

Vasilev, Aleksandar

Working Paper

How important are consumer confidence shocks for the propagation of business cycles in Bulgaria?

LEAF Working Paper Series, No. 19-03

Provided in Cooperation with:

Lincoln Economics and Finance Research Group (LEAF), Lincoln International Business School, University of Lincoln

Suggested Citation: Vasilev, Aleksandar (2019) : How important are consumer confidence shocks for the propagation of business cycles in Bulgaria?, LEAF Working Paper Series, No. 19-03, University of Lincoln, Lincoln International Business School, Lincoln Economics and Finance Research Group (LEAF), Lincoln

This Version is available at:

<https://hdl.handle.net/10419/204487>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.



UNIVERSITY OF
LINCOLN

L INCOLN **E** CONOMICS **A** ND **F** INANCE

LEAF Working Paper Series

No. 19-03

**How important are consumer confidence shocks for the
propagation of business cycles in Bulgaria?**

Aleksandar Vasilev

Lincoln International Business School, University of Lincoln,
Brayford Pool, Lincoln, LN6 7TS
Tel: +44 (0)1522 882 000

How important are consumer confidence shocks for the propagation of business cycles in Bulgaria?

Aleksandar Vasilev*

April 2019

Abstract

This paper takes an otherwise standard real-business-cycle setup with government sector, and augments it with shocks to consumer confidence to study business cycle fluctuations. A surprise increase in consumer confidence generates higher utility, as the household values consumption more in that scenario. As a test case, the model is calibrated to Bulgaria after the introduction of the currency board (1999-2018). We find that shocks to consumer confidence by themselves cannot be the main driving force behind business cycle fluctuations, but when combined with technology shocks, model performance improves substantially. Therefore, allowing for additional factors, such as consumer confidence, to interact with technology shocks can be useful in explaining business cycle movements.

Keywords: consumer confidence shocks, business cycles, Bulgaria

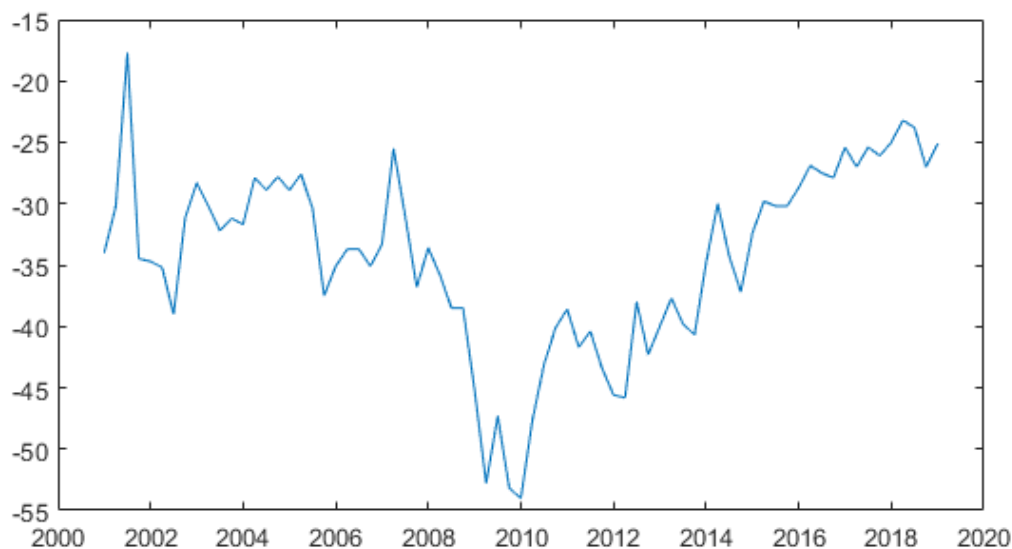
JEL Codes: E32, E62, E21

*Lecturer, Lincoln International Business School, UK. E-mail for correspondence: AVasilev@lincoln.ac.uk.

1 Introduction and Motivation

Macro/economic theory, *e.g.*, Pigou (1927), and Keynes (1936), has long ago claimed that "waves of optimism and pessimism" (Dees and Gunther 2014) could be important drivers of business cycles. Dees and Gunther (2013, 2014) use survey data on consumer sentiment and find that confidence shocks explain a large share of the variance in real economic activity. They interpret the as a confirmation that confidence shocks play some role in business cycle fluctuations. Other researchers also argue that confidence measures have both predictive power in economic models, and thus a role in understanding business cycle fluctuations, *e.g.*, Carroll, Fuhrer, and Wilcox (1994), Ludvigson (2004), and Benhabib *et al.* (2015). Benhabib and Spiegel (2017) also found consumer sentiment to affect aggregate demand in the US, at state level.

Nowadays, many countries provide information on consumer confidence index. If we take for example Bulgaria, a new EU member state, and a former transition economy, which is still developing, we observe the following behavior over time:



Source: NSI (2019).

