Towards a Theory of Policy Making

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Towards a Theory of Policy Timing

Abstract

The paper presents a theory of policy timing that relies on uncertainty and transaction costs to explain the optimal timing and length of policy reforms. Delaying reforms resolves some uncertainty by gaining valuable information and saves transaction costs. Implementing reforms without waiting increases welfare by adjusting domestic policies to changed market parameters. Optimal policy timing is found by balancing the trade-off between delaying reforms and implementing reforms without waiting. Our theory offers an explanation of why countries differ with respect to the length of their policy reforms, and why applied studies often judge agricultural policies to be inefficient.

Keywords: Policy analysis, Uncertainty, Dynamic model, Transaction costs

1. Introduction

Whenever a government makes a policy decision, it ultimately has to decide on three distinct issues: the choice of policy instruments, the setting of the levels of these instruments, and the timing of their implementation. In theoretical and applied policy analysis, the time dimension of policy formation is often ignored or simply taken as an occurrence exogenous to the rest of the policy formation process. The aim of this paper is to consider the timing of policy as an integral part of the process, explicitly chosen by government. In particular, we draw insights from transaction cost economics and from developments in the theory of decision making under temporal revelation of information, and incorporate those insights into a political economy model.

The central element of our theory is that government balances the costs of delaying policy reforms against the benefits. Costs are in the form of welfare losses, brought about by delayed adjustment to changes in the economic and political environment. Benefits of delaying policy reforms stem from receiving better information by waiting, and by delaying costs of the political process that accompany policy changes. In a world in which no further information is revealed over time and without costs of setting or changing policy, government would set an optimal policy and never change it. In a world in which new information, e.g. world market prices, is continuously revealed over time but negotiation costs and other costs of policy change are zero, government would change policy every time it receives additional information and hence very often. However, in the real world we observe neither situation, but rather observe governments changing policies discretely.

In our model, the value of waiting for information and the costs of policy change balance in political economic equilibrium, and result in intermittent policy change. Our analysis shares much with the option value part of the investment literature, except that we do not require irreversibility of policies. Instead we allow policies to change back and forth, but we still incorporate the concept of irreversible costs of policy change. We derive testable theoretical results from the model that could be further developed and investigated.

Although the setup of our model is fairly simple, the analytical solutions are quite complex and not necessarily tractable. By using data related to a reform of the EU Common Agricultural Policy (CAP) in 1992, we were able to create numerical illustrations of our general results. We also contribute to the literature that seeks to explain the rationale behind the 1992 reform (Mahe and Roe 1996; Kay 1998; 2003; Daugbjerg, 1999; 2003) by explaining how the timing of policy change relies on irreversible transaction costs, i.e., that once a reform was made, it would have been quite costly to reverse.

The remainder of the paper is organized as follows. The next section sets out the main ideas of our theory of policy timing. Section 3 uses data from around the 1992 CAP-reform to analyze and illustrate the model with a numerical simulation. Section 4 presents the main results of our simulations. Section 5 concludes with a discussion.

2. Theory of policy timing

Our theory of policy timing relies on the concepts of option value and the transaction costs of the political process. When decisions are made under uncertainty, and when more and better information arrives over time, having the ability to wait before making a decision has value. This value is commonly called the option value in the finance literature (Dixit and Pindyck 1994) or the quasi-option value in the environmental economics literature (Arrow and Fisher 1974; Smith 1983; Kolstad 1996).

The issue of optimal timing is far from new to the economics profession and typically arises in decision-making under uncertainty and involves irreversibilities and sunk costs as in Arrow and Fisher (1974), Fisher and Hanemann (1990) and Dixit and Pindyck (1994). Numerous studies in various fields have attempted to capture timing aspects of policy-making. Pindyck (2002) studies optimal timing problems in environmental economics. Szymanski (1991) addresses similar issues with regard to infrastructure investment. Aoki (2003) and Taylor (1993) analyze those aspects in monetary policy. Stern (2007) and Gerlagh et al. (2009) provide examples from economic research related to climate change.

The literature on optimal timing problems frequently regards policy change to be irreversible (e.g., Pindyck 2002). This assumption seems strong. By their very nature, policies can shift back and forth, and policy-makers frequently make use of this by regularly introducing, changing, removing, and re-introducing policies. For decisions to be made in the political arena, most nations have in place institutions that facilitate the meeting and bargaining of varying interest groups or their representatives. There is a growing literature that analyzes the costs of social interaction in general (e.g., Williamson 1985), and the costs of making economic policy in particular (Dixit 1996). These transaction costs include the costs associated with searching for information, bargaining, making contracts, enforcing contracts, and protecting property rights (Eggertsson 1990). Our focus is on negotiation costs, such as costs associated with meeting and bargaining (the legislators' salaries, travel costs, other administrative costs, etc). There are also the costs of preparation for those meetings, when agents gather information on policy issues and policy alternatives, and conduct ex-ante evaluation of the economic and social consequences of those alternatives. In this sense, though it brings about obvious benefits, the whole political process of debating issues, lobbying, voters keeping themselves informed, etc., is costly. We maintain that this costliness of meeting and bargaining affects how often legislatures meet, how often elections are held, and how often major pieces of policy legislation are passed. It is this cost which keeps governments from finely tuning policies on a day-by-day basis. We therefore suggest a conceptual theory of policy timing that allows for flexibility in changing policies back and forth, but requires irreversible negotiation costs whenever a policy change takes place.

There are other costs to policies and policy change that lie beyond the focus of this paper. There may be costs of adjustment as producers, consumers and taxpayers change their decisions in line with the new policies. For decisions that have long-lasting effects, e.g. investments, adjustment costs may be of particular importance to decision makers. We abstract from these costs as our focus is on costs of the policy process.

