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Polarized business cycles

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ABSTRACT

Four stylized facts motivate this paper: (i) business cycle movements are wider in emerging countries (EC) than in developed ones; (ii) EC experience greater economic policy uncertainty; (iii) EC are more polarized and less politically stable; and (iv) EPU is positively related to political polarization. A standard real business cycle model augmented to incorporate political polarization, a 'polarized business cycle' (PBC) model, is shown to be consistent with these facts. We first derive our results analytically, and then quantify the effects of a permanent increase in polarization to the US economy.

1. Introduction

A set of observations drawn from comparing stylized facts in emerging versus developed economies motivate our work. First, output and consumption are more volatile and less persistent in emerging countries. While a traditional neoclassical economy would not generate such patterns, Aguiar and Gopinath (2007) show that a real business cycle (RBC) model augmented by trend shocks can generate some of the observed variability. Even though the authors do not explicitly consider the causes underneath the divergence in the shock processes of emerging and developed economies, they point to government policy as a potential explanation. In this paper, we take their conjecture one step further by actually considering how political factors affect the business cycle. This is motivated by our second stylized fact: emerging economies experience greater economic policy uncertainty (EPU) than developed ones. For example, Mexico's EPU index—measured by a news search-based indicator—was on average 17% higher than Sweden's index between 1990 and 2003.[1]

Third, political polarization is on average 24% higher in emerging countries, and their political processes are more unstable. Finally, there is a positive correlation between economic policy uncertainty and political polarization. Fig. 1 illustrates this, using three alternative measures of EPU: two of them, the volatility of government revenues as a percentage of output (left panel) and the relative volatility of government consumption to output (central panel), are policy-based. The third one, the political risk index (right panel), measures investment risk associated with non-conventional policy such as expropriations and corruption. Finally, the correlation between polarization and the news search-based index of EPU computed by Brogaard and Detzel (2012) is 0.24, in a sub-sample of 19 countries (see Appendix 3).

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[1] Fig. 1 in Appendix 1 depicts the evolution of EPU for these two countries. Economic policy uncertainty is proxied by a news search-based index constructed by Brogaard and Detzel (2012), following the methodology in Baker et al. (2012).

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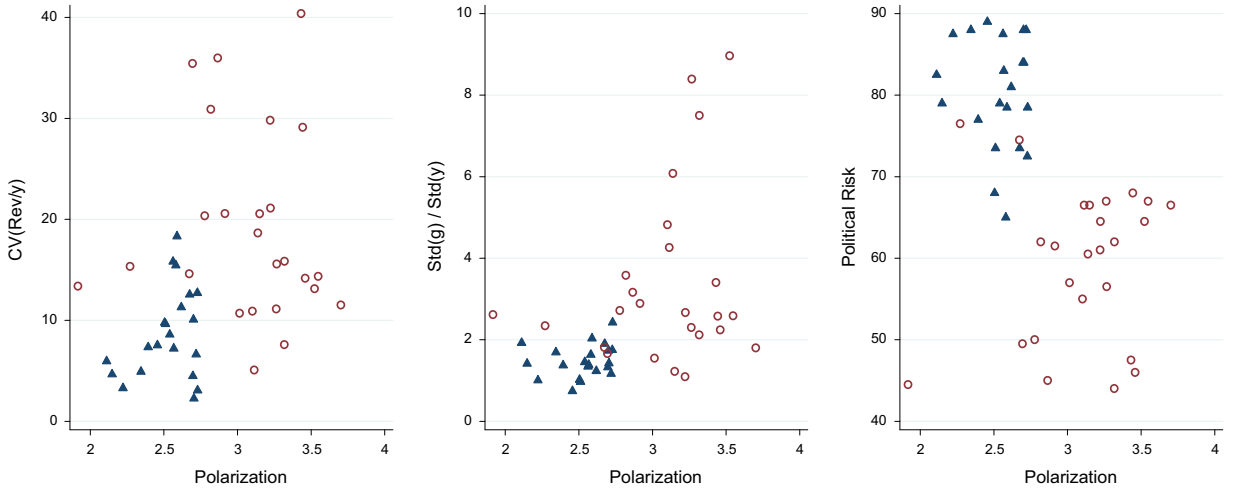

Fig. 1. Economic policy uncertainty and polarization. Notes: Economic policy uncertainty is proxied by two policy-based indices. Left panel: coefficient of variation of revenues as a percentage of output from 1960 to 2003. Central panel: relative standard deviation of government consumption to output, series detrended using a band-pass filter (2-20). Right panel: political risk index (from ICRG). Political polarization is obtained from Lindqvist and Ostling (2010). ▲ Developed and ○ Emerging.

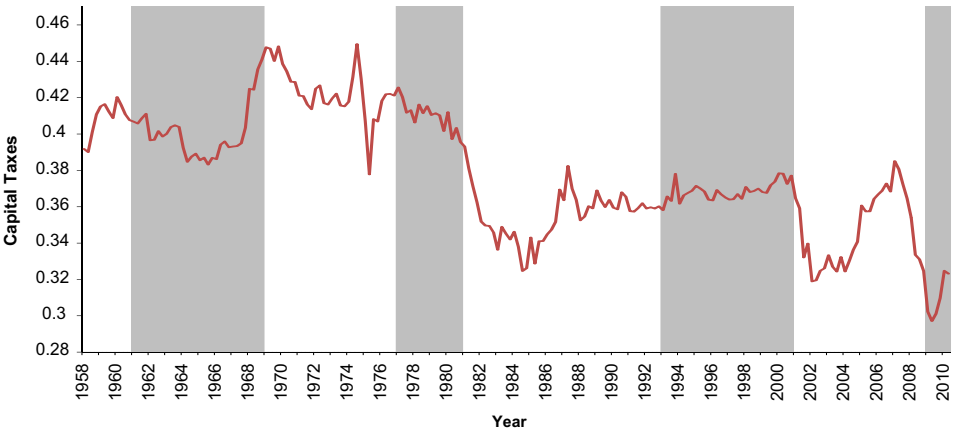

Fig. 2. Capital taxes in the U.S. and political ideology, 1958–2010. Notes: The time period is 1958:Q1–2010:Q2. Capital taxes (line) are obtained from Fernández-Villaverde et al. (2012)'s estimations. Shaded areas represent periods in which the President belongs to the Democratic Party.

Analyzing the evolution of political polarization and policy uncertainty in the U.S. suggests that this relationship may also hold true within a country over time. The Great Recession has been associated with greater-than-historical EPU (Baker et al., 2012). Interestingly, 2006–2011 has also been a period of higher-than-historical political polarization, as documented by McCarty et al. (2008).

The objective of this paper is to develop a theory that is consistent with these facts, centered on the interaction between political frictions and the real business cycle. Our main hypothesis is that fluctuations in economic variables are caused not only by innovations to productivity, as traditionally assumed in macroeconomic models, but also by shifts in political ideology.

Our setup embeds Persson and Svensson (1989)'s political economy model of public goods provision in a standard neoclassical framework. Political parties that disagree on the size of government stochastically alternate in power. Since public spending must be financed with distortionary instruments, wedges on investment are affected by political ideology. Fig. 2, which shows the evolution of the investment wedge (proxied by capital taxation) and the identity of the party in power (proxied by party affiliation of the President) in the U.S., provides suggestive evidence of this. Episodes where the Republican party takes power are followed by sharp declines in the investment wedge.[2]

Because parties alternate in power, political turnover in polarized societies induces economic policy uncertainty. This gives rise to polarized business cycles (PBCs). The mechanism is the following: switches between left-wing and right-wing governments generate uncertainty about the returns to private investment, and this affects real economic outcomes,

[2] This is robust to the introduction of TFP shocks and other control variables, such as composition of the legislature, in a regression in which the dependent variable is the percentage growth in capital taxes (to eliminate the time trend). Details available upon request.