Figure 1: Consumer Confidence Indicator (% change), Bulgaria (2001-2019)

As seen from Fig. 1, there is a big drop in consumer confidence around the financial crisis, and a recovery afterwards. Even though the rate of change is negative throughout the period, which is a sign of extreme pessimism, the series exhibits clear cyclical fluctuations.

How should economists think in a disciplined manner about consumer confidence indices, and their time series properties, more specifically? As argued in Barsky and Sims (2012), there are two main approaches to modelling the role of confidence in macroeconomics: the first is called the "information," or "news" approach, which suggests that confidence indicators contain information about the future values of aggregate variables, *e.g.*, Beaudry and Portier (2006), Barsky and Sims (2011), among others. The second - and contrasting - approach is the "animal spirits" one, which argues that changes in beliefs, or "self-fulfilling prophecies," as discussed in Azariadis (1981) and Farmer (1999), which are unrelated to economic fundamentals (preferences, production function) may have a causal effect on the business cycle, as in Akerloff and Shiller (2010), Angeletos and La'O (2013), and the references therein.

We take an alternative approach in this paper. Our analysis will be deeply rooted in economic fundamentals. We prefer to stay within a neoclassical paradigm, and utilize a disciplined micro-founded general equilibrium model. We take the consumer confidence channel seriously, and proceed to investigate its quantitative importance for the propagation of business cycles. In the model, a shock to consumer confidence will enter the consumption term in the household's utility function, and would thus disturb the marginal rate of substitution between consumption and labor (the "intra-temporal" substitution effect), the inter-temporal substitution of consumption, and the way the household substitutes hours over time, *i.e.*, the inter-temporal substitution of leisure. Since our model will feature rational expectations, the model will possess a unique steady-state.¹

¹In contrast, Benhabib and Farmer (1999) argue that consumer confidence is based on belief which can produce multiplicity of equilibria.

This is the first paper that studies the propagation mechanism of consumer confidence shocks.² In addition, the theoretical framework allows us to distinguish between technology and shocks to consumer confidence. As proposed, Bulgaria will be used as a testing ground for the theory. The focus will be on the period after the introduction of the currency board regime, which brought macroeconomic stability. The choice of the country makes sure that our findings will be relevant for other transition and developing economies. Using a computational experiment, and simulating the response of the artificial economy to innovations to consumer confidence, we find that shocks to consumer confidence by themselves cannot be the main driving force behind business cycle fluctuations, but when combined with technology shocks, model performance improves substantially. Therefore, allowing for additional factors, such as consumer confidence, to interact with technology shocks can be useful in explaining business cycle movements.

The rest of the paper is organized as follows: Section 2 describes the model setup, Section 3 describes the model calibration, Section 4 characterizes the symmetric steady-state, Section 5 evaluates the out-of-steady-state model dynamics, and Section 6 concludes.

2 Model Setup

The setup is standard. The novelty is the introduction of a shock to consumer confidence. There is a representative on-member household, which derives utility out of consumption and leisure. The time available to the household can be spent working, or in the form of leisure. The government collects tax revenue, and spends on public purchases and government transfers. On the production side, there is a representative firm, which produces a homogenous final good, which could be used for consumption, investment, or government purchases.

²As pointed above, our approach differs significantly from the "news" approach described earlier.

2.1 Households

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

$$E_0 \sum_{t=0}^{\infty} \beta^t \left\{ \frac{[(\gamma_t c_t)^\nu (1 - h_t)^{1-\mu}]^{1-\sigma}}{1 - \sigma} \right\}, \quad (1)$$

where E_0 is the expectations operator as of period $t = 0$, c_t denotes household's private consumption in period t , h_t are non-leisure hours in period t , $0 < \beta < 1$ is the discount factor, $0 < \mu, 1 - \mu < 10$ is the utility weight that the household attaches to consumption and leisure, respectively. Parameter $\sigma > 0$ captures the curvature of the utility function, while γ_t is a parameter reflecting how important/valuable consumption is. We will refer to this as consumer confidence parameter.

The household starts with an initial stock of physical capital k_0 , and has to decide how much to add to it in the form of new investment. Every period physical capital depreciates at a rate δ , where $0 < \delta < 1$. The law of motion for physical capital is then

$$k_{t+1} = i_t + (1 - \delta)k_t, \quad (2)$$

and 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, each household can generate labor income, which is remunerated at an hourly wage rate w_t .