3. Model

3.1 Theoretical model

Consider a government that is able to change policy once per period if it so desires. At each period $t = 1, \ldots, T$ the government makes final decisions and provisional decisions. It makes a final decision on whether to meet in period t, and it makes a final decision on period t's policy. If it decides not to meet in t, then changing t's policy is infinitely expensive, and therefore government will also decide not to change policy. Also in period t, government makes provisional decisions about meetings and policies for future years. We let ${}^{t}m_r$ be a variable representing the plan made in period t about meeting in period $r \geq t$. If $r > t$, then the meeting plan made in period t for period r is provisional. If $r = t$, then we have ${}^{t}m_t$, a variable representing the final decision made in period t about whether to meet in period t. In all cases, setting ${}^{t}m_r$ to one means that the plan made in period t is to meet in period r, and setting ${}^{t}m_r$ to zero means that the plan made in period t is to not meet in period r. Similarly, ${}^{t}\boldsymbol{a}_r$ is a vector of policy instruments, which are variables.[1] When ${}^{t}\boldsymbol{a}_r$ is assigned a value, it represents the policy planned in period t to be enacted in period r. If $r > t$, then the policy plan is provisional. If $r = t$, then the policy plan is final.

Utility obtained by group i in period r is u_{ir}, which depends on ${}^{r}m_r$ (i.e., on whether a meeting is held in period r), on ${}^{r}\boldsymbol{a}_r$ (the policy set in period r), on ${}^{r\text{-}1}a_{r\text{-}1}$ (the policy that was set in period r-1), on β_r (the world price in period r), and on b_r, which describes the exogenous economic environment in period r (e.g., specifications of supply and demand functions): $u_{ir} = \psi_i\left({}^{r}m_r, {}^{r}\mathbf{a}_r, {}^{r-1}\mathbf{a}_{r-1}, \mathbf{b}_r, \beta_r\right)$

Current utility thus depends on current decisions and past decisions, i.e., on the policy that was set in the previous period, through the formulation of the negotiation cost function, which will be explained in detail below. In a generic year $t \in \{1, \ldots, T\}$, the optimization problem for the government is to determine a planned meeting schedule ${}^{t}\boldsymbol{m} = ({}^{t}m_t, {}^{t}m_{t+1}, \ldots, {}^{t}m_T)$ and a planned policy schedule ${}^{t}\boldsymbol{a} = ({}^{t}\boldsymbol{a}_t, {}^{t}\boldsymbol{a}_{t+1}, \ldots, {}^{t}\boldsymbol{a}_T)$ to maximize the expected value of the discounted weighted sum of future interest group welfare. This expected value is conditioned on the current value of the world price, β_t, so the government's problem is,

$$\max_{\substack{{}^{t}m_t, \ldots, {}^{t}m_T \\ {}^{t}\mathbf{a}_t, \ldots, {}^{t}\mathbf{a}_T}} E\left\{ \sum_{r=t}^{T} \sum_{i=1}^{N} \rho^{r-1} \left[\alpha_i \psi_i\left({}^{t}m_r, {}^{t}\mathbf{a}_r, {}^{t}\mathbf{a}_{r-1}, \mathbf{b}_r, \beta_r\right)\right] \middle| \beta_t \right\}, \tag{1}$$

where $\rho \leq 1$ is a discount factor, and u_{ir} is i's welfare obtained in period r. To keep notation compact, we let ${}^{t}\boldsymbol{a}_{t\text{-}1} = {}^{t\text{-}1}\boldsymbol{a}_{t\text{-}1}$. That is, at t, the "decision" about the previous year's policy has already been made, so the "decision" made in t for the policy in t-1 is just the decision that was made in t-1 about the policy in t-1. Expectations are taken over the future periods' world prices, $\beta_{t+1}, \ldots, \beta_T$, given that the value of the current world price β_t has been revealed and is known. Heikkinen and Pietola (2009) present a similar model, in which a firm makes flexible investments in each time period $t = 1, \ldots, T$, but maximizes the expected value of its investment over a period of infinite horizon, capturing the investment's effect on all future periods. On the contrary, in our model governments annually decide whether to change policies.

For illustrative purposes and to simplify the calculations, we switch in the remainder of this paper from the general model presented in (1) to a specific version. We assume two interest groups ($n = 2$) and three time periods ($T = 3$). Our focus is on one commodity market (the wheat market), and on one policy instrument a, the wheat intervention price. There is one stochastic variable, the wheat world price, denoted by β_t. We assume that β_t enters linearly in the empirical application and in (3) below. Wheat producers and non-wheat producers are indexed by s and c, respectively. We assume further that there are negotiation costs, which are made up of a fixed component (travel costs, housing costs etc.) and a variable component

[1] Our modeling of policies and policy instruments follows several examples in the literature, including HARSANYI (1963), (1977), ZUSMAN (1976), GARDNER (1983), and BULLOCK, SALHOFER, AND KOLA (1999).

(negotiators' labor costs, etc.). For a generic year t, negotiation costs are a function of whether a meeting is held, the previous year's policy, and the current year's policy:

$$N\left({}^{t}m_{t},{}^{t}a_{t},{}^{t-1}a_{t-1}\right)={}^{t}m_{t}\left[f+\gamma\left({}^{t}a_{t}-{}^{t-1}a_{t-1}\right)^{2}\right]+\left(1-{}^{t}m_{t}\right)\left[\xi\left({}^{t}a_{t}-{}^{t-1}a_{t-1}\right)^{2}\right] \tag{2}$$

In (2), f denotes the fixed part of the negotiation costs, while parameter $\gamma > 0$ determines how costs increase with the size of the (square of the) policy change. Policy instruments ${}^{t}a_{t}$ and ${}^{t-1}a_{t-1}$ represent a price support policy variable in periods t and t-1, and are denoted in million euros per ton. For example, if $\gamma = 0.25$, then a price change of 20 €/ton would give a variable negotiation cost of 100 €. The greater changes in policy, the more costly it is to implement the policy. A simple justification would be that the debate takes longer, so the opportunity costs of the time spent at the meeting increase. The parameter $\xi > 0$ is assumed to be very large and has the effect of making policy change prohibitively costly if no meeting is held (${}^{t}m_{t} = 0$).

