Russian Revolution & the Soft Budget Constraint[1]

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Abstract: Russia's introduction into the gold standard in 1897 fueled its industrialization program, as it facilitated the massive entry of foreign capital into domestic industry. Did the introduction of the gold standard polarize Russian society by increasing the welfare gap between nobility and the working class? Are the socio-economic preconditions of the Russian Revolution to be sought in the Witte system? We model industrialization as an infinite horizon game in which the government in each period decides how much to tax the peasants and the degree of centralization it intends to have for its financial system. Peasants can reject the government proposal and revolt in the first period or accept it and reap the financial benefits of industrialization. If the government proposal passes, then external liquidity is available for the financing of domestic industrialization projects. The nature of the financial system is stochastically determined and it can be either centralized or decentralized. In equilibrium, the government is a successful reformer, when it is able to make offers that render the *ex-ante* revolution constraint non-binding. Revolution *ex-post* is more likely to be the result of industrialization through a centralized rather than a decentralized financial system. When the financial system is centralized, the bank is better off refinancing bad projects submitted by government-sponsored entrepreneurs rather than replacing them with good entrepreneurs from the peasantry. When the financial system is decentralized, there is a hardening of budget constraints and bad government-sponsored entrepreneurs exit the market. This paper explains the economic reforms of Sergei Witte and some of his predecessors (Vyshnegradski, Bunge and von Reutern) and the extent to which they contributed to the Russian Revolution.

Keywords: industrialization, financial system, soft budget constraint, Russian revolution, stochastic games

JEL Codes : N53, N93, P48, P51

I. Introduction

Market transitions in Eastern Europe and the Soviet Union have been defined by the comparison of two reform implementation strategies, gradualism and shock-therapy (Roland, 2000). There are three criteria for the evaluation of these reform paths: 1. Existence of complementarities between partial reforms, 2. Probability of reversal to the *status-quo-ante* between two partial reforms or after the implementation of the reform package and 3. Emerging democratic institutions allowing citizens to reject reform packages that do not meet median voter preferences (ibid.). Economic reforms in the Russian Empire started after its severe defeat in the Crimean War and culminated with Witte's industrialization program in the turn of the 20th century. What I propose in this paper is that the debate between gradualism and shock-therapy may not be as recent as economists think. The tradeoff between *ex-post*

[1] Preliminary and incomplete.

irreversibility and *ex-ante* acceptability, which underpins the median voter payoffs from shock therapy and gradualism respectively, suggests that the simultaneous implementation of a reform package is more efficient under conditions of reform complementarity, but it may also make the reversal of a badly designed reform package extremely costly *ex-post* (ibid.). Similarly, the sequential implementation of a reform package gives the opportunity to a social or political majority to reverse the reform package only after the first partial reform has been implemented. This early reversal option makes the electorate more willing to accept the initiation of a reform package and constitutes a guarantee for its long-term sustainability, once it has come into force.

The Russian Empire never qualified as a democracy, so elections are not an instrument that can discipline politicians, who select policies far from the median voter ideal point. Bad weather as a negative exogenous shock for harvest explains why the first partial reform may be reversed. Financing the rising public debt is regarded as a key priority for the Ministry of Finance so that it can attract external liquidity from German and French banks. Roland and Qian (1998) argue that fiscal decentralization increases the opportunity cost of bailing out an enterprise; under conditions of non-state capital mobility local governments face higher incentives to terminate the financing of bankrupt enterprises, because that way they cannot afford offering competitive tax regimes to foreign investors. Moreover, under partial fiscal decentralization local governments compete both for earmarked grants by the central governments and for foreign capital inflows (ibid.). This increases the opportunity cost of providing a soft budget constraint for any local government, given that earmarked grant by the local government is not too large. Dewatripont and Maskin (1995) identify the soft budget constraint as a structural element of a centralized financial system, where the lender cannot credibly commit to terminate an inefficient project *ex-ante*, when he becomes better off refinancing it *ex-post*. They show that decentralization of the financial system hardens the budget constraint of firms introducing bad projects and hence offers them the incentive to abstain from proposing them in the first place. The existence of multiple credit institutions reduces the monitoring effort of the first lender over the entrepreneur; the first bank knows that the second bank can bail out an inefficient project, but it cannot enforce it onto it. As Dewatripont and Maskin (ibid.) indicate, the non-transferability of information across multiple creditors and the related challenge of renegotiating a loan make refinancing less likely.

In this paper I find that a centralized financial system that channels external liquidity to the domestic market in order to bolster industrialization has the propensity of generating soft budget constraints and thus increase the relative welfare differential between the emerging class of industrialists and peasants that have been drawn to the cities and transformed to industrial workers. This research

idea is in line with Gerschenkron's theory on the crucial role of the Russian government in securing external liquidity to finance industrialization. Moreover, it expands Burhop's evidence on the positive effect of joint-stock credit banks on German industrialization in early 19th century (2006). As Burhop (ibid.) correctly observes, savings banks played only later an important role in capital formation.