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

$$E_0 \sum_{t=0}^{\infty} \beta^t \left\{ \frac{[(\gamma_t c_t)^\nu (1 - h_t)^{1-\mu}]^{1-\sigma}}{1 - \sigma} \right\} \quad (3)$$

s.t.

$$(1 + \tau^c)c_t + k_{t+1} - (1 - \delta)k_t = (1 - \tau^y)[w_t h_t + r_t k_t + \pi_t] + g_t^t, \quad (4)$$

where τ^c, τ^y is the consumption and income tax, respectively, g_t^t is household's government transfer, and π_{it} is the profit income earned by each household. The problem generates the following optimality conditions:

$$c_t : (\gamma_t c_t)^{\mu(1-\sigma)-1} (1 - h_t)^{(1-\mu)(1-\sigma)} = \lambda_t (1 + \tau^c) \quad (5)$$

$$k_{t+1} : \lambda_t = \beta \lambda_{t+1} [1 + (1 - \tau^y)r_{t+1} - \delta] \quad (6)$$

$$h_t : \frac{\gamma_t c_t}{1 - h_t} = \frac{(1 - \tau^y)w_t}{1 + \tau^c} \quad (7)$$

$$TVC : \lim_{t \rightarrow \infty} \beta^t \lambda_t k_{t+1} = 0, \quad (8)$$

where λ_t is the Lagrangean multiplier attached to household's budget constraint in period t .

The first optimality condition states that for each household, in equilibrium the marginal utility of consumption should equal the marginal utility of wealth, corrected for the consumption tax rate. The second equation is the so-called "Euler condition," which describes how each household chooses to optimally allocate physical capital over time. Next, at the margin, each hour spent 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. Similarly, the disutility from an hour spent rent-seeking should equate the benefit (in terms of captured tax revenue). The last condition is the boundary, or "transversality condition" (TVC), which states that at the end of the horizon, the value of physical capital should be zero.

2.2 Firm

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 , and labor hours, h , to maximize static profit

$$\pi_t = A_t k_t^\alpha h_t^{1-\alpha} - r_t k_t - w_t h_t, \quad (9)$$

where A_t denotes the level of technology as of 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 ($\pi_{it} = 0$), and each input is priced according to its marginal product, *i.e.*:

$$k_t : \alpha \frac{y_t}{k_t} = r_t, \quad (10)$$

$$h_t : (1 - \alpha) \frac{y_t}{h_t} = w_t. \quad (11)$$

2.3 Government

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

$$g_t^c + g_t^t = \tau^c c_t + \tau^y [r_t k_t + w_t h_t] \quad (12)$$

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

2.4 Exogenous stochastic processes

The exogenous processes for total factor productivity, A_t , and consumer confidence, γ_t , will follow AR(1) processes in natural logarithms:

$$\ln A_{t+1} = (1 - \rho_a) \ln A + \rho_a \ln A_t + \epsilon_{t+1}^a \quad (13)$$

$$\ln \gamma_{t+1} = (1 - \rho_\gamma) \ln \gamma + \rho_\gamma \ln \gamma_t + \epsilon_{t+1}^\gamma \quad (14)$$

where A, γ is the steady-state values of the TFP processes and consumer confidence, respectively, $0 < \rho_a, \rho_\gamma < 1$ are the corresponding persistence parameters, and the productivity and confidence innovations are drawn from the following distributions: $\epsilon_t^a \sim i.i.dN(0, \sigma_a^2)$ and $\epsilon_t^\gamma \sim i.i.dN(0, \sigma_\gamma^2)$, respectively.

2.5 Dynamic Competitive Equilibrium (DCE)

Given the processes followed by technology and consumer confidence, $\{A_t, \gamma_t\}_{t=0}^\infty$, the average tax rates $\{\tau^c, \tau^y\}$, initial capital stock k_0 , the decentralized dynamic competitive equilibrium is a list of sequences $\{c_t, i_t, k_t, h_t, g_t^c, g_t^t\}_{t=0}^\infty$, 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 compute the size of overall tax evasion in Bulgaria, we will focus on the period after the introduction of the currency board (1999-2018). Data on output, consumption and investment was collected from National Statistical Institute (2019), while the real interest rate is taken from Bulgarian National Bank Statistical Database (2019). The calibration strategy described in this section follows a long-established tradition in modern macroeconomics:

first, the discount factor, $\beta = 0.937$, is set to match the steady-state capital-to-output ratio in Bulgaria, $k/y = 3.491$, in the steady-state Euler equation. The labor share parameter, $\alpha = 0.429$, was obtained as the average value of labor income in aggregate output over the period 1999-2014.³ 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 as well over the period studied. The depreciation rate of physical capital in Bulgaria, $\delta = 0.05$, was taken from Vasilev (2015b). It was estimated as the average depreciation rate over the period 1999-2014. The average income tax rate was set to $\tau^y = 0.22$,⁴ and the average social contribution rate paid by the employer on the workers' behalf is $\tau^{e,ss} = 0.234$. Finally, the tax rate on consumption is set to its value over the period, $\tau^c = 0.2$. The TFP process is estimated from the detrended series of the Solow residuals by running an AR(1) regression. Similarly, using data on consumer confidence from the National Statistical Institute, we estimate the process followed by consumption shocks. Table 1 below summarizes the values of all model parameters used in the paper.