Both negotiation costs and the monetary expenditures made by government to implement its policies are paid by the interest groups according to their shares of the population, δ_s and δ_c. We bring uncertainty into the model by assuming that, in any period t, at the time the government's decisions are made, only the level of the previous year's world price, β_{t-1} is known. In any year the world price can either rise or fall: $\beta_{t+1} = \beta_t + \Delta H$, or $\beta_{t+1} = \beta_t + \Delta L$, where $\Delta H > 0$ and $\Delta L < 0$. We assume that the price goes down in year 1 with probability π^D, and goes up with probability $\pi^U = 1-\pi^D$. Similarly, the world price falls in all three periods with probability π^{DDD}, and rises in all three periods probability π^{UUU}. Assuming that price movements (not price levels) in each year are independent, the eight states of nature occur with probabilities $\pi^{UUU} = \pi^U\pi^U\pi^U$, $\pi^{DDD} = \pi^D\pi^D\pi^D$, and similarly π^{UUD}, π^{UDU}, π^{UDD}, π^{DUU}, π^{DUD}, or π^{DDU}.

In period 1, the government's planned choice schedule is a set of strategy variables, two of which are made in each of the three periods: $\{{}^{1}m_1, {}^{1}a_1, {}^{1}m_2, {}^{1}a_2, {}^{1}m_3, {}^{1}a_3\}$. If the government chooses ${}^{1}m_1 = 1$, then it meets in the first period. If it sets ${}^{1}m_1 = 0$, then it does not meet in that period. Say that the policy in the period before period 1 was set at some level ${}^{0}a_0$. If there is a first-period meeting, the government sets a policy ${}^{1}a_1$. The government's provisional decision in period 1 about whether to meet in period 2 is ${}^{1}m_2$, and the provisional policy set in period 1 for period 2 is ${}^{1}a_2$. Note that the government's own actions influence the information that it possesses about future market prices. Information about the world market price in period t-1 is always revealed in t. A government that wants to use information about the world market price in t-1 can do so by deciding to meet in period t. This government, however, then faces negotiation costs. Government will choose to wait for better information if the expected value of this information gain more than offsets the costs of meeting.

Let the vector of variables ${}^{1}\boldsymbol{m} = ({}^{1}m_1, {}^{1}m_2, {}^{1}m_3)$ represent the government's planned meeting schedule as of period 1. The set of possible planned meeting schedules is M, and it has eight elements: $M = \{m_1, \ldots, m_8\}$. The first possible strategy is to set $m_1 = \{1, 1, 1\}$, meaning that meetings are planned to be held in every period; the second is to set $m_2 = \{1, 1, 0\}$, meaning that meetings are planned to be held in the first two periods but not in the third; continuing in this manner, the eighth possible strategy is to set $m_8 = \{0, 0, 0\}$, meaning that no meetings are held in any period. When a meeting schedule is planned, only the plan about whether to have a first-period meeting is committed and unalterable; ${}^{1}m_2$ and ${}^{1}m_3$ are provisionally planned, and may be changed in future periods. In period 2, government has no real choice anymore about meeting and policy in period 1; so period 2's plan for period 1 is the same as the actions taken in period 1: $({}^{2}a_1, {}^{2}m_1) = ({}^{1}a_1, {}^{1}m_1)$. Given this choice from period 1, government solves the maximization problem in (1) by choosing pairs $({}^{2}a_2, {}^{2}m_2)$ and $({}^{2}a_3, {}^{2}m_3)$ that maximize (1) conditioned on the previous choice $({}^{1}a_1, {}^{1}m_1)$. Similarly, when period 3 arrives, government must take its past decisions as given, which means in our framework that it sets $({}^{3}a_1, {}^{3}m_1)$ to equal its past choice (${}^1a_1$, ${}^1m_1$), and similarly (${}^3a_2$, ${}^3m_2$) to equal its past choice (${}^2a_2$, ${}^2m_2$), then it chooses (${}^3a_3$, ${}^3m_3$).

Given $T = 3$, we use the following welfare measures for $t = 1, 2, 3$ and $r \in [t, 3]$: $\psi_c\left({}^tm_t, {}^ta_r, {}^ta_{r-1}, \mathbf{b}_r, \beta_r\right) = CS\left({}^ta_r, \mathbf{b}_r\right) - \delta_c T\left({}^ta_r, \beta_r, \mathbf{b}_r\right) - \delta_c N\left({}^ta_r, {}^ta_{r-1}, {}^tm_t,\right)$, and $\psi_s\left({}^tm_t, {}^ta_r, {}^ta_{r-1}, \mathbf{b}_r, \beta_r\right) = PS\left({}^ta_r, \mathbf{b}_r\right) - \delta_s T\left({}^ta_r, \beta_r, \mathbf{b}_r\right) - \delta_s N\left({}^ta_r, {}^ta_{r-1}, {}^tm_t,\right)$, where $CS\left({}^ta_r, \mathbf{b}_r\right) = \int_{{}^ta_r}^{\infty} D\left(p, \mathbf{b}_r\right)dp$ is consumer surplus, $PS\left({}^ta_r, \mathbf{b}_r\right) = \int_0^{{}^ta_r} S\left(p, \mathbf{b}\right)dp$ is producer surplus, $\mathrm{X}\left({}^t\mathrm{a}_r, \beta_r, \mathrm{b}_r\right) = \left({}^t\mathrm{a}_r - \beta_r\right)\left[\mathrm{S}\left({}^t\mathrm{a}_r, \mathrm{b}_r\right) - \mathrm{D}\left({}^t\mathrm{a}_r, \mathrm{b}_r\right)\right]$ represents export subsidies, and $N\left({}^ta_{r-1}, {}^ta_r, {}^tm_r\right) = {}^tm_r\left[f + \gamma\left({}^ta_r - {}^ta_{r-1}\right)^2\right] + \left(1 - {}^tm_r\right)\left[\xi\left({}^ta_r - {}^ta_{r-1}\right)^2\right]$ represents negotiation costs. The other parameters are explained earlier in this article.