Table 1
Volatility of economic variables.

Moment	Moment	Developed economies	Emerging economies
Volatilities	$\sigma(y)$	2.51e−2	4.95e−2
	$\sigma(I)/\sigma(y)$	3.80	3.86
	$\sigma(c)/\sigma(y)$	1.00	1.25
Autocorrelations	$\rho(y)$	0.65	0.62
	$\rho(I)$	0.59	0.5
	$\rho(c)$	0.60	0.49
Cyclicality	$\rho(y,I)$	0.84	0.68
	$\rho(y,c)$	0.80	0.64
	$\rho(y,g_c)$	0.24	0.25
Uncertainty	nEPU	2.57	2.78
	Pol. risk	80	59
	$\sigma(g)/\sigma(y)$	1.47	3.37
	$CV(Rev/y)$	8.64	19.04

Note: This table contains the average value of moments computed for a set of emerging and developed economies. Relative volatility measures for each country can be found in Tables 3 and 4 in Appendix 3. The variable $\sigma(g)/\sigma(y)$ represents the relative volatility of government consumption, while $CV(Rev/y)$ denotes the coefficient of variation of general government revenue as a ratio of GDP (in percentage terms). Data on y, c, I, and g are obtained from Kaminsky et al. (2004). The natural logarithms of deflated variables are de-trended using a band-pass filter 2-20. nEPU is obtained from Brogaard and Detzel (2012), for the longest span of data available between 1990 and 2003. Political risk is obtained from ICRG, for 2012. For robustness, we report the same moments using the HP-filter (with weight $w=100$) in Table 2 in Appendix 3.

amplifying business cycles. Countries that are more polarized exhibit greater EPU (e.g., larger swings in the levels of spending and revenue financing) and, hence, wider fluctuations in output and consumption.

By deriving these fluctuations from politico-economic fundamentals, we contribute to a recent but growing literature on economic policy uncertainty (see Baker et al., 2012). Endogenizing the political decision-making process causing uncertainty is important because equilibrium taxes are not only a function of political ideology and total factor productivity (TFP) shocks but they also depend on the aggregate stock of capital, an endogenous variable in any standard RBC model. Finally, our conjecture is that shocks to political polarization can be an important force driving variations in the innovation of observed fiscal processes (see Fernández-Villaverde et al., 2012).

Section 2 describes a set of stylized facts that characterize the business cycle properties of emerging and developed economies. The main assumptions of the model are summarized in Section 3. Intuition is provided by looking at an example economy in which the long-run distribution of fiscal and economic variables can be computed in closed-form in Section 4. In Section 5, a more general environment is calibrated to analyze the quantitative impact of polarization on the PBC of the U.S. economy. In particular, Section 5.3 summarizes the results from a counterfactual experiment in which the degree of polarization in the U.S. increased permanently to Mexico's level (a rise of about 30%). The results from this experiment shed light on how the recent increase in political polarization between 2006 and 2011 may have affected the business cycle during the last economic crisis, through its impact on EPU. Conclusions and extensions are contained in Section 6. All proofs are relegated to the Online Appendix, which also contains a more extensive literature review.

2. Stylized facts

Economic variables are obtained from Kaminsky et al. (2004). The countries under study and sample lengths are summarized in Table 1, Appendix 3. The S&P classification is used for developed economies, while all other countries are classified as emerging.[3]

Following Comin and Gertler (2006), natural logarithms of each (GDP-deflated) variable are de-trended using a band-pass filter. The advantage of following this approach rather than using the HP-filter is that data for different frequencies can be isolated. We focus on the 'medium-term cycle' in which frequencies range between 2 and 20 years (or 8 years to a decade in the time domain). These are more in line with *political* cycles than the high-frequency component (2 and 8 years) usually used to analyze *real* business cycles.

2.1. Fact 1: business cycle movements are wider in emerging countries

The volatility of output in emerging economies is about twice the volatility in developed ones, as seen in Table 1. This has previously been documented by Aguiar and Gopinath (2007) for quarterly data. They also point to the striking difference in

[3] Two primary criteria used in defining a country as a developed market are (i) it is located in a high-income country as defined by the World Bank and (ii) its capital markets are highly developed and transparent with large market capitalization.

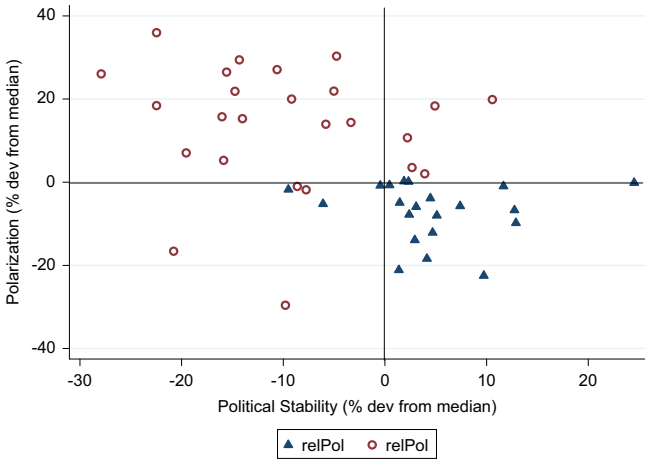

Fig. 3. Polarization and stability, relative to their means.

the volatility of consumption relative to output between the two groups. Consumption is as volatile as output for developed economies ($\sigma(c)/\sigma(y) = 1.00$), but it is 25% more volatile than output in emerging ones, in our sample.

2.2. Fact 2: emerging economies experience greater economic policy uncertainty

Economic policy uncertainty has been measured directly and indirectly in previous literature. Baker et al. (2012) construct a direct measure based on coverage of newspaper articles discussing uncertainty about US government policy. Brogaard and Detzel (2012)[4] applied this methodology to an extended set of countries. We find that the average value of their index for emerging economies is larger than that for developed economies between 1990 and 2003 (see Table 1). Developed economies also exhibit less investment risk, as seen from the fact that political risk scores, computed by ICRG, are significantly larger (see Appendix 3 for a description of this variable).

Uncertainty can also be measured by the volatility of actual policy outcomes. General government consumption is more volatile than output by a factor of three ($\sigma(g_c)/\sigma(y) = 3.37$) in emerging countries, twice the value observed in developed ones, $\sigma(g_c)/\sigma(y) = 1.47$. The coefficient of variation in revenues (as a percentage of output) is also significantly larger in emerging countries, where it takes a value of 19 versus 8.6 in developed economies.

2.3. Fact 3: emerging countries are more polarized and their political processes are less stable

Political polarization is obtained from Lindqvist and Ostling (2010), who construct the measure using self-reported political preferences from the 1999–2002 World Values Survey (a description of their method can be found in Appendix 3). Fig. 3 depicts percentage deviations of each variable with respect to its median. Most emerging economies have higher polarization and lower political stability indices than developed economies, since they are located in the upper left quadrant of the graph.

Differences are sizable, with variations of up to 40% away from the median values in both variables. The correlation is, however, not perfect. This is important to keep in mind, because these two institutional variables affect the volatility of economic series in different ways, as explained in Section 4. A theory that abstracts from political stability or polarization will not be able to account for the cross-country differences in the data.

2.4. Fact 4: there is a positive correlation between economic policy uncertainty and political polarization

Fig. 1 provides suggestive evidence of the positive relationship between polarization and policy-based EPU. To test the significance of this relationship, we estimated a simple regression in which the dependent variable is policy-based EPU (measured by the volatility of the government spending or revenues-to-output ratio) and the independent variables are polarization and political stability.[5]

As shown in Table 2, the coefficient on polarization is positive and statistically significant at the 5% level, regardless of whether the volatility in revenues to GDP or government consumption is considered, indicating that more polarized countries experience higher EPU. This suggests that polarization amplifies business cycles.