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 on the next page. 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

³This 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.

⁴This is a sum of two parts: the average effective tax rate on income between 1999-2007, when Bulgaria used progressive income taxation, and equal to the proportional income tax rate introduced as of 2008, *plus* the average amount of social security contributions made by each worker. Technically, $\tau^y = \hat{\tau}^y(1 - \tau^{w,ss}) + \tau^{w,ss}$ since social security payments are deducted from the tax base for income taxation, where $\hat{\tau}^y$ is the pure income tax, and $\tau^{w,ss}$ denote the social security contributions paid by each worker.

Table 1: Model Parameters

Parameter	Value	Description	Method
β	0.937	Discount factor	Calibrated
σ	2.000	Curvature, utility function	Set
α	0.429	Capital Share	Data average
$1 - \alpha$	0.571	Labor Share	Calibrated
γ	1.000	Steady-state, consumer confidence	Set
μ	0.333	Utility weight attached to consumption	Calibrated
δ	0.050	Depreciation rate on physical capital	Data average
τ^y	0.100	Average tax rate on income	Data average
τ^c	0.200	VAT/consumption tax rate	Data average
ρ_a	0.701	AR(1) persistence coefficient, TFP process	Estimated
σ_a	0.044	st. error, TFP process	Estimated
ρ_γ	0.830	AR(1) persistence coefficient, consumer confidence process	Set
σ_γ	0.040	st. error, consumer confidence process	Set

consumption-to-output ratio by construction; The investment and government purchases 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 after-tax return, where $\tilde{r} = (1 - \tau^y)r - \delta$ is also relatively well-captured by the model.

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	0.674	0.674
i/y	Investment-to-output ratio	0.201	0.175
g^c/y	Government cons-to-output ratio	0.159	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
A	Scale parameter of the production function	N/A	1.095
\tilde{r}	After-tax net return on capital	0.056	0.067

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 solve the model numerically by log-linearizing the original equilibrium (non-linear) system of equations around the steady-state. This transformation produces a first-order system of stochastic linear difference equations. First, we study the dynamic behavior of model variables to an isolated shock to the total factor productivity process, to an isolated shock to institutional quality, and then 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: Technology Shock

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. 2 on the next page. First, output increases directly upon impact as a result of the improvement in technology. This expands the availability of resources in the economy, so uses of output

- private consumption, investment, and government purchases also increase contemporaneously. At the same time, the increase in productivity increases the after-tax return on the two factors of production, labor and capital. The households then respond to the incentives contained in prices and start accumulating capital, and dedicates more time to working. In turn, the increase in capital and labor input feeds back in output through the production function and that further adds to the positive effect of the technology shock. Over time, as capital is being accumulated, its after-tax marginal product starts to decrease, which follows from the diminishing marginal product property built in the production function. A lower interest rate then lowers the households' incentives to save in the form of capital. Investment starts to decrease and returns to its old steady-state value. In turn, physical capital stock