In period $t \in \{1, 2, 3\}$, government's objective is to solve,

$$\max_{\substack{{}^tm_t, \ldots, {}^tm_3 \\ {}^ta_t, \ldots, {}^ta_3}} E\left\{\sum_{r=t}^{3} \sum_{i \in \{c,s\}} \rho^{r-1}\left[\alpha_i \psi_i\left({}^tm_r, {}^ta_r, {}^ta_{r-1}, \mathbf{b}, \beta_r\right)\right] \middle| \beta_t\right\}. \tag{3}$$

Note that β_t is random, but enters linearly in the government welfare function. This allows us to replace all β_r terms by their expected values in period t, $\mathrm{E}\{\beta_r | \beta_t\}$.

To solve (3), consider the first period, which is when government makes final choices ${}^1m_1$ and ${}^1a_1$, and makes provisional plans ${}^1m_2$, ${}^1a_2$, ${}^1m_3$ and ${}^1a_3$. Assuming linear supply and demand functions[2], the three first order conditions necessary for optimal choices of ${}^1a_1$, ${}^1a_2$ and ${}^1a_3$ are given in matrix form by,

$$
{}^1\tilde{\mathbf{a}}\left({}^1\mathbf{m}\right) \equiv \begin{bmatrix} {}^1\tilde{a}_1\left({}^1\mathbf{m}\right) \\ {}^1\tilde{a}_2\left({}^1\mathbf{m}\right) \\ {}^1\tilde{a}_3\left({}^1\mathbf{m}\right) \end{bmatrix} \equiv \begin{bmatrix} {}^1\tilde{a}_1\left({}^1m_1, {}^1m_2, {}^1m_3\right) \\ {}^1\tilde{a}_2\left({}^1m_1, {}^1m_2, {}^1m_3\right) \\ {}^1\tilde{a}_3\left({}^1m_1, {}^1m_2, {}^1m_3\right) \end{bmatrix} =
$$

$$
\begin{bmatrix} k_3\left({}^1m_1, {}^1m_2\right) & k_4\left({}^1m_2\right) & 0 \\ k_2\left({}^1m_2\right) & k_3\left({}^1m_2, {}^1m_3\right) & k_4\left({}^1m_3\right) \\ 0 & k_2\left({}^1m_3\right) & k_{3last}\left({}^1m_3\right) \end{bmatrix}^{-1} \begin{bmatrix} -\left(k_0 + k_1\beta_1\right) - k_2\left({}^1m_1\right)a_0 \\ -\left(k_0 + k_1\beta_2\right) \\ -\left(k_0 + k_1\beta_3\right) \end{bmatrix}, \tag{4}
$$

with $k_0 = \left(-\alpha_c c_0 + \alpha_s b_0 - \varepsilon\left(b_0 - c_0\right)\right)$, $k_1 = \varepsilon\left(b_1 - c_1\right)$, $k_2\left({}^tm_t\right) = \varepsilon\sigma\left({}^tm_t, \mathbf{b}\right)$, $k_3\left({}^tm_t, {}^tm_{t+1}\right) = \left(-\alpha_c c_1 + \alpha_s b_1 - \varepsilon\left[2\left[b_1 - c_1\right] + \sigma\left({}^tm_t, \mathbf{b}\right) + \rho\sigma\left({}^tm_{t+1}, \mathbf{b}\right)\right]\right)$, $k_{3last}\left({}^tm_3\right) = \left(-\alpha_c c_1 + \alpha_s b_1 - \varepsilon\left[2\left[b_1 - c_1\right] + \sigma\left({}^tm_t, \mathbf{b}\right) + \rho\sigma\left({}^tm_{t+1}, \mathbf{b}\right)\right]\right)$, and $k_4\left({}^tm_t\right) = \rho\varepsilon\sigma\left({}^tm_t, \mathbf{b}\right)$, where $\varepsilon = \delta_c\alpha_c + \delta_s\alpha_s$ and $\sigma = 2m\gamma + 2\left(1 - m\right)\xi$.

For any meeting plan ${}^1m \in M$, (4) gives the optimal first-period support price as a function of the meeting plan: $\tilde{a}_1\left({}^1\mathbf{m}\right)$. As ${}^1m_t$ is a binary variable, the optimal support price in period 1, called ${}^1a_1^*$, is found by selecting the action ${}^1m^*$ that results in highest expected payoff when (4) is plugged back into (3):

[2] $S(p, \boldsymbol{b}) = b_0 + b_1 p$, $D(p, \boldsymbol{b}) = c_0 + c_1 p$

$$ {}^{1}\mathbf{m}^{*} = \left({}^{1}m_1^{*}, {}^{1}m_2^{*}, {}^{1}m_3^{*}\right) = \arg\max_{{}^{1}\mathrm{m}\in \mathrm{M}} \left\{ E\left\{ \sum_{\gamma=1}^{3} \sum_{i\in\{c,s\}} \rho^{\gamma-1} \left[\alpha_i \psi_i \left({}^{1}m_{\gamma}, {}^{1}\tilde{a}_{\gamma}\left({}^{1}\mathbf{m}\right), {}^{1}\tilde{a}_{\gamma-1}\left({}^{1}\mathbf{m}\right), \mathbf{b}, \beta_{\gamma} \right) \right] \middle| \beta_1 \right\} \right\} \quad (5) $$

Note that when decision ${}^{1}m^{*}$ is made, only ${}^{1}m_1^{*}$ of ${}^{1}m^{*}$ is committed. Choices ${}^{1}m_2^{*}$ and ${}^{1}m_3^{*}$ are made only provisionally, and may be changed in the future. Finally, the optimal policy in the first period becomes ${}^{1}a_1^{*} = {}^{1}\tilde{a}_1\left({}^{1}\mathbf{m}^{*}\right)$.