Weir (1989) traces the financial origins of the French Revolution in the Terray reforms, which led to a freeze of dividend payments under the tontines scheme; these were transformed into life annuities and provided the basis for an increase in state revenues. The French bourgeoisie after 1770 could no longer trust the government's commitment to the conditions of this life-contingent credit institution (ibid.). While the French Revolution was facilitated by Terray's decision to raise money for the Treasury at the expense of the bourgeoisie, the Russian Revolution became possible by the adverse inequality effect of Witte's industrialization program. Similarly, White (1995) proposes that the French Crown's reliance on indirect taxes and its inability to balance the budget with a consistent fiscal policy, which would not shift the burden of fiscal adjustment to the middle class and would not preserve the privileges of nobility and clergy. Excessive borrowing was a response to insufficient tax revenues and the perspective of permanent postwar deficits consolidated this policy (ibid.). The positive role of banks in economic development per Gerschenkron remains a black box, unless banks are treated not just as financial intermediaries, but also as social institutions with distinct relationships to government (Lamoreux, 1986). Government ownership of banks is more likely in countries with lower income per capita, financial underdevelopment, low protection of property rights and interventionist governments (LaPorta, Lopez-De-Silanes and Shleifer, 2002). This finding suggests that the resource allocation process by government-owned banks becomes politicized (ibid.).

II. The Model

The model introduces an interaction between a government and peasants. The government introduces a new tax, which is higher than the tax that peasants used to pay before. Acceptance of the fiscal policy proposal by peasants allows the government to finance an industrialization program through the provision of credit. This can occur in two ways: through the central bank and a centralized financial system or through a decentralized financial system and commercial banks that are efficient in the selection of good projects.

Consider a finite game in which a government G tries to convince peasants P in favor of its reform program. G makes a policy proposal $\theta_t = \left(\tau_t, \vec{h}_{ij,t+1} \right)$ in the beginning of period t. P decides whether to accept or reject $G's$ reform proposal. Let $\vec{h}_{ij,t+1} = \left(f_{i,t+1}, g_{j,t+1} \right)$, which is the state space to which the stage game transitions in the subsequent period. We note that $f_{it} \in [0,1]$ is the degree of centralization of the financial system that provides credit for industrialization and $g_{jt} \in [0,1]$ is the share of peasantry that moves to cities.

If the financial system is centralized, then it generates soft budget constraints and that way it is less likely to discriminate between good and bad industrial projects submitted by the government. On the other hand, if the financial system is decentralized per Dewatripont and Maskin (1995), bad government-sponsored entrepreneurs are more likely to be terminated and replaced by good entrepreneurs originating from the peasantry. In the case of financial centralization, the provision of credit for industrialization occurs through the central bank, whereas in the case of financial decentralization through the central bank (B_c) and a commercial bank (B_d), which is hierarchically dependent on the central bank.

The *industrialization game* is therefore defined in the following form:

1. Players: a government G, peasants P and a financial institution B_k, where $k = c, d$ holds for a centralized and a decentralized financial system respectively, such that $N = \{G, P, B_k\}$.
2. Continuous states $S = \{\vec{f}_i, \vec{g}_j\}$ such that $\vec{f}_i = (f_1, ..., f_{m-1}, f_m)$ and $\vec{g}_j = (g_1, ..., g_{n-1}, g_n)$.
3. Strategy sets: $A^l, \forall l \in N$.
4. Payoffs: $u^l, \forall l \in N$.
5. Transition probabilities:

$P(g_{j,t+1} \mid g_{j,t}, \alpha_t^l) \geq 0$ such that $\int_0^\infty P(g_{j,t+1} \mid g_{j,t}, \alpha_t^l) dt = 1$

$P(f_{i,t+1} \mid f_{i,t}, \alpha_t^l) \geq 0$ such that $\int_0^\infty P(f_{i,t+1} \mid f_{i,t}, \alpha_t^l) dt = 1$

where $\alpha_t^l = \{\alpha_t^G, \alpha_t^P, \alpha_t^{B_k}\}$ are the strategies of the government, peasants, and the financial institution in any period t.

Stochastic processes obey to the following rules:

$$g_{j,t+1} = g_{jt} + (1-\beta)y_t + \rho_t$$
$$f_{i,t+1} = f_{it} + \eta x_t^F + \upsilon_t$$

where $x^F \in (0,+\infty)$ is foreign capital and $y_t \in (0,+\infty)$ baseline income. Monitoring effort is denoted by $\eta \in (0,1)$. An exogenous weather shock is denoted by ρ_t and an exogenous shock on the availability of external (emergency) liquidity (Lombard credit, discount credit) is denoted by υ_t.