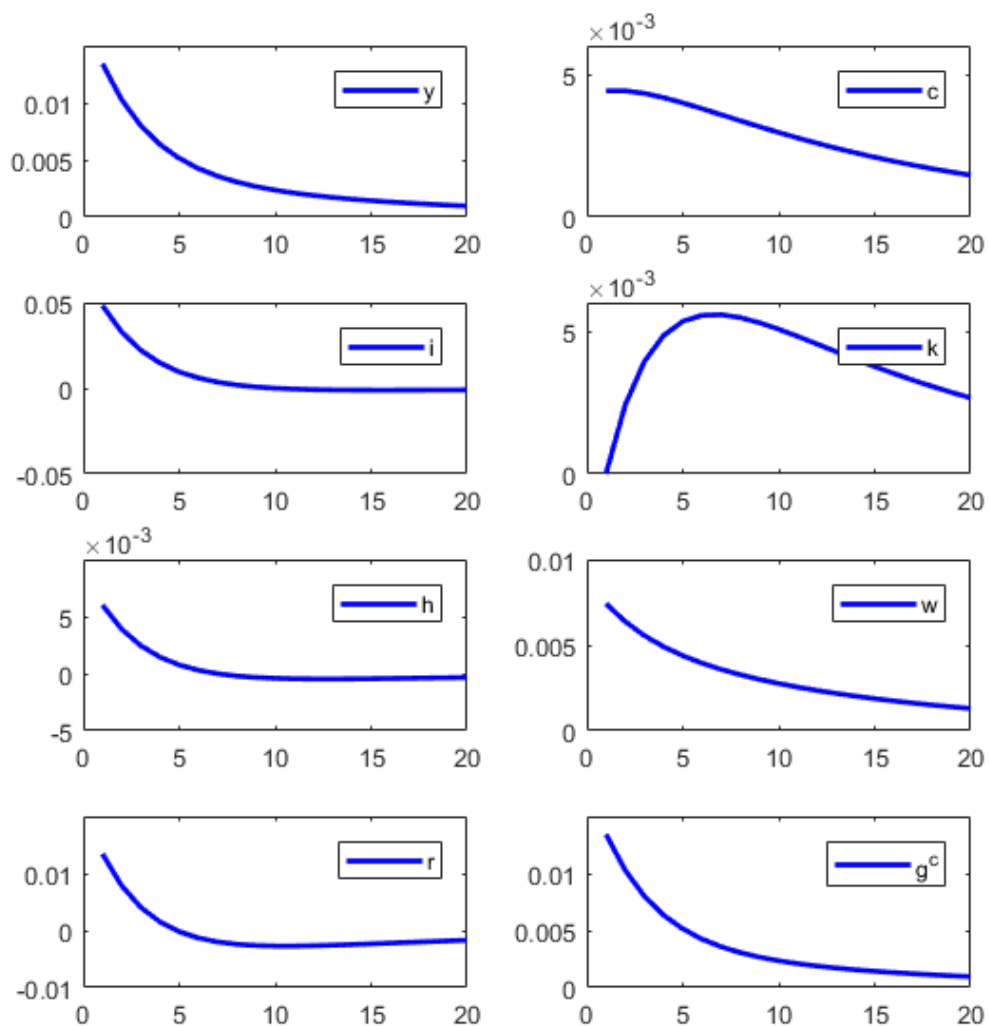


Figure 2: Impulse Responses to a 1% surprise innovation in technology

also returns to its steady-state, following a hump-shaped dynamics along its transition path. The rest of the model variables (except for consumption) also return to their old steady-states in a monotone fashion as the effect of the one-time surprise innovation in technology dies out.

5.1.1 Impulse Response Analysis: Consumer confidence shock

With consumer confidence shocks only, aggregate output is now deterministic. Consumer confidence shocks affect the static (intra-temporal) trade-off between contemporaneous consumption and hours worked, as well as the inter-temporal substitution of consumption, and the inter-temporal substitution of labor supply. The results are presented in Fig. 3 on the next page.

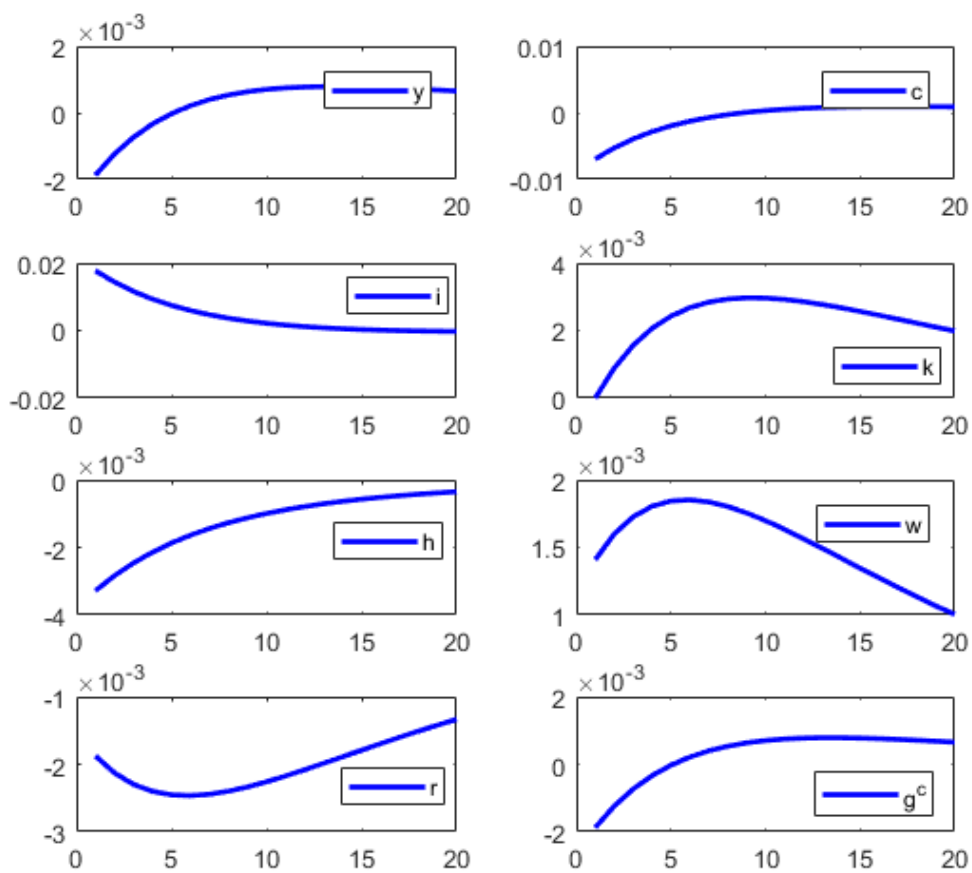


Figure 3: Impulse Responses to a 1% surprise innovation in consumption confidence

