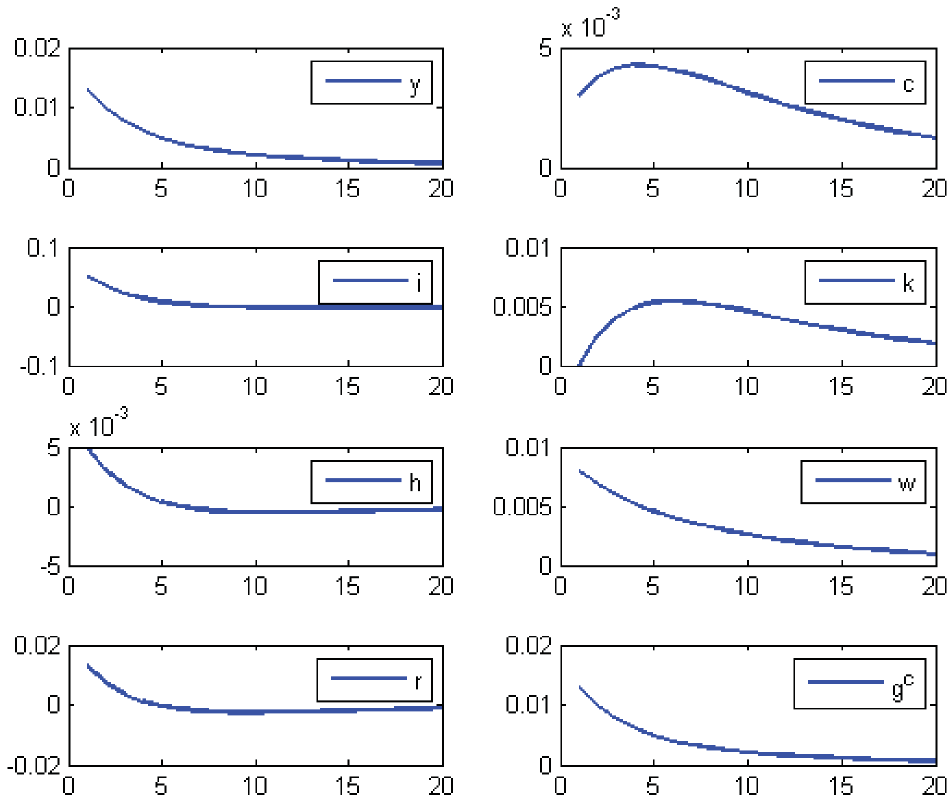

Figure 1: Impulse Responses to a 1% surprise innovation in technology

At the same time, the increase in productivity increases the after-tax return on the two factors of production, labor and capital. The representative households then respond to the incentives contained in prices and start accumulating capital, and supplies more hours worked. In turn, the increase in capital input feeds back in output through the production function and that further adds to the positive effect of the technology shock. In the labor market, the wage rate increases, and the household increases its hours worked. In turn, the increase in total hours further increases output, again indirectly. Over time, as capital is being accumulated, its after-tax marginal product starts to decrease, which lowers the households' incentives to save. As a result, physical capital stock eventually returns to its steady-state, and exhibits a hump-shaped dynamics over its transition path. The rest of the model variables return to their old steady-states in a monotone fashion as the effect of the one-time surprise innovation in technology dies out.

Similarly, the effect of an isolated shock to aggregate labor supply elasticity is summarized in Fig. 2.