6. Discount rate β s.t. $\beta \in (0,1)$.

The timing of the industrialization game has the following structure:

1. The government proposes $\theta_t = (\tau_t, h_{t+1})$.
2. Peasants accept or reject the reform proposal.
3. In case of reform rejection, there is a ***conflict ex-ante*** and the stage game is over. In case of reform acceptance, nature decides sequentially the share of peasants that move to cities and the degree of centralization in the financial system.
4. The government submits a good or a bad project to the central bank.
5. In case of a good project, the ***reform is implemented*** and the stage game is over. In case of a bad project, the central bank (centralization) or the commercial bank (decentralization) decide whether to refinance the government`s bad project or to replace it with a project submitted by the share of peasants that have moved to cities.
6. Peasants that have moved to cities (workers) observe the choice of the financial institution and decide whether to revolt or not; the outcome here is either ***conflict ex-post*** or ***reform implementation***. The stage game is over.

The revolution *ex-ante* payoffs for government and peasants are $\begin{bmatrix} u^G \\ u^P \\ u^B \end{bmatrix} = \begin{bmatrix} 0 \\ y_t^2(1-R_t)^2 \\ 0 \end{bmatrix}$, where R_t denotes reversal cost. The central bank is hierarchically dependent on the government; we assume no central bank independence in order to relate to the realities of 19th century Russia. Key differences between a centralized and a decentralized financial system arise, where the government submits a bad project that needs refinancing for an additional period. We assume a sequential hierarchy between the government, the central bank and, in the case of decentralization, a commercial bank. What defines this sequential hierarchy is that the cost of governmental monitoring over a commercial bank is higher than its cost of monitoring over the central bank such that $\theta^2(\eta)$ is the cost of monitoring that the government

exerts over the central bank and $\theta^{2n}(\eta)$ the cost of monitoring that the government exerts over a commercial bank; $n \geq 2$ denotes the number of commercial banks in a decentralized financial system. The intuition here is that soft budget constraints in the form of refinancing a bad governmental project are more likely in a centralized than in a decentralized financial system.

Peasants (that have now become workers) observe the choice of the central bank under financial centralization or a commercial bank under financial decentralization, and they select to revolt or not. If revolution occurs under centralization or decentralization, the payoff vector has the following form: $\begin{bmatrix} u^G \\ u^P \\ u^B \end{bmatrix} = \begin{bmatrix} 0 \\ y_t^2(1-R_t)^2 + x_t^F \\ 0 \end{bmatrix}$. If the central bank decides to refinance under centralization and peasants do not revolt, then $\begin{bmatrix} u^G \\ u^P \\ u^{B_c} \end{bmatrix} = \begin{bmatrix} \eta^* \left[\tau_t y_t^2 + x_t^F\right] - \theta^2(\eta^*) x_t^F \\ \dfrac{(1-\tau_t) y_t^2}{\eta^*} \\ \left[\theta^2(\eta^*) - \gamma\right] x_t^F \end{bmatrix}$, where η^* is the optimal level of monitoring under centralization. Similarly, $\begin{bmatrix} u^G \\ u^P \\ u^{B_d} \end{bmatrix} = \begin{bmatrix} \eta^{**} \left[\tau_t y_t^2 + x_t^F\right] - \theta^{2n}(\eta^{**}) x_t^F \\ \dfrac{(1-\tau_t) y_t^2}{\eta^{**}} \\ \left[\theta^{2n}(\eta^{**}) - \gamma\right] x_t^F \end{bmatrix}$, where η^{**} is the optimal level of monitoring under decentralization and γ denotes an efficiency loss from softening the budget constraint.. If the central bank decides to terminate the government project and replace it with a project submitted by an entrepreneur originating from the working class, then $\begin{bmatrix} u^G \\ u^P \\ u^{B_c} \end{bmatrix} = \begin{bmatrix} \eta^* \left[\tau_t y_t^2\right] - \theta^2(\eta^*) \\ \dfrac{(1-\tau_t) y_t^2 + x_t^F}{\eta^*} \\ \theta^2(\eta^*) x_t^F \end{bmatrix}$.

Similarly, $\begin{bmatrix} u^G \\ u^P \\ u^{B_d} \end{bmatrix} = \begin{bmatrix} \eta^{**} \left[\tau_t y_t^2\right] - \theta^{2n}(\eta^{**}) \\ \dfrac{(1-\tau_t) y_t^2 + x_t^F}{\eta^{**}} \\ \theta^{2n}(\eta^{**}) x_t^F \end{bmatrix}$ under decentralization. The degree of centralization of the financial system is defined by a threshold $\overline{f}_{m-k,t}$ above which the financial system is characterized as

centralized such that $f_{it} \geq \overline{f}_{m-k,t}$ and below which the financial system is characterized as decentralized such that $f_{it} < \overline{f}_{m-k,t}$. Figure 1 summarizes the stage game. The government submits a successful reform proposal, when peasants accept it such that $\mathrm{E}_{h_{ij,t}} u^P(\alpha_t, h_t) \geq y_t^2(1-R_t)^2$. $G's$ proposal leads to reform reversal, if $P's$ payoff to rejecting is higher than his payoff to accepting.