More specifically, a shock to consumer confidence increases the marginal utility of consumption, so the level of consumption decreases. From the marginal rate of substitution between

consumption and hours it follows that hours fall as well. Given that capital is predetermined, output falls upon impact of the shock. The scarcity of hours in turn increases the return to labor and capital, where the latter follows from the complementarity of hours and capital in the Cobb-Douglas production function. Over time, the increase in the wage rate and the interest rate result in an increased labor supply, and a higher investment rate. Over time, as physical capital becomes less scarce, its after-tax marginal product starts to decrease, which follows from the diminishing marginal product property built in the aggregate production function. A lower interest rate in turn lowers the households' incentives to save in the form of capital. Investment starts to decrease and returns to its old steady-state value. In turn, physical capital stock also returns to its steady-state, following a hump-shaped dynamics along its transition path. The rest of the model variables also return to their old steady-states in a monotone fashion as the effect of the one-time surprise innovation in consumer confidence dies out.

Overall, the magnitude of the impulse responses confirms that consumer confidence, represented by a shock to the consumption term in the household's utility function, cannot be a driving force in the economy. However, maybe in combination with technology shocks, the presence of consumer confidence disturbances might improve the model performance. We investigate this possibility by simulating the model in the next subsection.

5.2 Simulation and moment-matching

As in Vasilev (2017b), we simulate 10,000 series of innovations for both TFP and institutional quality for the length of the data horizon.⁵ We consider three specifications: Model I will feature only technology shocks, and γ will be held equal to its steady-state value; Model II shuts down any fluctuations in A_t , so the only source of economic fluctuations are innovations in consumer confidence. Model III is a setup with both technology and consumer

⁵Both empirical and model simulated data is detrended using the Hodrick-Prescott (1980) filter.

confidence shocks. The combined effect depends on the relative persistence and standard deviation of the shocks. 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 annual frequency. Similar to Vasilev (2016, 2017b, 2017c), the setups overestimate the relative volatility of consumption and investment, but are still qualitative consistent with the stylized facts that consumption varies less than output, and investment varies more than output. By construction, in all versions of the model government purchases vary as much as output. Adding consumer

Table 3: Business Cycle Moments

	Data	Model I: Tech. shocks only	Model II: Cons. shocks only	Model III: Both shocks
σ_c/σ_y	0.55	0.78	2.39	0.87
σ_i/σ_y	1.77	2.31	6.99	2.59
σ_g/σ_y	1.21	1.00	1.00	1.00
σ_h/σ_y	0.63	0.26	1.76	0.40
σ_w/σ_y	0.83	0.84	2.16	0.90
$\sigma_y/h/\sigma_y$	0.86	0.84	2.16	0.90
$corr(c, y)$	0.85	0.92	0.66	0.82
$corr(i, y)$	0.61	0.87	-0.21	0.71
$corr(g, y)$	0.31	1.00	1.00	1.00
$corr(h, y)$	0.49	0.68	-0.12	0.39
$corr(w, y)$	-0.01	0.97	0.54	0.87
$corr(w, h)$	0.33	0.51	-0.87	0.21

confidence shocks to the model driven by innovations to technology helps to increase the volatility of working hours. and that brings that moment closer to that in data. Wage variability in the benchmark- and the combined model is close to that observed in data, but way higher in the setup with consumer confidence shocks alone.

Next, in terms of contemporaneous correlations, the benchmark model systematically overpredicts the pro-cyclicality of the main aggregate variables - private consumption, investment, and government purchases. This, however, is a common limitation of this class of

market-clearing models. With respect to wages, the model predicts strong cyclical, while wages in data are acyclical. This shortcoming is also well-known in the neoclassical literature and an artifact of the wage being equal to the labor productivity in the model. However, when technology shocks are combined with consumer confidence shocks, Model III features a much better fit than the setup with technology shocks alone.⁶

5.3 Auto- and cross-correlation

This subsection discusses the auto-(ACFs) and cross-correlation functions (CCFs) of the major model variables. The coefficients of the empirical ACFs and CCFs at different leads and lags, obtained from an unrestricted VAR(1), are presented in Table 4 below against the averaged simulated AFCs and CCFs. For the sake of brevity, we present only results for Models I and III, i.e., the model with technology shock only, and the setup combined with consumption shocks.⁷ As seen from Table 4, 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, household consumption, and hours are relatively well-approximated by the model. The persistence of hours is not well-described by the model dynamics. Overall, both models generates too much persistence in output and employment, and is subject to the criticism in Nelson and Plosser (1992), Cogley and Nason (1995) and Rotemberg and Woodford (1996b). All those authors argue that the RBC class of models do not have a strong internal propagation mechanism besides the strong persistence in the TFP process. In this class of models, *e.g.* Vasilev (2009) for Bulgaria, and in the current one, labor market is modelled in the Walrasian market-clearing spirit, and there is no involuntary unemployment.