[4] We thank the authors for kindly sharing their data with us.

[5] We are not reporting the results using the news-based measure of EPU because there are too few observations in the intersection between our polarization data set and Brogaard and Detzel (2012)'s set.

Table 2
Economic policy uncertainty and polarization.

Independent variable	(1)	(2)	(3)	(4)
Polarization	9.1***	1.82***	15.3***	2.38***
	(2.09)	(0.49)	(3.95)	(0.70)
Pol stability	−15.3**	−3.47**	n.a.	n.a.
	(7.05)	(1.55)		
Polarization × *pol stability*	n.a.	n.a.	−1.36***	−0.19**
			(0.51)	(0.08)
Observations	46	46	46	46
R-squared	0.77	0.79	0.74	0.150

Note: The dependent variable for columns (1) and (3) is the coefficient of variation in revenues to output ($CV(Rev/y)$) and for columns (2) and (4) is the relative volatility of public consumption ($\sigma(g)/\sigma(y)$). Robust standard error are in parentheses. Constant term excluded because it was statistically insignificant.

* Significant at 10%.
** Significant at 5%.
*** Significant at 1%.

Clearly, political stability affects this relationship, since polarization would be irrelevant in a country with no political turnover. As expected, the coefficient of political stability is negative in specifications (1) and (2), where it enters additively. An interaction term is included in specifications (3) and (4). The negative (and significant coefficient) suggests that the amplification effects of polarization are smaller in countries with low political turnover (e.g., politically stable).[6]

3. A theory of polarized business cycles

Our setup embeds Persson and Svensson (1989)'s political economy model of public goods provision in a neoclassical growth framework.

Technology is characterized by a constant returns-to-scale production function that uses capital k and labor l to produce a single consumption good, $F(z,k,l)$. The variable z represents an aggregate productivity shock that follows a first-order Markov process. Capital depreciates at rate δ.

There is also a public good, denoted by g, that can be produced from the consumption good, according to a linear technology. The time endowment in the economy is normalized to 1. Thus, the aggregate resource constraint reads

$$c+g+k'=F(z,k,1)+(1-\delta)k.$$

There are competitive labor and capital markets and competitive production of public goods. The relative price of private and public goods is one in equilibrium. The wage rate is denoted by w and the rental rate of capital by r. Firms hire labor and capital in order to maximize profits after observing their productivity shock. Their decision problem is static and deterministic, implying $w=F_l(z,k,l)$ and $r=F_k(z,k,l)$.

Citizens live forever and discount the future at rate $\beta<1$. They derive utility from the consumption of private and public goods. Political disagreement arises from heterogeneity in agents' preferences regarding the overall size of the government. There are two types of agents indexed by i, with $i\in\{L,R\}$. The instantaneous utility of a type i agent is separable in private and public consumption

$$(1-\lambda_i)u(c)+\lambda_i v(g)$$

where u and v are increasing and concave, and the weights on public consumption satisfy

$$\lambda_L=\overline{\lambda}+\xi \quad \text{and} \quad \lambda_R=\overline{\lambda}-\xi.$$

Since $\lambda^R\leq\lambda^L$, we can think of R as right-wing (small government) and L as left-wing (large government) individuals. The variance of λ_i is determined by ξ, which can be interpreted as a measure of the degree of political polarization in society. If ξ were equal to zero, agents would be completely homogeneous. As ξ increases, views regarding the provision of g become more conflicting. This parameter will be the key variable governing the volatility of government distortions in cross-country comparisons.[7]

Citizens finance private consumption and investment with capital and labor income. The government raises revenues by taking a proportion τ of total income, so consumption equals

$$c_i=(1-\tau)[wl_i+rk_i+(1-\delta)k_i]-k_i'.$$

[6] These regressions are not intended to capture causality, since there could potentially be endogeneity problems in their specification. Our objective is just to point out that the positive correlation between polarization and policy volatility is significant.

[7] Complementarity between private and public consumption would induce a direct co-movement between the two goods and additional volatility in consumption. By assuming separability, this degree of freedom is reduced.

Since leisure is not valued, the supply of labor is inelastic. The choice of investment k_i' is inter-temporal and depends on government policy. While the current investment wedge τ is known at the time of decision-making, citizens need to form expectations about future policy τ'. This is the main source of economic policy uncertainty in our model. A description about how these expectations are formed is postponed until the next section. Note that because all agents face the same policy and because preferences are additively separable, investment decisions are independent of their type. As a result, we can focus the analysis on a representative agent that accumulates capital according to a standard Euler equation:

$$u_c(c) = \beta \mathbb{E}[R(\tau')u_c(c')],$$

where $R(\tau') = [r' + (1-\delta)](1-\tau')$ denotes the net (and uncertain) return on investment. Alternative financing instruments would also affect the returns to investment in a similar way. For example, under investment taxes or permits, $R(\tau') = 1/(1+\tau)[r' + (1-\delta)(1-\tau')]$. When capital income is expropriated or taxed, $R(\tau') = [r' + 1 - \delta](1-\tau')$. Regardless of the specification, τ distorts investment decisions, so we will refer to it as the 'investment wedge.' Because this is a closed economy and agents' private decisions are identical, abstracting from private debt is without loss of generality in this environment. The assumption of a closed economy is made in order to focus on the effects of domestic policy (e.g., investment wedges) on allocations.

The government is subject to a period-by-period balanced budget constraint:

$$\tau[wl + rk + (1-\delta)k] = g.$$

Clearly, governments would like to use debt in this environment to smooth out the distortionary costs of financing expenditures that result from productivity shocks. However, since incumbents disagree on spending levels in our economy, they would also want to use public debt to strategically manipulate their successor's policy (see Persson and Svensson, 1989). The effects of introducing public debt in our environment, which features both types of shocks, are not obvious: the effects of polarization on business cycles could be overestimated or underestimated. The characterization of PBCs under non-balanced budgets is a really interesting but challenging problem in itself, so its analysis is deferred to future research.

3.1. Political environment

There are two political parties, L and R, representing each group in the population. The incumbent party is chosen at the beginning of a period and sets policy in order to maximize the utility of its constituency. Agents and firms then choose allocations, taking as given current policy and expectations of future policy. Parties alternate in power following an exogenous Markov process, where $p \in [0.5, 1]$ denotes the type-independent probability of retaining office in the next period. Despite the fact that parties are symmetric in terms of re-election prospects, the probability of re-election can be greater than 0.5, reflecting incumbency advantage effects. The micro-foundations of this specification come from a probabilistic voting model as shown in Azzimonti (2011).

A key feature of the environment is the government's lack of commitment; revenue and spending policy promises are not credible unless they are ex-post efficient. The party in power plays a game against the opposition, taking its opponent's policy as given. We will characterize Markov perfect equilibria (MPE), defined as a set of strategies that depend only on the current payoff-relevant states of the economy: k and z. Because parties have different objectives, their policy choices differ in equilibrium, so strategies are also functions of their type.

The two key equilibrium objects are the spending rule of incumbent i, $\mathcal{G}_i(z,k)$ and the investment decision of our representative citizen $\mathcal{H}_i(z,k)$. Note that the latter is a function of the identity of the party in power due to the fact that the investment wedge τ, which is party-specific, affects private savings. The investment wedge rule $\mathcal{T}_i(z,k)$ is trivially determined from the government's budget constraint. The value function of a citizen type i when his group is in power will be denoted by $V_i(z,k)$ and by $W_i(z,k)$ when his group is out of power. This distinction is important when incumbents are 'partisan,' as assumed in this paper, because they take into account citizens' welfare even when out of office. The existence of these two value functions makes the analysis interesting, but also non-trivial to characterize and compute.