The **<u>conflict *ex-ante* condition</u>** in the stage game is therefore the following:

$$y_t^2(1-R_t)^2 > g_{jt}P(f_{it} \geq \overline{f}_{m-k,t})\left[\zeta\frac{(1-\tau_t)y_t^2}{\eta^*}+(1-\zeta)\left(\varphi\left[\lambda\left(y_t^2(1-R_t)^2+x_t^F\right)+(1-\lambda)\frac{(1-\tau_t)y_t^2}{\eta^*}\right]+(1-\varphi)\left[\lambda\left(y_t^2(1-R_t)^2+x_t^F\right)+(1-\lambda)\frac{(1-\tau_t)y_t^2+x_t^F}{\eta^*}\right]\right)\right]+$$

$$g_{jt}P(f_{it} < \overline{f}_{m-k,t})\left[\zeta\frac{(1-\tau_t)y_t^2}{\eta^{**}}+(1-\zeta)\left(\varphi\left[\lambda\left(y_t^2(1-R_t)^2+x_t^F\right)+(1-\lambda)\frac{(1-\tau_t)y_t^2}{\eta^{**}}\right]+(1-\varphi)\left[\lambda\left(y_t^2(1-R_t)^2+x_t^F\right)+(1-\lambda)\frac{(1-\tau_t)y_t^2+x_t^F}{\eta^{**}}\right]\right)\right]$$

where $\zeta, \varphi, \lambda \in \{0,1\}$ are the binary probabilities respectively that the government will submit a good project, the financial system will refinance a bad project, and the peasants (workers) will topple the government. G can always make P accept his reform proposal, if he makes an offer, which induces higher benefits from reform implementation than revolution *ex-ante* such that $x_t^F > (1-R_t)y_t$ and $\tau_t < R_t$. It follows that the government would never make a reform proposal whose payoff for peasants would approximate that of a revolution *ex-ante*, because then G would prefer not to initiate any reform to begin with. Moreover, he is able to have a reform package accepted, if $g_{jt} > 0$.

<u>Definition 1</u>

G is a successful reform proposer at stage game s_t if $x_t^F > (1-R_t)y_t$, $\tau_t < R_t$ and $g_{jt} > 0$.

Transforming the aforementioned game into a dynamic linear quadratic optimization problem, I derive the value functions of the government, peasants, and financial system, depending on the realizations of continuous states in the game: the share of peasants that migrate to cities and become workers, and the degree of centralization of the financial system. I introduce a discount rate $\beta \in [0,1)$. The objective function of a player l is $U^l(\alpha_t, h_{ij,t}) = \mathrm{E}_{h_{ij,t}}\left[\int_0^\infty \beta^{t-1}u^l(\alpha_t, h_{ij,t})dt\right]$. The Bellman payoffs for the government have the following form:

$$H^{G}_{Good}(s_t) = g_{jt}\left[P(f_{it} \geq \overline{f}_{m-k,t})\bar{u}^{G}_{Good}(s_t) + P(f_{it} < \overline{f}_{m-k,t})\underline{u}^{G}_{Good}(s_t) \right] + \beta P(h_{ij,t+1} \mid h_{ij,t}, \alpha^{l}_{t}) \times$$

$$E_{h_{ij,t+1}}\left[\zeta H^{G}_{Good}(s_{t+1}) + (1-\zeta) H^{G}_{Bad}(s_{t+1}) \mid h_{ij,t}, \alpha^{l}_{t} \right]$$

$$H^{G}_{Bad}(s_t) = g_{jt}\left[P(f_{it} \geq \overline{f}_{m-k,t})\bar{u}^{G}_{Bad}(s_t) + P(f_{it} < \overline{f}_{m-k,t})\underline{u}^{G}_{Bad}(s_t) \right] + \beta P(h_{ij,t+1} \mid h_{ij,t}, \alpha^{l}_{t}) \times$$

$$E_{h_{ij,t+1}}\left[\zeta H^{G}_{Good}(s_{t+1}) + (1-\zeta) H^{G}_{Bad}(s_{t+1}) \mid h_{ij,t}, \alpha^{l}_{t} \mid \right]$$

where:

$$\bar{u}^{G}_{Good}(s_t) = \eta^{*}\left[\tau_t y_t^2 + x_t^F \right] - \theta^2(\eta^{*}) x_t^F$$

$$\underline{u}^{G}_{Good}(s_t) = \eta^{**}\left[\tau_t y_t^2 + x_t^F \right] - \theta^2(\eta^{**}) x_t^F$$

$$\bar{u}^{G}_{Bad}(s_t) = \varphi\left[\lambda\left(y_t^2(1-R_t)^2 + x_t^F \right) + (1-\lambda)\frac{(1-\tau_t)y_t^2}{\eta^{*}} \right] + (1-\varphi)\left[\lambda\left(y_t^2(1-R_t)^2 + x_t^F \right) + (1-\lambda)\frac{(1-\tau_t)y_t^2 + x_t^F}{\eta^{*}} \right]$$

$$\underline{u}^{G}_{Bad}(s_t) = \varphi\left[\lambda\left(y_t^2(1-R_t)^2 + x_t^F \right) + (1-\lambda)\frac{(1-\tau_t)y_t^2}{\eta^{**}} \right] + (1-\varphi)\left[\lambda\left(y_t^2(1-R_t)^2 + x_t^F \right) + (1-\lambda)\frac{(1-\tau_t)y_t^2 + x_t^F}{\eta^{**}} \right]$$