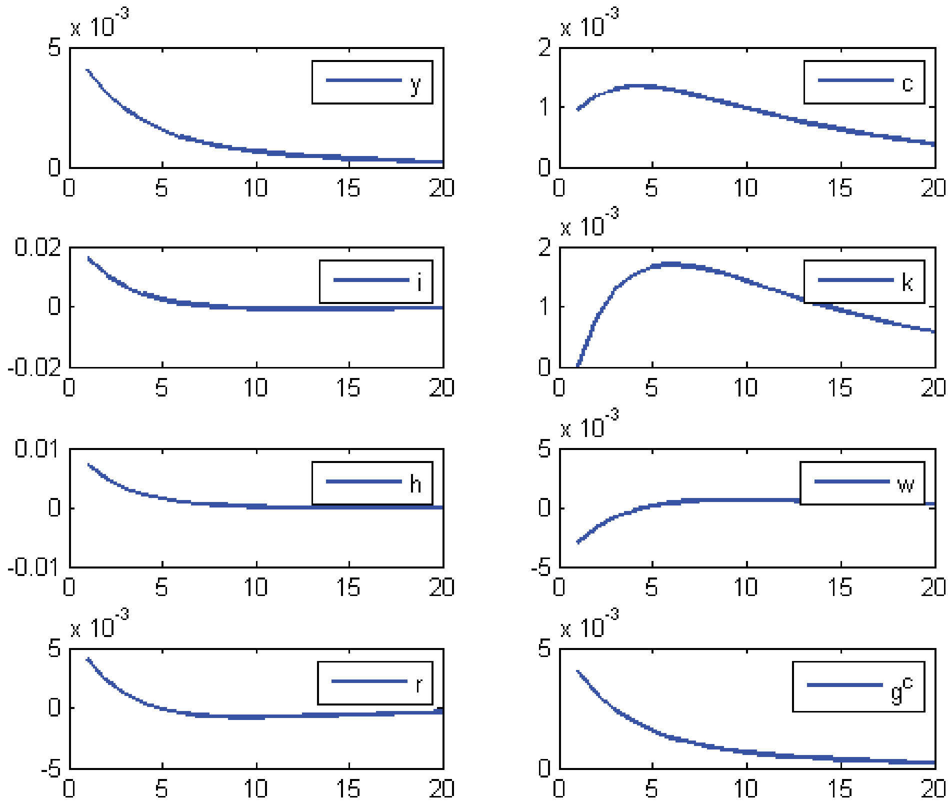

Figure 2: Impulse Responses to a 1% surprise innovation in technology

The effect is qualitatively similar to a technology shock, but much smaller in strength, so an unlikely driver of aggregate fluctuations. After a positive innovation to the labor supply elasticity, hours increase strongly, which has both a direct effect on output, and also an indirect effect - through capital - as the two inputs are complements in the production function. An increase in hours increases the interest rate (but drops the wage rate), thus giving incentive to the household to accumulate capital via investment. As a result, the uses of output - consumption, government spending, and investment, also increase upon impact. Over time, as capital is being accumulated, its after-tax marginal product starts to decrease, which lowers the households' incentives to save. As a result, physical capital stock eventually returns to its steady-state, and exhibits a hump-shaped dynamics over its transition path. The rest of the model variables return to their old steady-states in a monotone fashion as the effect of the one-time surprise innovation in aggregate labor supply elasticity dies out.

5.2 Simulation and moment-matching

As in Vasilev (2017b), we will now simulate the model 10,000 times for the length of the data horizon. Both empirical and model simulated data is detrended using the Hodrick-Prescott (1980) filter. Table 3 on the next page summarizes the second moments of data (relative volatilities to output, and contemporaneous correlations with output) versus the same moments computed from the model-simulated data at quarterly frequency.The "Model" is the case with stochastic aggregate labor supply elasticity, while the "Benchmark RBC" is a setup with a constant labor supply elasticity. In addition, to minimize the sample error, the simulated moments are averaged out over the computer-generated draws. As in Vasilev (2016, 2017b, 2017c), both models match quite well the absolute volatility of output and investment. By construction, government consumption in the models varies as much as output. In addition, both models generate predicted consumption and investment volatilies that are too high. Still, the models are qualitatively consistent with the stylized fact that consumption generally varies less than output, while investment is more volatile than output. The model with stochastic aggregate labor supply elasticity produces a bit smoother investment series, but the quantitative effect is almost indistinguishable across models.

With respect to the labor market variables, the variability of employment predicted by the model with stochastic aggregate labor supply elasticity is higher, and closer to that in data,

Table 3: Business Cycle Moments

	Data	Model both shocks	Benchmark RBC tech shocks only
σ_y	0.05	0.05	0.05
σ_c/σ_y	0.55	0.82	0.82
σ_i/σ_y	1.77	2.34	2.35
σ_g/σ_y	1.21	1.00	1.00
σ_h/σ_y	0.63	0.41	0.28
σ_w/σ_y	0.83	0.86	0.86
$\sigma_{y/h}/\sigma_y$	0.86	0.86	0.86
$corr(c,y)$	0.85	0.90	0.90
$corr(i,y)$	0.61	0.82	0.83
$corr(g,y)$	0.31	1.00	1.00
$corr(h,y)$	0.49	0.49	0.59
$corr(w,y)$	-0.01	0.12	0.96

as compared to the setup with a constant labor supply elasticity. This is a good news for this extension, and a move in the right direction in terms of matching data better. Next, in terms of contemporaneous correlations, the model systematically over-predicts the pro-cyclicality of the main aggregate variables - consumption, investment, and government consumption. This, however, is a common limitation of this class of models. Along the labor market dimension, the contemporaneous correlation of employment with output is exactly matched by the model with stochastic labor supply elasticity. With respect to wages, the model with stochastic labor supply elasticity predicts a very weak cyclicality (0.12), while wages in data are acyclical (-0.01). Therefore, the stochasticity in labor supply responsiveness is able to address to a major extent yet another shortcoming in the neoclassical literature - that the standard RBC model produces almost perfect positive correlation between hours and wages - which was artifact of the wage being equal to the labor productivity in the model.

In the next subsection, as in Vasilev (2016), we investigate the dynamic correlation between labor market variables at different leads and lags, thus evaluating how well the model matches the phase dynamics among variables. In addition, the autocorrelation functions (ACFs) of empirical data, obtained from an unrestricted VAR(1) are put under scrutiny and compared and contrasted to the simulated counterparts generated from the model.