3.2. Political equilibrium

An incumbent party chooses the provision of public good g knowing that it might be replaced by a different policymaker with probability p. Suppose that a left-wing government L is elected. Given the stock of public capital k and the current state of the economy z, the incumbent's objective function today is given by

$$\max_g \ (1-\lambda_L)u(c) + \lambda_L v(g) + \beta \mathbb{E}_z[pV_L(z',k') + (1-p)W_L(z',k')]$$

$$\text{where} \quad c = f(z,k) + (1-\delta)k - g - k' \equiv \mathcal{C}(z,k,k',g).$$

Private savings k' given current spending g satisfies the Euler equation:

$$u_c(c) = \beta \mathbb{E}_{zL}[R(\tau_j')u_c(\mathcal{C}_j(z',k'))] \tag{1}$$

where $\mathcal{C}_j(z',k') = \mathcal{C}(z',k',\mathcal{H}_j(z',k'),\mathcal{G}_j(z',k'))$ and the future investment wedge satisfies the government budget constraint $\tau_j' = \mathcal{G}_j(z',k')/(w(k') + [r(k') + 1 - \delta]k')$. Expectations $\mathbb{E}_{zL}$ are taken with respect to productivity z' and the identity of tomorrow's incumbent j, given that L is currently in power and the current realization of TFP is z.

The functional equation (1) determines future capital as a function of current capital, productivity, and public spending under an L-type government, $k' = H_L(z,k,g)$. It summarizes an agent's optimal reaction to a one-period deviation of g from the equilibrium rule that an incumbent would follow in the Markov-perfect equilibrium, $\mathcal{G}_L(z,k)$. Agents expect tomorrow's incumbent of type j to follow the equilibrium strategy $g_j' = \mathcal{G}_j(z',k')$, and capital to satisfy $k_j'' = \mathcal{H}_j(z',k')$ under such policy. Consistency requires that $\mathcal{H}_i(z,k) = H_i(z,k,\mathcal{G}_i(z,k))$ for all i.

The description of the problem is completed by defining the functions $V_L(z,k)$ and $W_L(z,k)$:

$$V_L(z,k) = (1-\lambda_L)u(\mathcal{C}_L(z,k)) + \lambda_L v(\mathcal{G}_L(z,k)) + \beta\mathbb{E}_z[pV_L(z',k') + (1-p)W_L(z',k')] \tag{2}$$

and

$$W_L(z,k) = (1-\lambda_L)u(\mathcal{C}_R(z,k)) + \lambda_L v(\mathcal{G}_R(z,k)) + \beta\mathbb{E}_z[(1-p)V_L(z',k') + pW_L(z',k')] \tag{3}$$

where, as before, $\mathcal{C}_i(z,k) = \mathcal{C}(z,k,\mathcal{H}_i(z,k),\mathcal{G}_i(z,k))$. The main difference between Eqs. (2) and (3) is that spending levels in the second equation are chosen by a right-wing party and, hence, do not maximize the objective of incumbent L. A second difference comes from the expectation over political ideology, since p denotes the probability of retaining power for a given incumbent.

The political uncertainty, combined with the conflict over the provision of public goods, creates incentives to act strategically. This becomes clear when analyzing incumbent L's first-order condition:

$$(1-\lambda_L)u_c(-1-H_g) + \lambda_L v_g + \beta\mathbb{E}_z[pV'_{k,L} + (1-p)W'_{k,L}]H_g = 0.$$

When choosing g, the decision-maker trades off the current benefit of larger government expenditures given by the increase in $v(g)$ to the current cost of financing this increase, which lowers today's consumption c. In addition, it takes into account the dynamic effects of this policy change, since larger investment wedges reduce current savings by H_g. This affects continuation utilities V and W directly by reducing future income and indirectly by lowering future spending of incumbent j. By controlling the level of investment—via changes in the investment wedge—an incumbent party can affect the spending level of future policymakers through changes to tomorrow's revenue base.

Definition 3.1 (*MPE*). A Markov-perfect equilibrium satisfies

(i) Given current policy and expectations on future policy, agents' and firms' decisions are a competitive equilibrium.
(ii) Given equilibrium allocations and expectations on future policy, current policy solves incumbent i's problem.
(iii) The incumbent party's choices are consistent with private expectations, $g = \mathcal{G}_i(z,k)$.

This definition imposes consistency between citizens' and government's decisions. Additionally, it implies that private expectations are correct and that no incumbent has an incentive to deviate from the MPE. A theoretical characterization of the MPE is non-trivial in general, but under some restrictive assumptions on the primitives of the economy it is possible to find an analytical solution to the model.

4. Theoretical characterization

Uncertainty about economic policy affects the economy differently than uncertainty about TFP. For example, consumption and investment react instantaneously to a change in ideology, while output reacts with a one-period lag. Keeping TFP constant, this results in consumption and investment volatility being larger than output volatility. It also affects the comovement between economic variables and their persistence. To illustrate this further, it is useful to analyze an example economy.

Assumption 4.1. Suppose that (i) preferences, u and v, are logarithmic, (ii) productivity follows a two-state Markov process: z_s with $s \in \{H,L\}$ and a symmetric transition matrix, where $\pi = P(z' = z_i/z = z_i) \geq 0.5$, (iii) the production function is Cobb–Douglas $F(z,k,l) = e^z k^\alpha l^{1-\alpha}$, and (iv) there is full depreciation, $\delta = 1$.

Under these assumptions, private investment is proportional to output $y_z = e^z k^\alpha$ and decreasing in public spending, $H(z,k,g) = \alpha\beta y_z - g$. Because private consumption is also linear in output, we guess that government spending follows a linear and type-dependent rule. This guess is verified in the following proposition.

Proposition 4.1. *Under Assumption 4.1, the MPE satisfies*

$$\mathcal{T}_i = \lambda_i\eta, \quad \mathcal{H}_i(z,k) = \alpha\beta(1-\lambda_i\eta)e^z k^\alpha, \quad \mathcal{G}_i(z,k) = \lambda_i\eta e^z k^\alpha \quad \textit{and}$$

$$\mathcal{C}_i(z,k) = (1-\alpha\beta)(1-\lambda_i\eta)e^z k^\alpha \quad \textit{where} \quad \eta = \frac{1-2\alpha\beta p-\alpha^2\beta^2(1-2p)}{1+\alpha\beta(1-2p)}.$$

Proof. See Appendix 4.