⁶Finally, Model II fits data poorly, which is a strong indicator that consumer confidence shocks are not a major driver of business cycle fluctuations.

⁷Following Canova (2007), this comparison is used as a goodness-of-fit measure.

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 I	$corr(n_t, n_{t-k})$	1.000	0.953	0.895	0.828
	(s.e.)	(0.000)	(0.028)	(0.054)	(0.078)
Model III	$corr(n_t, n_{t-k})$	1.000	0.955	0.900	0.836
	(s.e.)	(0.000)	(0.027)	(0.053)	(0.077)
Data	$corr(y_t, y_{t-k})$	1.000	0.810	0.663	0.479
Model I	$corr(y_t, y_{t-k})$	1.000	0.957	0.905	0.846
	(s.e.)	(0.000)	(0.024)	(0.047)	(0.069)
Model III	$corr(y_t, y_{t-k})$	1.000	0.958	0.907	0.849
	(s.e.)	(0.000)	(0.025)	(0.048)	(0.070)
Data	$corr(a_t, a_{t-k})$	1.000	0.702	0.449	0.277
Model I	$corr(a_t, a_{t-k})$	1.000	0.955	0.900	0.836
	(s.e.)	(0.000)	(0.026)	(0.050)	(0.072)
Model III	$corr(a_t, a_{t-k})$	1.000	0.956	0.902	0.839
	(s.e.)	(0.000)	(0.027)	(0.052)	(0.075)
Data	$corr(c_t, c_{t-k})$	1.000	0.971	0.952	0.913
Model I	$corr(c_t, c_{t-k})$	1.000	0.959	0.910	0.856
	(s.e.)	(0.000)	(0.023)	(0.045)	(0.066)
Model III	$corr(c_t, c_{t-k})$	1.000	0.958	0.909	0.852
	(s.e.)	(0.000)	(0.025)	(0.049)	(0.071)
Data	$corr(i_t, i_{t-k})$	1.000	0.810	0.722	0.594
Model I	$corr(i_t, i_{t-k})$	1.000	0.953	0.898	0.832
	(s.e.)	(0.000)	(0.027)	(0.052)	(0.075)
Model III	$corr(i_t, i_{t-k})$	1.000	0.954	0.898	0.833
	(s.e.)	(0.000)	(0.028)	(0.054)	(0.079)

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

		k						
Method	Statistic	-3	-2	-1	0	1	2	3
Data	$corr(n_t, (y/n)_{t-k})$	-0.342	-0.363	-0.187	-0.144	0.475	0.470	0.346
Model I	$corr(n_t, (y/n)_{t-k})$	0.056	0.056	0.056	0.505	0.076	0.010	-0.033
	(s.e.)	(0.342)	(0.297)	(0.242)	(0.256)	(0.224)	(0.257)	(0.289)
Model III	$corr(n_t, (y/n)_{t-k})$	-0.004	0.004	0.011	0.234	0.032	-0.005	-0.031
	(s.e.)	(0.338)	(0.295)	(0.244)	(0.482)	(0.273)	(0.298)	(0.327)
Data	$corr(h_t, w_{t-k})$	0.355	0.452	0.447	0.328	-0.040	-0.390	-0.57
Model I	$corr(n_t, w_{t-k})$	0.056	0.056	0.056	0.505	0.076	0.010	-0.033
	(s.e.)	(0.342)	(0.297)	(0.242)	(0.256)	(0.224)	(0.257)	(0.289)
Model III	$corr(n_t, w_{t-k})$	-0.004	0.004	0.011	0.234	0.032	-0.005	-0.031
	(s.e.)	(0.338)	(0.295)	(0.244)	(0.482)	(0.273)	(0.298)	(0.327)

In addition, as seen from Table 5 below, over the business cycle, in data labor productivity leads hours. Neither the model with institutional quality, nor the standard model with a technology shock can account for this fact, as both shocks generate only a contemporaneous effect between employment and labor productivity. Indeed, this is what we see in all the three specification: the highest value of the correlation is the contemporaneous one.

6 Conclusions

This paper takes an otherwise standard real-business-cycle setup with government sector, and augments it with shocks to consumer confidence to study business cycle fluctuations. A surprise increase in consumer confidence generates higher utility, as the household values consumption more in that scenario. As a test case, the model is calibrated to Bulgaria after the introduction of the currency board (1999-2018). We find that shocks to consumer confidence by themselves cannot be the main driving force behind business cycle fluctuations, but when combined with technology shocks, model performance improves substantially. Therefore, allowing for additional factors, such as consumer confidence, to interact with technology shocks can be useful in explaining business cycle movements.

References

Akerlof, G. and R. J. Shiller (2010). *Animal Spirits: How Human Psychology Drives the Economy, and Why It Matters*, Princeton University Press: Princeton, NJ.