In the second period, government makes a new choice similar to (5), but with the difference that ${}^{1}a_1^{*}$ and ${}^{1}m_1^{*}$ are sunk. The second period decision-making process yields ${}^{2}a_2^{*}$, ${}^{2}m_2^{*}$, ${}^{2}a_3^{*}$, ${}^{2}m_3^{*}$, which may be identical to or differ from the first period provisional choices ${}^{1}a_2^{*}$, ${}^{1}m_2^{*}$, ${}^{1}a_3^{*}$, ${}^{1}m_3^{*}$. Similarly, government chooses an optimal ${}^{3}a_3^{*}$ and ${}^{3}m_3^{*}$, where ${}^{1}a_1^{*}$, ${}^{1}m_1^{*}$, ${}^{2}a_2^{*}$, ${}^{2}m_2^{*}$ all are given.

3.2 Empirical application

We illustrate our model by using data for the 1992 CAP-reform, the main policy change of which was a considerable reduction in the cereals intervention prices (partly) compensated by direct area payments and other accompanying measures. As our focus is on the value of delaying policy reforms, we assume that the EU could have implemented the 1992 CAP-reform in 1982, 1986 and, as it did, in 1991. We chose 1980/81 as our base year.

We calculated the EU wheat producer price as the unweighted average German and French wheat producer price for 1980/81 (FAO 2009), which was 219.94 €/ton. Usable production and internal use were 56.4 million tons and 44.9 million tons, respectively (EU-Commission 1989). We assumed 0.3277 as the own-price elasticity of wheat supply (Guoymard et al. 1996) and -0.270 as the own-price elasticity of wheat demand (Sullivan et al. 1989).

The initial world price was defined as the US wheat producer price 1980/81, which was β_0 = 146.44 €/ton (FAO 2009). The development of the world price until 1991 was based on the assumption that future prices could vary as much as they did in the 15 years before 1980/81. The two possible movements in the world price were set to ΔH = 18 €/ton and ΔL = – 22 €/ton. Within three periods time, the world price could reach a maximum of β^{UUU} = 200.44 €/ton and a minimum of β^{DDD} = 80.44 €/ton. The probability of a rise (fall) in the world price was π^{U} = 0.65 (π^{D} = 0.35), indicating an expectation of an upward shift of the world price. The population share of non-wheat producers (i.e. consumers) and wheat producers was calculated based on the number of cereal farms in 1980/81, assuming four persons per holding: δ_c = 0.9967 and δ_s = 0.0033. The discount rate was set at 5 percent, ρ = 0.95.

To the best of our knowledge, there is no attempt in the literature to empirically measure the transaction costs of policy-making, although the influence of transaction costs on (economic) policy-making is widely acknowledged (Dixit 1996) As initial values, we use γ = 0.25, f = 1, and ξ = 100,000,000, which is a "technical" parameter that is assumed high enough to prevent government from changing the policy when not meeting.

To help keep our focus on policy timing, we employed the very simple political economy model sometimes called the political preference function approach, based on Rausser and Freebairn (1974) to obtain estimates of our model's interest group weights, α_s and α_c. As argued by Bullock (1994, p. 35), this approach assumes "observed policies [to be] efficient", and "the number of policy instruments to be exactly one less than the number of interest groups." In our model we assume political-economic equilibrium in the base-year, i.e. that (β_0, m_0) = (219.94, 1). In equilibrium, α_c = 0.4572 and α_s = 0.5428, which implies that wheat producers were slightly favored by the government compared to non-wheat producers.

4. Numerical results

4.1 The length of a policy reform

The length of a policy reform is generally defined as starting with period r in which a government has decided to meet, and ending with the first period $s > r$ in which government decides to meet next. Its length is given by s - r. Assume government has met in t_1 ($m_1 = 1$) and t_3 ($m_3 = 1$), but not in t_2 ($m_2 = 0$). There are two policy reforms in this example. The first policy reform starts in t_1 and lasts for 3 - 1 = 2 periods. The second policy reform starts in t_3 and lasts for one period. The maximal length of a policy reform in our model is four periods, because we assume government to have met in the period immediately preceding the first period.

The optimal length of a policy reform is endogenous and given by the solution to (3). The first order conditions (4) indicate how the length of a policy reform is affected by changes in exogenous parameters. As the analytical solution to (4) is quite complex, numerical illustration is provided to yield insights.

An increase in the parameters f and γ of the negotiation cost function increase the length of the policy reform as it becomes more costly to change policy. Figure 1 shows the optimal meeting strategy at $t = 1$ as a function of the parameters of the negotiation cost function, $f \in [0, 6]$ and $\gamma \in [0, 2.5]$, and for the given random walk of the world price. The contour lines in figure 1 demarcate the areas in which four of the eight possible meeting strategies are optimal. They have been drawn by calculating the optimal meeting strategy for each possible pair of $\{f, \gamma\}$.