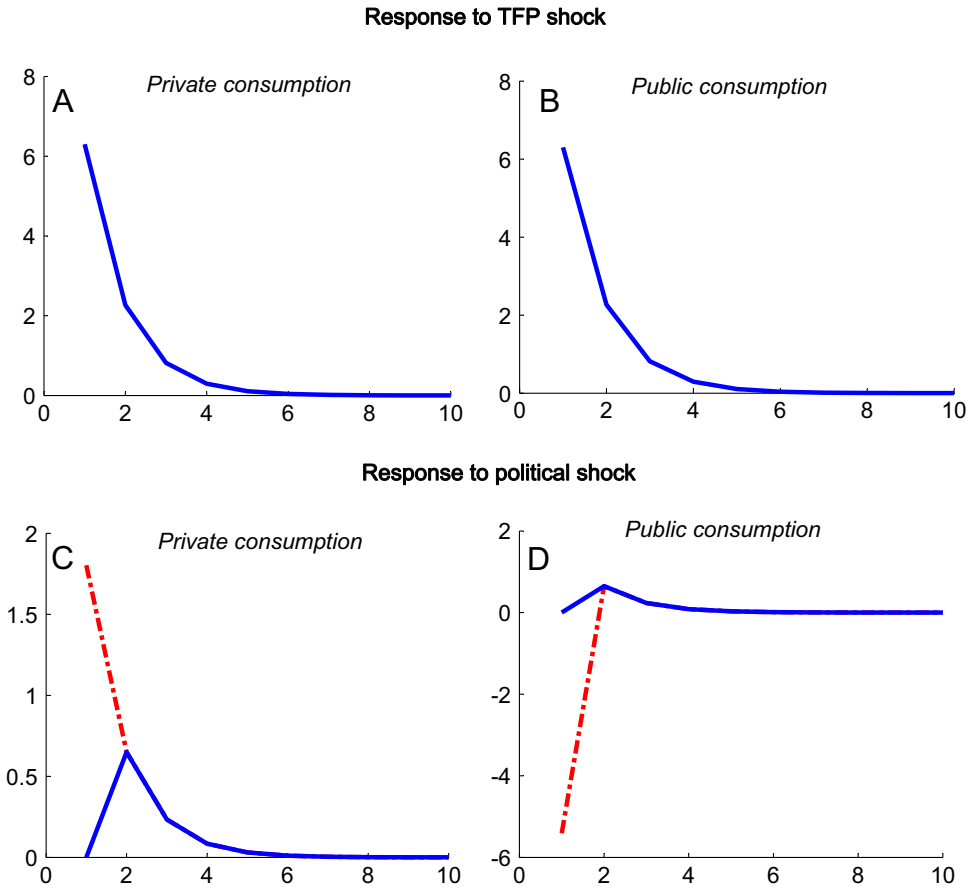

Fig. 4. Impulse-response to productivity and political shocks (- - consumption and – output). *y*-axis: % deviations and *x*-axis: time.

The investment wedge $\mathcal{T}_i = \lambda_i \eta$ is independent of the stock of capital and productivity but depends on the identity of the incumbent in power. Given that political turnover follows a first-order Markov process, with $p = Pr(\lambda_t = \lambda_i / \lambda_{t-1} = \lambda_i)$ for $i \in \{L, R\}$, the stochastic investment wedge can be re-interpreted as a 'political shock': a random variable that follows a Markov-chain and introduces economic policy uncertainty. Since $\lambda_R < \lambda_L$, distortions are smaller under right-wing governments than they are under left-wing incumbents. This results in a smaller desired government size, since $\lambda_R \eta$ also represents *R*'s marginal propensity to spend under logarithmic utility. Since disposable income is larger, individuals choose higher investment and consume more than they do under a left-wing party. As a result, growth is faster and the economy converges to a higher steady-state level of capital. Starting from a low level of capital, the series exhibits an increasing trend until it reaches the 'ergodic set,' at which point it fluctuates around a constant mean.

4.1. *Polarized business cycles (PBCs)*

Once the economy reaches its ergodic set, fluctuations will be driven by TFP shocks (as in a standard RBC model) as well as political shocks (e.g., changes in the investment wedge). Economic cycles in the ergodic set will be referred to as *polarized business cycles* (PBCs).

4.1.1. *Impulse-responses*

A positive TFP shock has the same effects on economic variables as those found in a standard real business cycle (RBC) model. In particular, current output increases immediately as the economy becomes more productive. Under logarithmic utility, a 1% increase in output results in exactly a 1% rise in both public and private consumption. This can be seen clearly in Panels (A) and (B) of Fig. 4, where the size of the response to a productivity shock coincides for all variables (representing percentage changes relative to the steady state).

Now consider the response of the economy to a political shock, starting from the steady state attained under a left-wing government. Suppose that party *R* gains power for only one period and *L* regains control of the government forever after. The impulse–response function of consumption and output is depicted in Panel (C) of Fig. 4. The switch in political ideology generates a reduction in both public spending—as seen in Panel (D)—and the investment wedge, which triggers an increase

in current consumption. Output remains unchanged due to the fact that capital is given and labor is inelastic.[8] Individuals increase investment in response to the lower wedges that follow the regime change. The resulting larger stock of capital increases production in the second period. This, together with the fact that a left-wing government regains power, increases government spending in that period above its steady-state value.

4.1.2. Volatility and amplification in the PBC model

The first step to analyzing volatility and amplification under economic policy uncertainty is to characterize the long-run distribution of capital, since it determines the evolution of all other variables in the PBC model. Because policy functions are linear in the states when variables are expressed in natural logarithms, this distribution can be characterized analytically. The first and second moments of (log) capital are summarized in Lemma 4.1.

Lemma 4.1. *Define* $\hat{x}_j = \ln(1-\tau_j)$, *where the political shock satisfies* $\tau_j = \lambda_j \eta$. *Then* $\hat{k}'$ *follows*:

$$\hat{k}' = q + \alpha\hat{k} + \hat{x} + z$$

where $q = \log(\alpha\beta)$, $\hat{x} \in \{\hat{x}_L, \hat{x}_R\}$ *and* $z \in \{z_H, z_L\}$. *The shocks have unconditional means*

$$\overline{x} = 0.5(\hat{x}_R + \hat{x}_L) \quad \text{and} \quad \overline{z} = 0.5(z_H + z_L)$$

and unconditional variances

$$\sigma_{\hat{x}}^2 = 0.5^2(\hat{x}_R - \hat{x}_L)^2 \quad \text{and} \quad \sigma_z^2 = 0.5^2(z_H - z_L)^2.$$

The long-run distribution of $\hat{k}$ *has the following properties*:

(i) *The mean is* $E(\hat{k}) = (q + \overline{x} + \overline{z})/(1-\alpha)$.
(ii) *The covariances are* $Cov(\hat{k}, \hat{x}) = (2p-1)\sigma_{\hat{x}}^2/[1-\alpha(2p-1)] > 0$ *and* $Cov(\hat{k}, z) = (2\pi - 1)\sigma_z^2/[1-\alpha(2\pi-1)] > 0$.
(iii) *The variance is*

$$\mathrm{Var}\left(\hat{k}\right) = \frac{\sigma_z^2 + \sigma_{\hat{x}}^2}{1-\alpha^2} + \frac{2\alpha}{1-\alpha^2}\left[Cov(\hat{k}, \hat{x}) + Cov(\hat{k}, z)\right] \equiv \sigma_{\hat{k}}^2.$$

Proof. See Appendix 5.

The ergodic distribution of capital is not trivial to characterize due to the persistence of political and productivity shocks: the error term $\hat{x} + z$ follows a discrete Markov process.[9] In addition, while political turnover is exogenous, $\hat{x}$, the value taken by the shock affecting the process is determined within the model. It depends on technological and institutional characteristics of the economy, since η is a function of the capital share α and the probability of re-election p.[10] Finally, while capital is linear in TFP, it is non-linear in political shocks, since $\hat{x}_j = \ln(1-\tau_j)$. Thus, innovations to the variance of political shocks, given by the degree of political polarization ξ, directly affect decision rules (more on this later).

Because output, consumption, and public spending are proportional to capital, their processes are also stationary, and their evolution can be simply characterized from Lemma 4.1. Due to our full depreciation assumption, investment behaves exactly like capital in this model. Finally, since the investment wedge is independent of capital, its stochastic properties are inherited from the process determining λ. Proposition 4.2 presents a decomposition of the long-run volatility of output, public and private consumption, and the investment wedge as a function of each type of shock.

Proposition 4.2. *Let* $\hat{c} = \ln c$, $\hat{y} = \ln y$, $\hat{\tau} = \ln \tau$ *and* $\hat{x} = \ln(1-\tau\eta)$, *then the long-run variances of* (*log*) *output*, *private consumption*, *and public consumption satisfy*, *respectively*,

(i) $Var(\hat{y}) = \sigma_z^2 + \alpha^2\, Var(\hat{k}) + 2\alpha\, Cov(\hat{k}, z)$,
(ii) $Var(\hat{c}) = Var(\hat{y}) + \sigma_{\hat{x}}^2 + 2\, Cov(\hat{y}, \hat{x})$,
(iii) $Var(\hat{g}) = Var(\hat{y}) + \sigma_{\hat{\tau}}^2 + 2\, Cov(\hat{y}, \hat{\tau})$,
where

$$Cov(\hat{y}, \hat{x}) = \alpha\sigma_{\hat{x}}^2 \frac{2p-1}{1-\alpha(2p-1)} \geq 0,$$

[8] The response under endogenous labor depends on how the labor supply depends on income and substitution effects. If only substitution effects are relevant, then a decrease in the investment wedge would increase net-wages, inducing an increase in labor and, hence, a contemporaneous increase in output.