5.3 Auto- and cross-correlation

This subsection discusses the auto- (ACFs) and cross-correlation functions (CCFs) of the major model variables. The coefficients empirical ACFs and CCFs at different leads and lags are presented in Table 4 below against the averaged simulated AFCs and CCFs. For the sake of brevity, we present only the results with the effect of total factor productivity and stochastic aggregate labor supply elasticity combined.

As seen from Table 4 above, the model compares relatively well vis-a-vis data. Empirical ACFs for output and investment are slightly outside the confidence band predicted by the model, while the ACFs for total factor productivity and household consumption are well-approximated by the model. The persistence of labor market variables are also relatively well-described by the model dynamics. Overall, the model with stochastic labor supply elasticity generates too much persistence in output and employment, and is thus still subject to the criticism in Nelson and Plosser (1992), Cogley and Nason (1995) and Rotemberg and Woodford (1996b), who argue that the RBC class of models do not have a strong internal propagation mechanism besides the strong persistence in the TFP process. In those models, e.g. Vasilev (2009), and in the current one, labor market is modeled in the Walrasian market-clearing spirit, and output and persistence is low.

Table 4: Autocorrelations for Bulgarian data and the model economy

		k			
Method	Statistic	0	1	2	3
Data	$corr(n_t, n_{t-k})$	1.000	0.484	0.009	0.352
Model	$corr(n_t, n_{t-k})$	1.000	0.955	0.899	0.834
	(s.e.)	(0.000)	(0.028)	(0.053)	(0.077)
Data	$corr(y_t, y_{t-k})$	1.000	0.810	0.663	0.479
Model	$corr(y_t, y_{t-k})$	1.000	0.955	0.902	0.841
	(s.e.)	(0.000)	(0.028)	(0.053)	(0.078)
Data	$corr(a_t, a_{t-k})$	1.000	0.702	0.449	0.277
Model	$corr(a_t, a_{t-k})$	1.000	0.955	0.901	0.838
	(s.e.)	(0.000)	(0.027)	(0.053)	(0.076)
Data	$corr(c_t, c_{t-k})$	1.000	0.971	0.952	0.913
Model	$corr(c_t, c_{t-k})$	1.000	0.958	0.908	0.851
	(s.e.)	(0.000)	(0.026)	(0.049)	(0.072)
Data	$corr(i_t, i_{t-k})$	1.000	0.810	0.722	0.594
Model	$corr(i_t, i_{t-k})$	1.000	0.953	0.894	0.826
	(s.e.)	(0.000)	(0.029)	(0.055)	(0.079)
Data	$corr(w_t, w_{t-k})$	1.000	0.760	0.783	0.554
Model	$corr(w_t, w_{t-k})$	1.000	0.965	0.905	0.846
	(s.e.)	(0.000)	(0.027)	(0.053)	(0.077)

Next, as seen from Table 5 below, over the business cycle, in data labor productivity leads employment. The model with stochastic aggregate labor supply elasticity, however, cannot account for this fact. As in the standard RBC model a technology shock can be regarded as a factor shifting the labor demand curve, while holding the labor supply curve constant. Therefore, despite the stochastic shift in the labor supply curve, the net effect between employment and labor productivity is only a contemporaneous one.

Table 5: Dynamic correlations for Bulgarian data and the model economy

		k						
Method	Statistic	-3	-2	-1	0	1	2	3
Data	$corr(h_t, (y/h)_{t-k})$	-0.342	-0.363	-0.187	-0.144	0.475	0.470	0.346
Model	$corr(h_t, (y/h)_{t-k})$	0.013	0.015	0.016	0.125	-0.01	-0.003	-0.051
	(s.e.)	(0.339)	(0.298)	(0.249)	(0.507)	(0.270)	(0.291)	(0.320)
Data	$corr(h_t, w_{t-k})$	0.355	0.452	0.447	0.328	-0.040	-0.390	-0.57
Model	$corr(h_t, w_{t-k})$	0.013	0.015	0.016	0.125	-0.01	-0.003	-0.051
	(s.e.)	(0.339)	(0.298)	(0.249)	(0.507)	(0.270)	(0.291)	(0.320)

6 Conclusions

Stochastic shocks to aggregate labor supply elasticity are introduced into a real-business-cycle setup augmented with a detailed government sector. The model is calibrated to Bulgarian data for the period following the introduction of the currency board arrangement (1999-2018). The quantitative importance of the presence of stochastic aggregate labor supply elasticity parameter is investigated for the magnitude of the cyclical fluctuations in Bulgaria. The quantitative effect of such a stochasticity increases the variability of hours, and lowers the correlation between hours and wages, and thus is found to be quantitatively important for the labor market aspect of business cycles. Thus, more micro-based research is needed to uncover the causes of volatility in labor supply elasticity at aggregate level.

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