Similarly, for peasants:

$$H^{P}_{Conflict}(s_t) = g_{jt}\left[P(f_{it} \geq \overline{f}_{m-k,t})\bar{u}^{P}_{Good}(s_t) + P(f_{it} < \overline{f}_{m-k,t})\underline{u}^{P}_{Good}(s_t) \right] + \beta P(h_{ij,t+1} \mid h_{ij,t}, \alpha^{l}_{t}) \times$$

$$E_{h_{ij,t+1}}\left[\lambda H^{P}_{Conflict}(s_{t+1}) + (1-\lambda) H^{P}_{\mathrm{Re}\,form}(s_{t+1}) \mid h_{ij,t}, \alpha^{l}_{t} \right]$$

$$H^{P}_{\mathrm{Re}\,form}(s_t) = g_{jt}\left[P(f_{it} \geq \overline{f}_{m-k,t})\bar{u}^{P}_{\mathrm{Re}\,form}(s_t) + P(f_{it} < \overline{f}_{m-k,t})\underline{u}^{P}_{\mathrm{Re}\,form}(s_t) \right] + \beta P(h_{ij,t+1} \mid h_{ij,t}, \alpha^{l}_{t}) \times$$

$$E_{h_{ij,t+1}}\left[\lambda H^{P}_{Conflict}(s_{t+1}) + (1-\lambda) H^{P}_{\mathrm{Re}\,form}(s_{t+1}) \mid h_{ij,t}, \alpha^{l}_{t} \right]$$

where:

$$\bar{u}^{P}_{Conflict}(s_t) = (1-\zeta)\lambda\left[y_t^2(1-R_t)^2 + x_t^F \right] = \underline{u}^{P}_{Conflict}(s_t)$$

$$\bar{u}^{P}_{\mathrm{Re}\,form}(s_t) = (1-\zeta)(1-\lambda)\left[\varphi\frac{(1-\tau_t)y_t^2}{\eta^{*}} + (1-\varphi)\frac{(1-\tau_t)y_t^2 + x_t^F}{\eta^{*}} \right] = (1-\zeta)(1-\lambda)\frac{(1-\tau_t)y_t^2 + x_t^F(1-\varphi)}{\eta^{*}}$$

$$\underline{u}^{P}_{\mathrm{Re}\,form}(s_t) = (1-\zeta)(1-\lambda)\left[\varphi\frac{(1-\tau_t)y_t^2}{\eta^{**}} + (1-\varphi)\frac{(1-\tau_t)y_t^2 + x_t^F}{\eta^{**}} \right] = (1-\zeta)(1-\lambda)\frac{(1-\tau_t)y_t^2 + x_t^F(1-\varphi)}{\eta^{**}}$$

Moreover, for the financial system:

$$H^{B_k}_{\mathrm{Re}\,finance}(s_t) = g_{jt}\left[P(f_{it} \geq \overline{f}_{m-k,t})\bar{u}^{B_k}_{\mathrm{Re}\,finance}(s_t) + P(f_{it} < \overline{f}_{m-k,t})\underline{u}^{B_k}_{\mathrm{Re}\,finance}(s_t) \right] + \beta P(h_{ij,t+1} \mid h_{ij,t}, \alpha^{l}_{t}) \times$$