[9] If these shocks were iid instead ($\pi = 0.5$ and $p = 0.5$), capital would simply follow an AR(1) process.

[10] We have assumed that the probability of re-election is independent of productivity shocks, so λ and, hence, $\hat{x}$ are independent of z. An interesting extension would consider the effect of such a correlation.

$$Cov(\hat{y},\hat{\tau}) = \alpha 0.5^2(\hat{\tau}_R-\hat{\tau}_L)(\hat{x}_R-\hat{x}_L)\frac{2p-1}{1-\alpha(2p-1)} \leq 0$$

and

$$\sigma^2_{\hat{\tau}} = 0.5^2(\hat{\tau}_L-\hat{\tau}_R)^2.$$

Proof. See Appendix 6.

This proposition shows that the presence of economic policy uncertainty amplifies real business cycles. The volatility of capital in a standard RBC model is smaller than it is in the PBC model, since in the absence of political shocks, $\sigma^2_{\hat{x}} = Cov(\hat{k},\hat{x}) = 0$. Since $Var(\hat{k})^{PBC} > Var(\hat{k})^{RBC}$, output is more volatile in the PBC model than it is in the RBC model $Var(\hat{y})^{PBC} > Var(\hat{y})^{RBC}$.

This proposition also illustrates the consumption volatility puzzle (see Aguiar and Gopinath, 2007 or Neumeyer and Perri, 2005) that arises under the lens of a traditional neoclassical framework. Because political shocks are abstracted from, $\sigma^2_{\hat{x}} = Cov(\hat{y},\hat{x}) = 0$, so consumption is predicted to be at most as volatile as output in the RBC model. When the model is augmented to include volatility in political ideology, then $Var(\hat{c}) \geq Var(\hat{y})$ as the covariance between political and economic shocks is positive (recall that $p \geq 0.5$). We show that a PBC can generate $Var(\hat{c}) \lesseqgtr Var(\hat{y})$ when assuming less than full depreciation (see in Section 5).

Public consumption may be more or less volatile than output once political shocks are considered. The reason is that the covariance between output and the investment wedge is negative. The following lemma shows sufficient conditions for $Var(\hat{g}) \geq Var(\hat{y})$.

Lemma 4.2. *Suppose that* $p \leq (1+3\alpha)/(6\alpha)$ *and* $\overline{\lambda} \leq 1/2\eta$, *with*

$$\eta = \frac{1-2\alpha\beta p-\alpha^2\beta^2(1-2p)}{1+\alpha\beta(1-2p)}.$$

Then $[Var(\hat{g})-Var(\hat{y})]^{PBC} \geq 0$.

Proof. See Appendix 7.

Hence, countries that are politically unstable (that is, where p is low) will exhibit excess volatility of public consumption relative to output. This provides a rationale for our empirical findings, since emerging economies often have lower political stability than developed ones.[11]

In our model, the investment wedge is always negatively correlated with output. This results from our balanced budget assumption. In the data, the correlation between the revenue-to-output ratio (a proxy for the investment wedge) and GDP takes positive as well as negative values, and it is on average close to zero for our sample. Assuming a non-balanced budget constraint would mitigate but not necessarily overturn our theoretical result. The reason is that while the tax-smoothing motive would create incentives to keep taxes low in bad times, increasing the contemporaneous correlation between output and the investment wedge, the political shock would still push this correlation down, which effect dominates depends on the variability and persistence of political versus TFP shocks.

4.1.3. *The cyclicality of public spending in the PBC model*

Bachmann and Bai (2013) show that the correlation between government consumption and spending is counterfactually close to one in a model similar to that of Klein et al. (2008) augmented for TFP shocks. In our model, the correlation between public consumption and output may be less than one due to the existence of economic policy uncertainty.

Proposition 4.3. *Suppose that* $p \geq 0.5$. *Let* $\hat{g} = \ln g$, $\hat{y} = \ln y$, *and* $\hat{\tau} = \ln(\tau)$, *then the correlation between public consumption and output satisfies*

$$Corr(\hat{g},\hat{y})^{PBC} = \frac{Var(\hat{y})+Cov(\hat{\tau},\hat{y})}{[Var(\hat{g})Var(\hat{y})]^{1/2}} < Corr(\hat{g},\hat{y})^{RBC} = 1, \tag{4}$$

where

$$Cov\left(\hat{\tau},\hat{k}\right) = 0.5^2(\hat{x}_R-\hat{x}_L)(\hat{\tau}_R-\hat{\tau}_L)\frac{2p-1}{1-\alpha(2p-1)} \leq 0.$$

Proof. See Appendix 8.

The excessive cyclicality of public consumption predicted by a standard model (one without political frictions) is evident when inspecting Eq. (4) above. If political shocks are ignored, $Cov(\hat{\tau},\hat{y}) = 0$, so the volatility of public consumption equals

[11] Note that for empirically relevant values of the capital share α, the upper bound does not violate incumbency advantage. For example, when $\alpha = 0.36$, the constraint requires that $p < 0.963$.

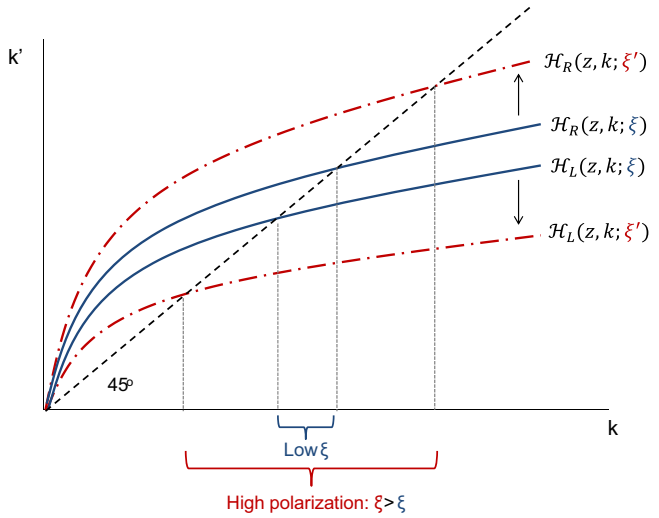

Fig. 5. Increase in polarization (– benchmark ξ and - - high polarization ξ'). (For interpretation of the references to color in this figure caption, the reader is referred to the web version of this article.)

that of GDP, $Var(\hat{g}) = Var(\hat{y})$. Therefore, $Corr(\hat{g}_t, \hat{y})^{RBC} = 1$. Once political turnover between polarized parties is introduced, the cyclicality of public consumption goes down. To see this, consider the case with no incumbency advantage, $p = 0.5$. From the lemma above, $Cov(\hat{\tau}, \hat{y}) = 0$. Since $Var(\hat{g}) > Var(\hat{y})$ (from Lemma 4.2), Eq. (4) implies that $Corr(\hat{g}, \hat{y})^{PBC} < 1$. In other words, once there is political turnover between polarized parties, the cyclicality of public consumption dampens. Government consumption can be procyclical or countercyclical in our model, as it is in the data (see Tables 3 and 4 in Appendix 3). It is worth noting that political turnover per se (that is, $p < 1$) is not enough to generate these results. Absent polarization we would have $\hat{\tau}_L = \hat{\tau}_R$, in which case the correlation between output and consumption would still be equal to one.

4.2. The effects of polarization in the PBC model

Our main experiment consists of increasing the degree of polarization, ξ, and analyzing its affects on PBCs.