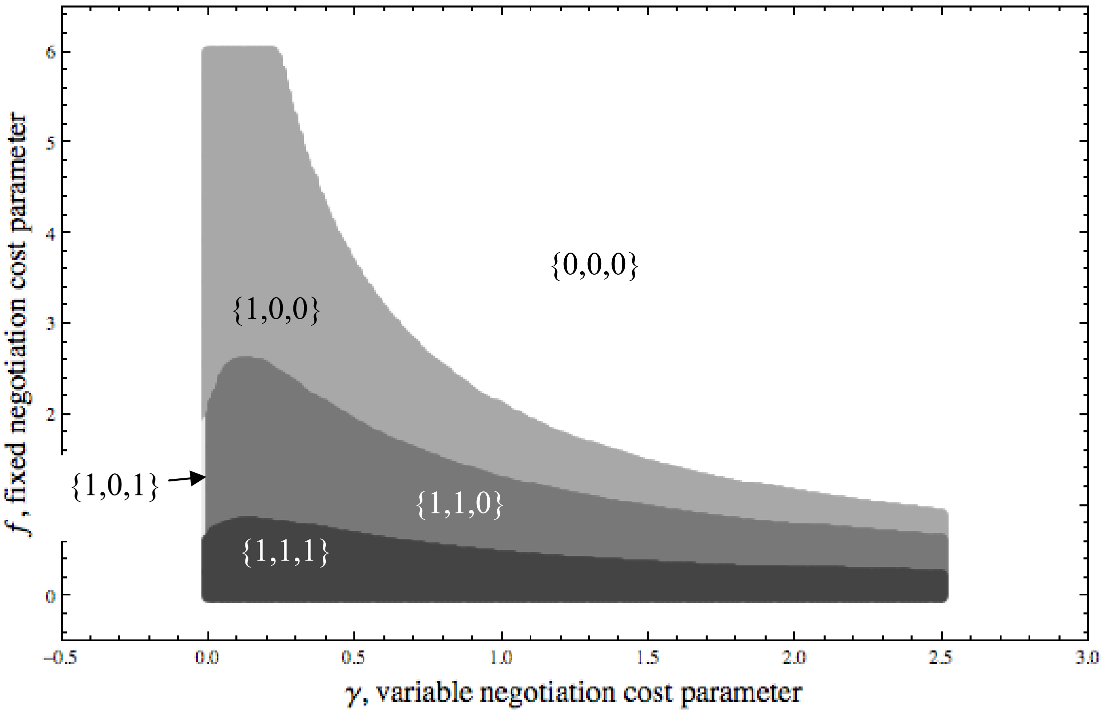

Figure 1. Optimal meeting plan $\{m_1, m_2, m_3\}$ in t_1 in $\{\gamma, f\}$ – space

Within the range of the parameter values in figure 1, the optimal plan is, as expected, to meet in every period {1, 1, 1} if fixed costs and variable costs are low enough. As variable costs increase (holding fixed costs constant), the number of meetings is reduced starting with meetings in later periods, until {0, 0, 0} finally becomes the optimal meeting strategy (not shown in figure 1). For $f = 1$, {0, 0, 0} will be optimal for $\gamma > 170$. A similar result occurs when fixed costs increase (holding marginal costs constant). Fewer meetings are held. Meeting strategy {1, 0, 1} is chosen over {1, 1, 0} only when $\gamma = 0$ and f is sufficiently low. In the area to the right of and above the upper-right contour in figure 1, the optimal meeting plan is not to meet in any period, which is {0, 0, 0}.[3]

It turns out that none of the meeting strategies that include not meeting in the first, but meeting in the second, third, or both periods is optimal under these conditions. This result depends heavily on the parameterization of the random walk of the world price. Figure 2 is identical to figure 1, with the exception that the expected change in the world market price in t_3 has been doubled, i.e., $\beta_3 = \beta_2 + 2\Delta H$, and $\beta_3 = \beta_2 + 2\Delta L$. As a result, meeting strategy {0, 0, 1} now becomes optimal for certain ranges of the negotiation cost parameters.