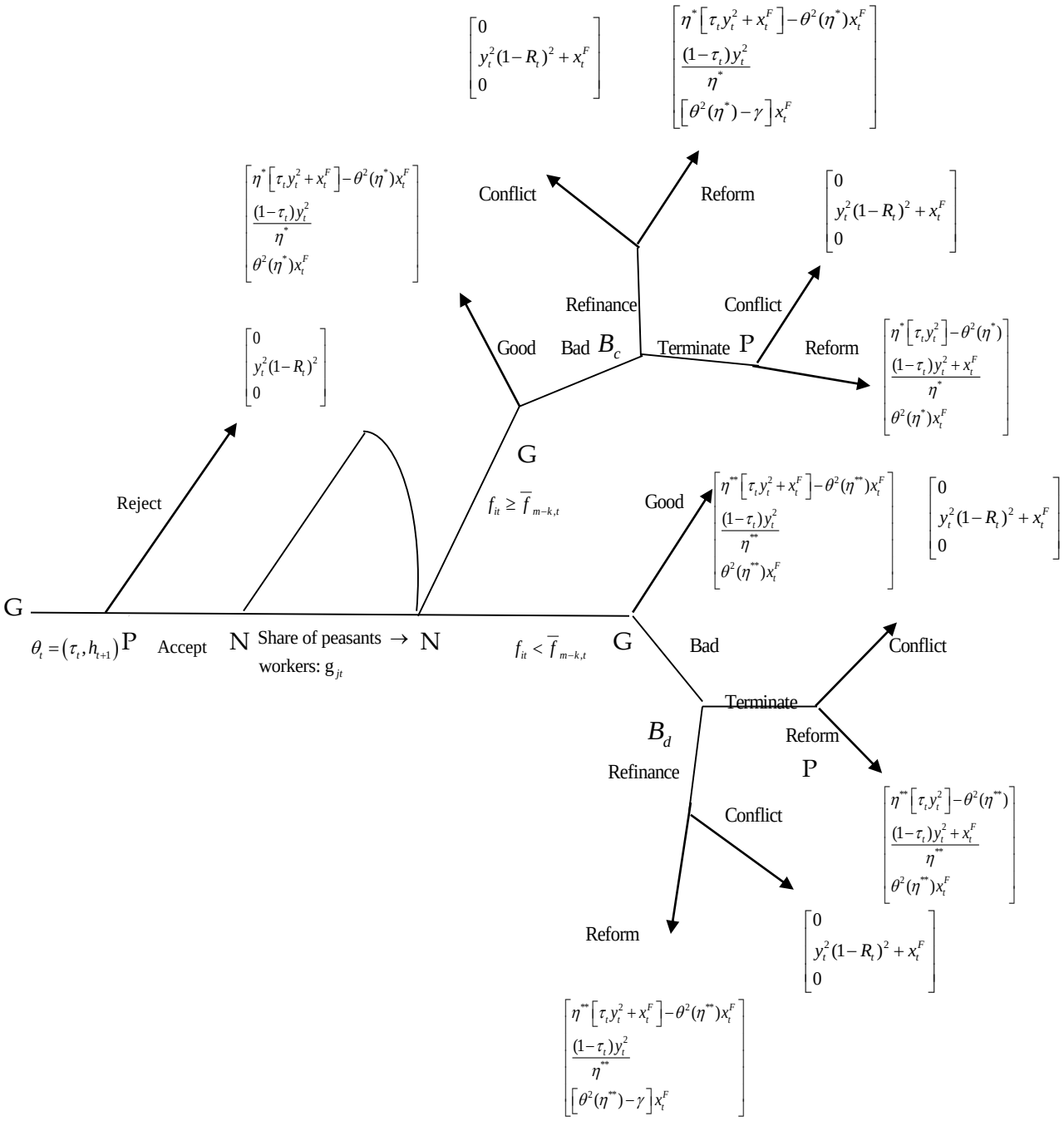
$$E_{h_{ij,t+1}}\left[\varphi H^{B_k}_{\mathrm{Re}\,finance}(s_{t+1}) + (1-\varphi) H^{B_k}_{Ter\,\min ate}(s_{t+1}) \mid h_{ij,t}, \alpha^{l}_{t} \right]$$

$$H^{B_k}_{Ter\,\min ate}(s_t) = g_{jt}\left[P(f_{it} \geq \overline{f}_{m-k,t})\bar{u}^{B_k}_{Ter\,\min ate}(s_t) + P(f_{it} < \overline{f}_{m-k,t})\underline{u}^{B_k}_{Ter\,\min ate}(s_t) \right] + \beta P(h_{ij,t+1} \mid h_{ij,t}, \alpha^{l}_{t}) \times$$

$$E_{h_{ij,t+1}}\left[\varphi H^{B_k}_{\mathrm{Re}\,finance}(s_{t+1}) + (1-\varphi) H^{B_k}_{Ter\,\min ate}(s_{t+1}) \mid h_{ij,t}, \alpha^{l}_{t} \right]$$

Figure 1: The Stage Game

$$\begin{bmatrix} u^G \\ u^P \\ u^B \end{bmatrix} = \begin{bmatrix} Government \\ Peasants \\ Financial\ System \end{bmatrix}$$



where:

$$\bar{u}^{B_k}_{\text{Re } finance}(s_t) = (1-\zeta)\varphi\left[\theta^2(\eta^*) - \gamma\right]x_t^F$$

$$\underline{u}^{B_k}_{\text{Re } finance}(s_t) = (1-\zeta)\varphi\left[\theta^2(\eta^{**}) - \gamma\right]x_t^F$$

$$\bar{u}^{B_k}_{Ter\min ate}(s_t) = (1-\zeta)(1-\varphi)\theta^2(\eta^*)x_t^F$$

$$\underline{u}^{B_k}_{Ter\min ate}(s_t) = (1-\zeta)(1-\varphi)\theta^2(\eta^{**})x_t^F$$

To compute the Bellman value functions for government, peasants and the financial institutions, I consider the expectation over future successor states in continuous time.