Corollary 4.1 (*to Proposition 4.1*). *The volatility of the investment wedge increases with polarization*

$$\frac{\partial \sigma_{\hat{\tau}}^2}{\partial \xi} = \eta(\hat{\tau}_L - \hat{\tau}_R) > 0.$$

Hence, there is a positive correlation between polarization and economic policy uncertainty.

This prediction is consistent with stylized Fact 4, when EPU is measured by the volatility of the revenue-to-output ratio. In addition, since emerging economies tend to be more polarized—as established by Fact 3—we should expect them to experience greater economic policy uncertainty. This provides a model-based rationale for Fact 2.

The additional volatility in economic policy spills over into the real economy through its effects on private investment. The solid (blue) lines in Fig. 5 depict the investment functions $\mathcal{H}_i(z,k;\xi)$ under each party, $i \in \{L,R\}$, for a given productivity level z. When polarization increases from ξ to ξ', the curve $\mathcal{H}_R(z,k;\xi)$ moves upward while the curve $\mathcal{H}_L(z,k;\xi)$ moves downward, represented by the broken (red) lines in the figure.

An immediate result is that the ergodic set (defined by the intersection between the 45° line and the policy rules) expands, as the range taken by capital under a low ξ is smaller than the one under a high polarization level ξ' (Fig. 5). As a consequence, the volatility of investment goes up. This can also be derived analytically from Lemma 4.1.

Corollary 4.2 (*to Lemma 4.1 and Proposition 4.2*). *The volatility of investment increases with polarization*, $\partial\, Var(\hat{k})/\partial\xi > 0$. *Therefore*, $\partial\, Var(\hat{y})/\partial\xi > 0$ *and* $\partial\, Var(\hat{c})/\partial\xi > 0$.

Moreover, it is straightforward to show that the excess volatility of consumption, $[Var(\hat{c}) - Var(\hat{y})]^{PBC}$, increases as well. These results, together with Fact 3, are consistent with Fact 1: business cycle movements are wider in emerging countries.

5. Quantitative analysis

In this section, our benchmark model is calibrated to test whether its quantitative implications are in line with the stylized facts from the U.S. economy. The counterfactual experiment is the following: Suppose that the U.S. became as polarized and politically unstable as Mexico, how should this affect relevant PBC moments? The numerical procedure used to solve the model involves finding a fixed point in equilibrium policy rules (see Appendix 9 for details). Computation is

Table 3
Results: model, data, and counterfactual experiment.

Moment	Data	Benchmark	High $\xi' = 0.017$ (%)	Low $p = 0.744$ (%)
$\sigma(y)$	2.2e−2	2.2e−2*	0.6	0.4
$\sigma(I)/\sigma(y)$	3.31	3.31*	6.3	1.5
$\sigma(c)/\sigma(y)$	0.85	0.94	2.2	4.1
$\sigma(g)/\sigma(y)$	1.33	1.33*	32.7	40.4
$\rho(y)$	0.60	0.55	0.4	−0.6
$\rho(y,I)$	0.87	0.85	−7.2	−9.2
$\rho(y,c)$	0.91	0.97	−1.9	−3
$\rho(y,g)$	0.35	0.2	−18.5	−1.5

* Denotes calibrated moments. Columns (2) and (3) are expressed as percentage changes relative to the benchmark economy.

non-trivial because it is necessary to guess four functions: the savings rules for individuals under a left-wing and a right-wing government, $\mathcal{H}_L(z,k)$ and $\mathcal{H}_R(z,k)$, and the spending rules of each party, $\mathcal{G}_L(z,k)$ and $\mathcal{G}_R(z,k)$. In addition, the savings function under a one-period deviation $H(z,k,g)$ needs to be solved for.

As is standard in the RBC literature, the model will be augmented to include capital adjustment costs to investment $\Phi(k,k') = \phi(k'/k-1)^2 k$ as modeled by Greenwood et al. (2000). The introduction of this feature is motivated by the observation that while consumption and public spending volatilities are larger in emerging economies than in developed ones, the relative volatility of investment is roughly the same ($\sigma(I)/\sigma(y) = 3.80$ and $\sigma(I)/\sigma(y) = 3.86$ respectively, see Table 1), suggesting the presence of such costs.

5.1. Calibration

Because we are building on the neoclassical framework, many of the parameters are standard. A time period represents a year, so the discount factor is $\beta = 0.95$. The share of capital α is set to 0.36 and the depreciation rate δ is 0.1. Preferences are logarithmic. Productivity, specified as $z' = \rho z + \epsilon'$, is discretized using a two-state Markov process with an autocorrelation coefficient of $\rho = 0.91$ and a conditional standard deviation of $3.62e^{-2}$. The latter is chosen to match the annual standard deviation of de-trended output observed in the U.S. over the sample period 1960–2003 of 2.2%. The adjustment cost parameter $\phi = 0.625$ is chosen so that model-generated investment volatility is equal to the value observed in the U.S. for the same period, 7.3%.[12]

The probability of re-election p is obtained from data on political stability, assigned by the Political Risk Services Group's (PRS) International Country Risk Guide. The data set is described in Appendix 3. The value of $p = 0.83$ used in the model corresponds to the average value observed in developed countries and generates an average tenure in power of about 10 years, in line with political turnover in the U.S. The mean value of λ_i is chosen to match the average ratio of public spending (net of transfers) to output $gExp/y$, which is a good proxy for the level of distortions generated by government spending. The variable determining polarization, ξ, is set to match the U.S. volatility of government consumption, 2.92%.[13]

5.2. Results

Table 3 reports the fit of the model for a broader set of business cycle moments (those marked with asterisks are matched as part of our calibration strategy). The first thing to note is that the introduction of political frictions to an otherwise standard neoclassical framework does not undermine the fit of the model to relevant economic variables. For example, the cyclical behavior of consumption and investment is remarkably close to its empirical counterpart, as seen by comparing our predicted measures of $\rho(y,c)$ and $\rho(y,I)$ to the U.S. values. Moreover, the correlation between private consumption and investment is also close to its data counterpart.

Even though it was not a target of our calibration, the relative volatility of consumption to output $\sigma(c)/\sigma(y)$ is in line with the observed value for the U.S. In contrast to our analytical example, this relative volatility is smaller than one. This follows from relaxing the full depreciation assumption, which decouples the response of consumption and output from changes in TFP. The model predicts that government spending is pro-cyclical, though the degree of cyclicality is slightly below the one observed in the U.S. The persistence of public spending is too low in our calibrated economy, since $\rho(g) = 0.43$ versus 0.84 in the data. This results from abstracting from adjustment costs associated with changing government financing and assumes no implementation lags in enacting fiscal policy. Bachmann and Bai (2013) discuss how these two features affect the persistence of government purchases in a related model.

[12] The model implied moments are obtained by simulating the political equilibrium for 11,000 periods where the first 1000 are discarded to eliminate the effects of initial conditions.

[13] Cyclical moments computed by de-trending (using a band-pass filter 2-20) the natural logs variables over the sample 1960–2003. I and y are obtained from Kaminsky et al. (2004), and $gExp$ is consolidated government expenditures net of transfers, from NIPA Table 3.1 Government Current Receipts and Expenditures.

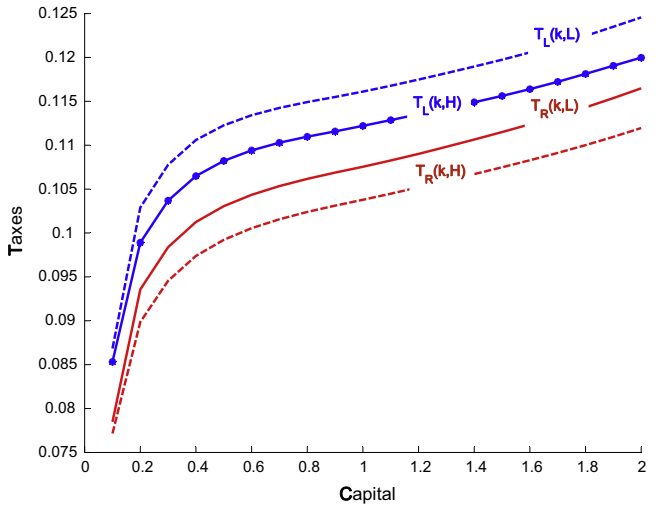

Fig. 6. Taxes as a function of capital, TFP shocks, and political ideology.