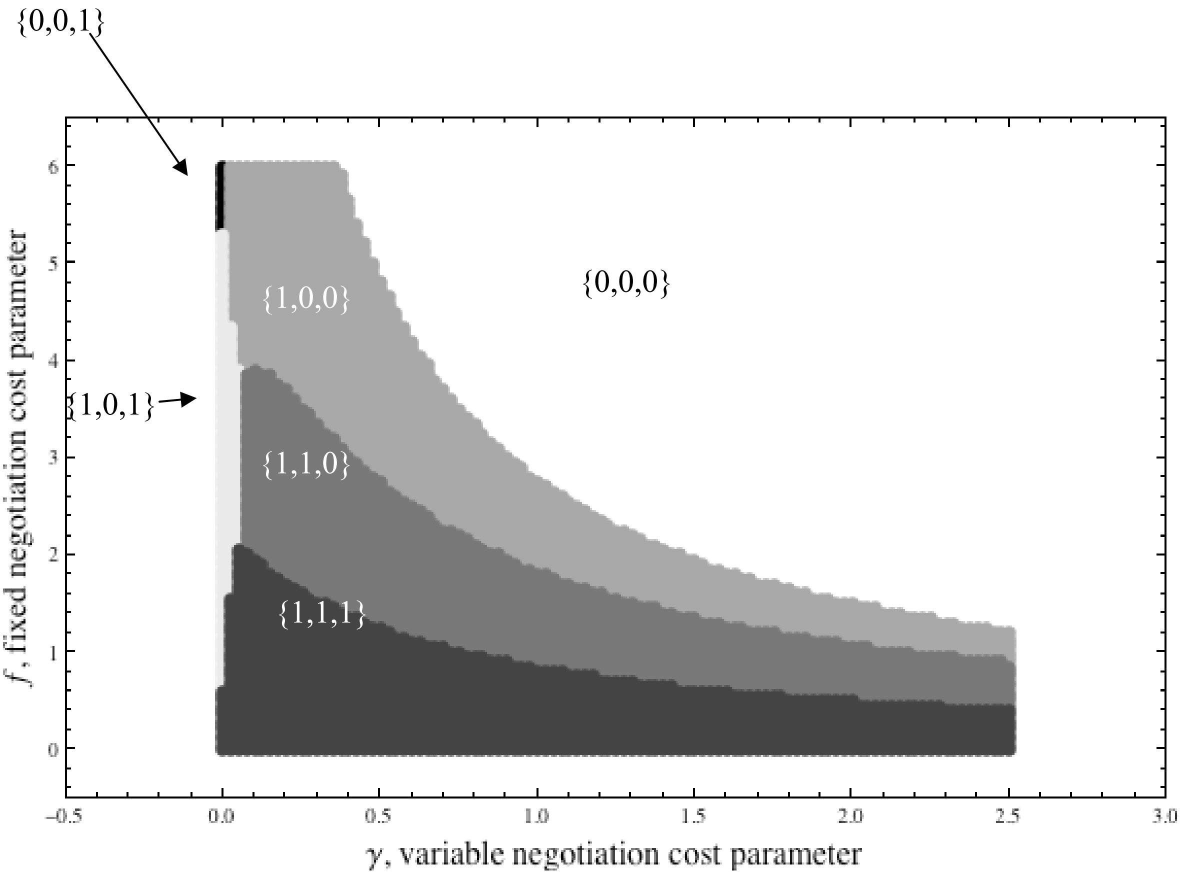

Figure 2. Optimal meeting plan $\{m_1, m_2, m_3\}$ in $\{\gamma, f\}$ – space with twice the expected change in world price in t_3

Increased variance of the world market price development in t_3 makes it more valuable to meet in that period. By comparing figure 2 with figure 1, we can also infer that meeting strategies {1, 0, 1} and {1, 1, 1} become optimal for a wider range of the parameters of the negotiation costs function. But still, when negotiation costs reach a sufficiently high level, not meeting (i.e., {0, 0, 0}) becomes the optimal meeting strategy.

4.2 Size of policy change

The size of the policy change, $a_t - a_{t-1}$, depends on several of the model's parameters. An increase in the marginal meeting costs, γ, reduces the size, as more resources go into the political process instead of increasing welfare. A change in the fixed meeting costs does not impact the size of the policy change. However the size of the policy change does depend on the strength of the external shock that is applied; the larger the change in the political and economic conditions (i.e. the change in the world price in our model), the larger will be the

[3] A mean-preserving change in the variance does not alter the optimal policy plan. This is because government is assumed to be risk-neutral and considers only the mean.

policy change. This is true both for current and future policy decisions, and independent of whether the change is in the current period or in future periods. Moreover, the size of the policy change depends on the length of a policy reform. The longer the period without a reform, the larger will be the policy change both at the time the new policy is implemented as well as the next time the government accomplishes a new reform. Table 1 illustrates by comparing optimal policies for different meeting scenarios at $t = 1$.

Table 1. Optimal policies a_1, a_2 and a_3 at t_1 for different meeting scenarios [€/t]

	a_0	A_1	$a_1 - a_0$	a_2	$a_2 - a_1$	a_3	$a_3 - a_2$	$a_3 - a_0$
{0, 0, 1}	219.94	219.94	0.00	219.94	0.00	222.61	2.67	2.67
{0, 1, 1}	219.94	219.94	0.00	223.24	3.30	225.25	2.01	5.31
{1, 0, 0}	219.94	223.58	3.63	223.58	0.00	223.58	0.00	3.63
{1, 0, 1}	219.94	223.31	3.37	223.31	0.00	225.30	1.99	5.36

Source: Own calculations.

Examining table 1, comparing scenario {0, 0, 1} with scenario {0, 1, 1}, the change from $t = 2$ to $t = 3$ as measured by $a_3 - a_2$ is larger for the former scenario where no meeting was held until $t = 3$ (2.67 €/t), than the latter scenario where a meeting was held in $t = 2$ (2.01 €/t). Similarly, the change from $t = 0$ to $t = 1$ as measured by $a_1 - a_0$ is larger for the scenario {1, 0, 0}, where no meeting is held after $t = 1$ than for the scenario {1, 0, 1}, where a new meeting is held in $t = 3$. These results do not imply, however, that the total policy change over the observed time period will be larger. Total policy change as measured by $a_3 - a_0$ is 5.31 €/t in scenario {0, 1, 1} compared to 2.67 €/t in scenario {0, 0, 1}. The same holds for scenarios {1, 0, 1} and {1, 0, 0}.

4.3 Efficiency of seemingly inefficient policies

Following the seminal work of Stigler (1982), Becker (1983) and Gardner (1983), a long-standing debate in agricultural economics considers whether government redistribution is efficient. Numerous empirical studies have been conducted to support or question this hypothesis (Bullock 1995) and the references therein). But those models frequently do not account for the costs of policy change, and so bear the risk of erroneously finding observed policies to be inefficient. To see why, compare the optimal response of the domestic policy a_1 to a change in the world price from β_0 to β_1 for the cases with and without negotiation costs. Intuitively, for a given β_1, the change in the domestic policy will be higher without negotiation costs. A positive policy analysis neglecting negotiation costs would thus observe a domestic policy different from what the model would predict, and erroneously judge that policy to be inefficient. Figure 3 provides a graphical illustration.

The solid (dotted) line in figure 3 depicts the optimal response policy a_1 with (without) negotiation costs. The two lines intersect at the point $(a_0, \beta_0) = (219.94, 146.44)$, as no change in the world price does not require a change in the domestic price either. The grey shaded area between the two lines indicates the price range of the domestic price for a given change in the world price for which a political economy model neglecting negotiation costs would find the observed domestic policy a_1 to be inefficient. Consider point A which is approximately (140, 70) in figure 3. Without negotiation costs, a domestic price of 140 €/t would be the optimal response to a world price of 70 €/t. However, taking negotiation costs into account and assuming (a_0, β_0) = (219.94, 146.44) from the previous period, the optimal policy would be at point B, approximately (220, 70). A political economy analysis that neglects negotiation costs would find the observed policy $a_1 \approx 220$ €/t to be inefficient (i.e., too high) as it would assume policy $a_1 \approx 140$ €/t to be optimal policy given the market parameters and the world price. This is because negotiation costs reduce the benefits of changing policies and thus reduce the size of the optimal policy response. The price range increases with an increase of the change in the world price from the previous period.