Proposition 1 (Conflict ex-post vs. Reform)

When G is a successful reform proposer, then G is faced with the tradeoff between reform and conflict ex-post in centralized and decentralized financial systems:

1. *Conflict ex-post in a centralized financial system occurs if and only if:*

$$P(f_{it} \geq \bar{f}_{m-k,t}) = \int_{m-k}^{1} f_{it}dt \geq \frac{1}{2}, H^G_{Good}(s_t) < H^G_{Bad}(s_t), \lim_{\gamma\to 0} H^{B_k}_{\text{Re } finance}(s_t) > H^{B_k}_{Ter\min ate}(s_t) \text{ and } V_P(s_t) = H^P_{Conflict}(s_t),$$

$$\text{when } V_P(s_t) > \max\left\{\text{P}_P(s_t), H^P_{\text{Re } form}(s_t)\right\}, \text{ where } \text{P}_P(s_t) = \frac{y_t^2(1-R_t)^2}{1-\beta}$$

2. *Conflict ex-post in a decentralized financial system occurs if and only if:*

$$P(f_{it} < \bar{f}_{m-k,t}) = \int_{0}^{m-k} f_{it}dt \geq \frac{1}{2}, H^G_{Good}(s_t) < H^G_{Bad}(s_t), \lim_{\gamma\to 0} H^{B_k}_{\text{Re } finance}(s_t) < H^{B_k}_{Ter\min ate}(s_t) \text{ and } V_P(s_t) = H^P_{Conflict}(s_t),$$

$$\text{when } V_P(s_t) > \max\left\{\text{P}_P(s_t), H^P_{\text{Re } form}(s_t)\right\}, \text{ where } \text{P}_P(s_t) = \frac{y_t^2(1-R_t)^2}{1-\beta}$$

3. *Reform in a centralized financial system occurs if and only if:*

$$P(f_{it} \geq \bar{f}_{m-k,t}) = \int_{m-k}^{1} f_{it}dt \geq \frac{1}{2}, H^G_{Good}(s_t) < H^G_{Bad}(s_t) \text{ and } \lim_{\gamma\to 0} H^{B_k}_{\text{Re } finance}(s_t) > H^{B_k}_{Ter\min ate}(s_t),$$

$$\text{or } H^G_{Good}(s_t) > H^G_{Bad}(s_t) \text{ and} \lim_{\gamma\to 0} H^{B_k}_{\text{Re } finance}(s_t) = H^{B_k}_{Ter\min ate}(s_t), \text{ and } V_P(s_t) = H^P_{\text{Re } form}(s_t),$$

$$\text{when } V_P(s_t) > \max\left\{\text{P}_P(s_t), H^P_{Conflict}(s_t)\right\}, \text{ where } \text{P}_P(s_t) = \frac{y_t^2(1-R_t)^2}{1-\beta}$$

4. *Reform in a decentralized financial system occurs if and only if:*

$$P(f_{it} < \overline{f}_{m-k,t}) = \int_0^{m-k} f_{it}dt \geq \frac{1}{2}, H^G_{Good}(s_t) < H^G_{Bad}(s_t) \text{ and } \lim_{\gamma \to 0} H^{B_k}_{\text{Re } finance}(s_t) < H^{B_k}_{Ter\,\min ate}(s_t),$$

$$\text{or } H^G_{Good}(s_t) > H^G_{Bad}(s_t) \text{ and} \lim_{\gamma \to 0} H^{B_k}_{\text{Re } finance}(s_t) = H^{B_k}_{Ter\,\min ate}(s_t), \text{ and } V_P(s_t) = H^P_{\text{Re } form}(s_t),$$

$$\text{when } V_P(s_t) > \max\left\{\mathrm{P}_P(s_t), H^P_{Conflict}(s_t)\right\}, \text{ where } \mathrm{P}_P(s_t) = \frac{y_t^2(1-R_t)^2}{1-\beta}$$

Common Shocks

We know that the stochastic processes underpinning the continuous states of this game are the following:

$$g_{j,t+1} = g_{jt} + (1-\beta)y_t + \rho_t$$

$$f_{i,t+1} = f_{it} + \eta x_t^F + \upsilon_t$$

There are three players and two state variables per player, where ρ_t and υ_t are random shocks such that $\rho_t, \upsilon_t \in \{0,1\}$. Weather conditions and the exposure of the financial system to international crises drive transitions for each of the two state variables in my model. I assume that the share of peasants moving to cities is determined by their baseline income such that $\frac{\chi y_t}{1+\chi y_t}$ is the probability of massive migration and $\chi > 0$ denotes the toughness of weather conditions. In continuous time, jumps in the state of migration from villages to cities are also linked to the discount rate $\beta \in [0,1)$, when the successor state does not entail an upward discontinuous jump such that:

$$\mu(g_{j,t+1} \mid g_{jt}, \alpha_t^l) = \begin{cases} \dfrac{\chi y_t^1}{\left(1+\chi y_t^1\right)\xi(g_{1t}, \alpha_t^l)}, & g_{j,t+1} = g_{1t} + (1-\beta), g_{j,t+1} \neq 0 \\ \vdots & \\ \dfrac{\chi y_t^n}{\left(1+\chi y_t^n\right)\xi(g_{nt}, \alpha_t^l)}, & g_{j,t+1} = g_{nt} + (1-\beta), g_{j,t+1} \neq 0 \\ \dfrac{\beta}{\xi(g_{jt}, \alpha_t^l)}, & g_{j,t+1} = \left(\max\{0, g_{1t}+\beta-1\}, \ldots, \max\{0, g_{nt}+\beta-1\}, g_t \neq (1,\ldots\ldots,1)\right) \end{cases}$$

where $\xi(g_{jt}, \alpha_t^l) = \sum_{j=1}^{n} \frac{\chi y_t^j}{1+\chi y_t^j} * 1(g_{jt} \neq 0) + \beta * 1\left(g_t \neq (1,\ldots\ldots,1)\right)$, which is the probability of jumps in the share of peasants that migrate to cities. Similarly, for the degree of centralization of the financial system, we have an economy-wide shock due to an international financial crisis, external liquidity emergency or war, such that:

$$\sigma(f_{i,t+1} \mid f_{it}, \alpha_t^l) = \begin{cases} \dfrac{\psi x_t^{F1}}{\left(1+\psi x_t^{F1}\right)\omega(f_{1t}, \alpha_t^l)}, & f_{i,t+1} = f_{1t} + \eta_t,\ f_{i,t+1} \neq 0 \\ \vdots & \\ \dfrac{\psi x_t^{Fm}}{\left(1+\psi x_t^{Fm}\right)\omega(f_{mt}, \alpha_t^l)}, & f_{i,t+1} = f_{mt} + \eta_t,\ f_{i,t+1} \neq 0 \\ \dfrac{\beta}{\omega(f_{mt}, \alpha_t^l)}, & f_{i,t+1} = \left(\max\{0,\ f_{1t} - \eta_t\}, \ldots, \max\{0,\ f_{mt} - \eta_t\}, g_t \neq (1, \ldots\ldots, 1)\right) \end{cases}$$

where $\omega(f_{it}, \alpha_t^l) = \sum_{i=1}^{m} \dfrac{\psi x_t^{Fi}}{\left(1+\psi x_t^{Fi}\right)} * 1(f_{it} \neq 0) + \beta * 1\left(f_t \neq (1, \ldots\ldots, 1)\right)$, which is the probability of jumps in the degree of centralization of the financial system and $\psi > 0$ denotes the intensity of international crises.

References

Barkai Haim. "The Macroeconomics of Tsarist Russia in the Industrialization Era: Monetary Developments, the Balance of Payments, and the Gold Standard", *Journal of Economic History,* Vol. 33, No. 2 (June 1973): 339-371.

Burhop Carsten. "Did Banks Cause the German Industrialization?", *Explorations in Economic History* Vol. 43, No. 1 (January 2006): 39-63.

Crisp Olga. "Russian Financial Policy and the Gold Standard in the End of the Nineteenth Century", *Journal of Economic History,* Vol. 6, No. 2 (December 1953): 156-172.

Dewatripont E. and E. Maskin. "Credit and Efficiency in Centralized and Decentralized Economies", *Review of Economic Studies*, Vol. 62, No. 4, 541-555, October 1995.

Garvy George. "Banking under the Tsars and the Soviets", *Journal of Economic History* Vol. 32, No. 4 (December 1972): 869-893.

Gerschenkron Alexander. *Economic Backwardness in Historical Perspective*, Belknap Press, January 1962.

Lamoreux Naomi R. "Banks, Kinship and Economic Development: The New England Case", *Journal of Economic History,* Vol. 46, No. 3 (September 1986): 647-667.

LaPorta Rafael, Florencio Lopez-De-Silanes and Andrei Shleifer. "Government Ownership of Banks", *Journal of Finance,* Vol. 57, No. 1 (February 2002): 265-301.

Powell Robert. "Monopolizing Violence and Consolidating Power", *Quarterly Journal of Economics* (2013): 807-859.

Qian Y. and G. Roland. "Federalism and the Soft Budget Constraint" *American Economic Review,* 88:5, 1143-1162, December 1998.

Roland Gérard, Transition and Economics: Politics, Markets and Firms, MIT Press, 2000.

Weir David R. "Tontines, Public Finance and Revolution in France and England, 1688-1789", *Journal of Economic History,* Vol. 49, No. 1 (March 1989): 95-124.

White Eugene Nelson. "The French Revolution and the Politics of Government Finance", *Journal of Economic History,* Vol. 55, No. 2 (June 1995): 227-255.