In contrast to the analytical example, the tax rate increases with capital in the calibrated economy (see Fig. 6). This follows from relaxing the full depreciation assumption. Moreover, as seen in the figure, taxes now depend on the state of the economy: Regardless of political ideology, taxes are higher in bad times than they are in good times.

These results highlight the importance of endogenizing the political decision making process, as opposed to just assuming an exogenous stochastic process for taxes in the RBC model. The level of capital, which is endogenous in any standard model, is shown to be an important determinant of the tax rate. This becomes particularly relevant when performing counter-factual institutional analysis of the effect of increased partisan conflict on the economy.

5.3. *Counterfactual experiment: from the U.S. to Mexico*

In this section, the effects on the U.S. economy of a permanent increase in polarization and political instability (to Mexico's levels) are analyzed. We first study how the economic response to political and productivity shocks change in a highly polarized environment and then quantify the impact of polarization on long-run moments of the U.S.'s PBC.

The empirical estimate of Mexico's polarization is about 30% higher than the U.S. recorded level (see Tables 3 and 4 in Appendix 3). Hence, the value of ξ is increased from 0.013 in the benchmark calibration to $\xi' = 0.017$. The impulse-responses of consumption and output to political versus TFP shocks are depicted in Fig. 7. Shocks are assumed to last 10 periods, the average tenure in power of a political party. Consumption responds slightly less than output to a TFP shock in this calibrated economy (right panel). This differs from the response computed for our closed form solution example under full depreciation, where both variables reacted identically to an innovation in productivity. The degree of polarization does not have a large impact on these responses, as shown by how close the solid and dotted lines are to each other. This implies that any additional volatility in economic variables arises from the resulting increase in EPU rather than from the response to productivity fluctuations when polarization levels are large.

The responses of output and consumption are indeed much larger in the high-polarization scenario (left panel). This illustrates the amplification effect of an endogenous rise in EPU induced by greater political polarization. Because the difference in investment wedges is larger in the high-polarization scenario, the response to a switch from a left-wing government to a right-wing government widens. As in the closed-form example, consumption reacts immediately while output increases with a lag. The persistence of the shock is larger due to the less-than-full-depreciation assumption. The figure also indicates that the relative volatility of consumption $\sigma(c)/\sigma(y)$ must increase when polarization rises. The response of consumption is not only larger than that of output when there is a switch in political ideology, but also the difference between them is wider when ξ is high. Table 3 (column 2) shows how a permanent increase in political polarization affects long-run policy and economic outcomes once political as well as productivity shocks are considered. Results are presented as percentage changes from the benchmark economy.

The largest increase arises in the relative volatility of public policy, which increases by 32% as polarization rises. This is consistent with the fact that emerging economies, which are in general more polarized, exhibit larger fluctuations in public consumption relative to output fluctuations. Moreover, our theory suggests a possible cause underlying the observed increase in EPU between 2006 and 2011 in the U.S. Because the investment wedge fluctuates more when political disagreement worsens (i.e., when polarization is high), individuals face higher uncertainty regarding public policy.

The experiment also shows how this additional volatility spills over into the real economy: output volatility rises 0.6%, while the relative volatility of consumption increases 2.2%. Output becomes more persistent (the autocorrelation rises 0.4%)

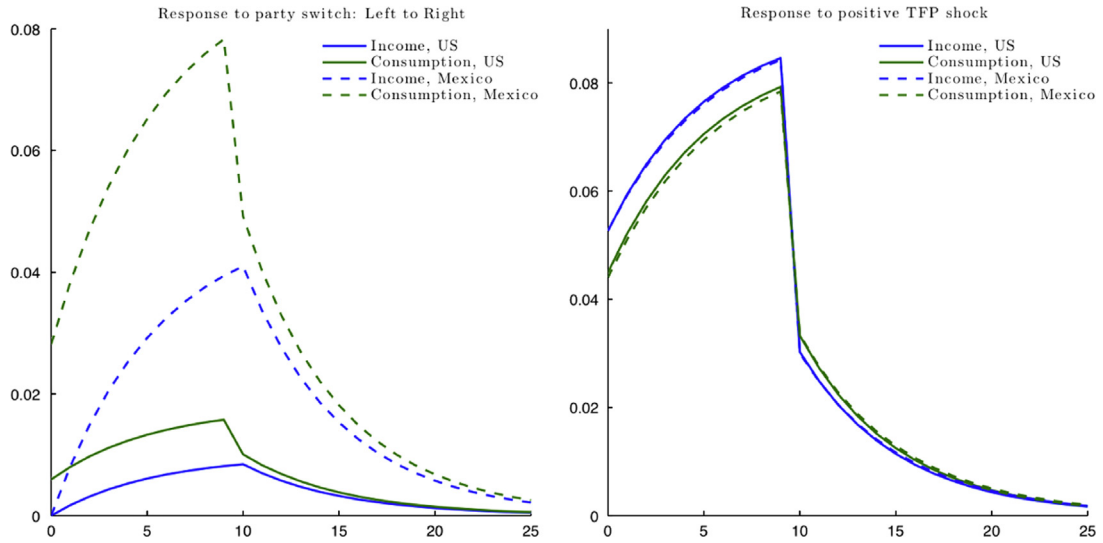

Fig. 7. Response to 10-period political and TFP shocks.

and less correlated to investment and consumption. The cyclicality of government consumption goes down by more than 18%.

The last column of Table 3 presents the percentage changes relative to the benchmark economy of a joint increase in polarization and political instability. In addition to raising ξ, p is decreased from its benchmark value of 0.83 to Mexico's level of 0.744 in this experiment. Political instability dampens the effect of polarization on the volatility of output (which increases by 0.4% versus 0.6% before) but intensifies its effect on the relative volatility of public and private consumption. Interestingly, the reduction in the cyclicality of government consumption is lower when both variables are considered. This is consistent with the observation that emerging economies, which are usually more polarized and less politically stable than developed ones, have similar cyclicality of government consumption (see Table 1).

6. Conclusion and extensions

A standard real business cycle model augmented to incorporate political polarization, a polarized business cycle model (PBC), is shown to be consistent with a set of stylized facts computed for emerging and developed economies. The main mechanism lies on the existence of political parties that disagree on the size of government and alternate in power. In a Markov-perfect equilibrium, this triggers policy changes that introduce an additional source of volatility for economic variables. The model is calibrated to the U.S. economy in order to quantify the effects on the PBC of a permanent increase in polarization. We showed that higher polarization induces greater economic policy uncertainty and amplifies fluctuations in output, private consumption, and investment. Our results suggest that the observed increase in economic policy uncertainty and the accompanying rise in economic fluctuations observed over the period 2006–2011 may have been caused by rising political polarization.

While our theory made some progress in understanding the effects of political frictions on economic fluctuations, there is still scope for further research in this area. The most interesting extension consists of relaxing the balanced budget assumption. On the one hand, debt would allow parties to smooth productivity, reducing fluctuations on the investment wedge. On the other hand, debt would introduce an additional channel for manipulation, since it restricts future spending. The combined effects of productivity and political shocks on deficits are therefore unclear.

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Appendix A. Supplementary data

Supplementary data associated with this article can be found in the online version at http://dx.doi.org/10.1016/j.jmoneco.2014.07.001.

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