Angeletos, G.-M. and La'O, J. (2013) "Sentiments," *Econometrica* 81: 739-779.

Azariadis, C. (1981) "Self-Fulfilling Prophecies," *Journal of Economic Theory* 25: 380-396.

Barsky, R. B. and Sims, E. R. (2011) "News shocks and business cycles," *Journal of Monetary Economics* 58: 273-289.

Barsky, R. B. and Sims, E. R. (2012) "Information, animal spirits, and the meaning of innovations in consumer confidence," *American Economic Review* 102: 1343-1377.

Beaudry, P. and Portier, F. (2006) Stock Prices, News, and Economic Fluctuations. *American Economic Review* 96: 1293-1307.

Beaudry, P., Dupaigne, M. and Portier, F. (2011) "The international propagation of news shocks," *Review of Economic Dynamics* 14: 72-91.

Beaudry, P., Nam, D. and Wang, J. (2011) "Do mood swings drive business cycles and is it rational?," *NBER Working Paper* No. 17651.

Benhabib, J., and R. Farmer (1999) "Indeterminacy and Sunspots in Macroeconomics," in: *Handbook of Macroeconomics*, Vol. 1, 387-448, J. Taylor and M. Woodford (eds.), Elsevier: Amsterdam, Holland.

Benhabib, J., and M. Spiegel (2017) "Sentiments and Economic Activity: Evidence from U.S. States," *Federal Reserve Bank of San Francisco Working Paper* 2016-19.

Benhabib, J., P. Wang, and Y. Wen (2015) "Sentiments and Aggregate Demand Fluctuations," *Econometrica* 83(2): 549-585.

Bulgarian National Bank (2019). *Bulgarian National Bank Statistics*. Available on-line at www.bnb.bg. Accessed on Feb. 21, 2019.

Carroll, C. D., Fuhrer, J. C. and Wilcox, D. W. (1994) "Does Consumer Sentiment Forecast Household Spending? If So, Why?," *American Economic Review* 84: 1397-1408.

Dees, S. and J. Gunther (2017) "The International dimension of confidence shocks," *International Economics* 151: 48-65.

Dees, S. and Soares-Brinca, P. (2013) "Consumer confidence as a predictor of consumption spending: Evidence for the United States and the Euro Area," *International Economics* 134: 1-14.

Farmer, R. (1999) *The Macroeconomics of Self-Fulfilling Prophecies*. MIT Press: Boston, US.

Keynes, J. M. (1936) *The General Theory of Employment, Interest, and Money*. Palgrave Macmillan: London, UK.

Ludvigson, S. C. (2004) "Consumer Confidence and Consumer Spending," *Journal of Economic Perspectives* 18: 29-50.

National Statistical Institute. 2019. *Aggregate Statistical Indicators*. Available on-line at www.nsi.bg. Accessed on Feb. 21, 2019.

Pigou, A. (1927) *Industrial Fluctuations*. MacMillan Publishing House: London, UK.

Vasilev, A. (2017a) "Business Cycle Accounting: Bulgaria after the introduction of the currency board arrangement (1999-2014), *European Journal of Comparative Economics*, 14(2): 197-219.

Vasilev, A. (2017b) "A Real-Business-Cycle model with efficiency wages and a government sector: the case of Bulgaria," *Central European Journal of Economic Modelling and Econometrics*, 9(4): 359-377.

Vasilev, A. (2017c) "A Real-Business-Cycle model with reciprocity in labor relations and fiscal policy: the case of Bulgaria," *Bulgarian Economic Papers* BEP 03-2017, Center for Economic Theories and Policies, Sofia University St. Kliment Ohridski, Faculty of Economics and Business Administration, Sofia, Bulgaria.

Vasilev, A. (2017d) "VAT Evasion in Bulgaria: A General-Equilibrium Approach," *Review of Economics and Institutions*, 8(2): 2-17.

Vasilev, A., (2017e). "On the cost of Opportunistic Behavior in the Public Sector: A General-Equilibrium Approach." *Journal of Public Economic Theory* 19, 565–582.

Vasilev, A. (2016) "Search and matching frictions and business cycle fluctuations in Bulgaria," *Bulgarian Economic Papers* BEP 03-2016, Center for Economic Theories and Policies, Sofia University St. Kliment Ohridski, Faculty of Economics and Business Administration,

Sofia, Bulgaria.

Vasilev, A. (2015a) "Welfare effects of an income tax reform: the case of Bulgaria," *Eastern European Economics* 53(2): 205-220.

Vasilev, A. (2015b) "Welfare gains from the adoption of proportional taxation in a general-equilibrium model with a grey economy: the case of Bulgaria's 2008 flat tax reform," *Economic Change and Restructuring*, 48(2): 169-185.

Vasilev, A. (2009) "Business cycles in Bulgaria and the Baltic countries: an RBC approach," *International Journal of Computational Economics and Econometrics*, 1(2): 148-170.