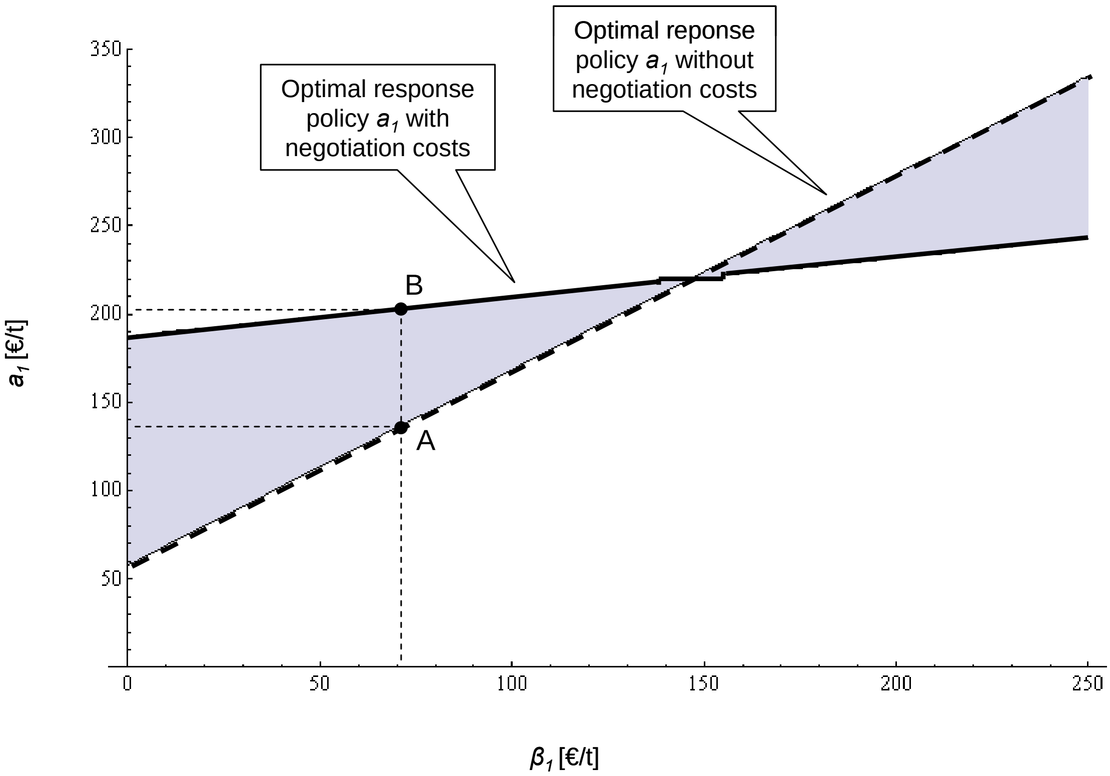

Figure 3. Price range for seemingly inefficient policies

Note that the optimal response function without negotiation costs has a steeper slope than the optimal response function with negotiation costs. In addition, the latter function is flat around (a_0, β_0). This is because in this neighborhood, the change in the world price from β_0 to β_1 is too small to outweigh the costs of domestic policy change. Therefore, government chooses to keep the former policy a_0.

5. Discussion and conclusion

This paper presents a theory of policy timing based on the cost-benefit trade-offs. On the one hand, there are benefits to adjusting quickly to changes in the economic and political environment. On the other hand, there are benefits of waiting for valuable information, and there are negotiation costs of policy change, as well. The theory is incorporated into a dynamic political economy model in which a government has full flexibility with regard to the design and length of a policy reform. Improving upon existing literature, the model does not require the irreversibility of policies themselves, but assumes instead the irreversibility of the costs of changing policies. The theory yields some interesting insights. It makes a contribution to the question of why countries adopt policy reforms of different lengths. We provide an example of the EU, which in connection with the 1992 CAP-reform changed its policy-making process from holding annual meetings to holding meetings only once every several years. This example may support our theory that predicts the positive relationship ceteris paribus between negotiation costs and the length of a policy reform. The theory also contributes to the long-standing debate on whether government redistribution is efficient. Policy analysis that does not take into account the dynamics of policy timing may run the risk of finding potentially efficient policies to be inefficient.

The theory of policy timing presented suggests several potentially valuable extensions. We only incorporate negotiation costs into the model. Introducing additional sources of transaction costs (like the implementation, administration and enforcement costs of policies) is expected to strengthen the impacts of those transaction costs already incorporated in the model. Therefore we would expect governments to wait even longer until new comprehensive policy reforms are introduced ("reactive governance").

We model the policy-decision making process as a one-dimensional objective: The weighted sum of interest group welfare net of the costs of "running the system". An interesting extension would be to model the governance structure of policy making in more detail and relate it to other types of transaction costs (like asset specificity) (Dixit 1996). Of course we do not claim that our negotiation cost function covers the complexity of EU agricultural policy making, but we acknowledge the costliness of decision-making through the inclusion of negotiation costs. The collection of empirical data to specify different kinds of transaction costs and their incorporation in a mathematical model of the kind provided in this study, constitutes, in this respect, an important venue for future work. Extending the political part of the model in this way, and extending the economic part of the model by introducing various input and output markets would be expected to yield new insights into the relationships between the causes of (agricultural) policies (derived from the political part of the model) and the consequences of (agricultural) policies (derived from the economic part of the model).

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