Bulletin Number 00-1 **March 2000**

ECONOMIC DEVELOPMENT CENTER

IS "GETTING THE PRICES RIGHT" ALWAYS RIGHT?

HOW TRADE LIBERALIZATION CAN FAIL

BEATRIZ GAITAN
FERDINAND PAVEL

ECONOMIC DEVELOPMENT CENTER
Department of Economics, Minneapolis
Department of Applied Economics, St. Paul

UNIVERSITY OF MINNESOTA

Is "Getting the Prices Right" always right? How Trade Liberalization can fail[1]

Beatriz Gaitan and Ferdinand Pavel[2]

March 2000

Abstract: We present a general equilibrium model with oligopsonistic market structure in one of the sectors. Buyers of inputs can set the price of inputs by being involved in rent seeking activities. The framework developed is applied to the Bulgarian economy in particular to the agro-food chain. From the application to the Bulgarian economy we find that if there are market imperfections, such as oligopsonistic behavior in the economy, there are no significant welfare gains from free trade. Significant welfare gains from trade are observed only when a competitive structure prevails. We show that eliminating this market imperfection can bring important welfare implications and an efficient reallocation of resources.

J.E.L. Classification: D43 Oligopoly and Other Forms of Market Imperfection

E13 Neoclassical Models

F12 Models of Trade with Imperfect Competition and Scale Economies

L16 Industrial Organization and Macroeconomics

Key words: Imperfect Competition, Oligopsony, International Trade, Growth and Development, Transition Economies.

---

[1] The authors would like to thank Terry L. Roe and Rodney Smith, and participants of the Economic Development Center Workshop *University of Minnesota* for very useful comments. Pavel gratefully acknowledges financial support from the *Volkswagen Foundation* and the *German Academic Exchange Service* (DAAD).

[2] Beatriz Gaitan is currently a Ph.D. student in the Department of Applied Economics*, University of Minnesota*. Ferdinand Pavel is currently a Ph.D. student in the Department of Agricultural Economics and Social Sciences, *Humboldt University*, Berlin.

1 Introduction

One of the *stylized facts* about the nature of post-communist transition in Central and Eastern Europe is the concept of the U-shaped output curve. In the early stages of reform, liberalization and macroeconomic stabilization result in an initial decrease in output and that this fall is steeper, the stronger a country's liberalization attempts are. However, after several years, strong reformers show the highest rates of growth leading to a U-shaped output curve over time (De Melo, Denizer and Gelb 1996, Fischer, Sahay and Vegh 1996, Aslund, Boone and Johnson 1996). Models, which explain this phenomenon have been developed by Hernandez-Cata, 1997 and Blanchard, 1997. They describe transition as a movement from a centrally planned, inefficient equilibrium to a competitive and efficient one. The transformation causes temporary rigidities, which explain the initial decrease in output, but, eventually rigidities are overcome leading to higher subsequent growth rates. These models suggest, that the greater the extent of liberalization, the higher the medium run growth rates and the faster the economy removes the old structure in favor of the new one.

However, ten years after the beginning of transition, there are still countries like Russia, the Ukraine, Bulgaria and Romania where recovery has not yet taken place. Although these countries can not necessarily be seen as closed economies, reform attempts apparently have not yet led to an efficient reallocation of resources. Moreover, output has declined over almost the entire period.

A formal explanation for why these countries have stagnated below their initial level of economic performance ten years after reforms began has not yet been provided. This paper develops a framework, which explains this phenomenon in the context of a neo-classical growth model. The arguments of Blanchard and Hernandez-Cata are based on competitive behavior of agents in the new market structure and focus on the rigidities on economy's evolution towards the new equilibrium. In contrast, we study the case where the economy has achieved a new equilibrium, but there is a noncompetitive and rent seeking behavior among agents. We apply this framework to the case of Bulgaria, where we find strong evidence to support our main assumptions.

The paper is organized in five parts. The first section gives a brief overview of developments during the transition process in Bulgaria. In the second part, we set up our framework and describe the assumed market arrangements. We then apply the framework to Bulgaria and discuss the calibration procedure and data underlying the model. The forth part explains the design of our policy experiments and discusses the results. In the last part we conclude and derive some policy implications.

2 Historical overview

Bulgaria's transition process started in the early nineties with the liberalization of nearly all prices. This action was followed by a sharp decline in GDP by roughly 25 per cent between 1989 and 1992. The following three years were characterized by moderate growth, mainly from large export-oriented firms and a small but growing private sector. In 1995, a sharp decline in agricultural output again led to a contraction of GDP. With the partial reintroduction of price setting policies by the government and two major waves of inflation in 1994 and 1996, the economy has stagnated at a level far below its initial level of performance. Furthermore, seven changes in government since 1990 have created an unstable environment for economic growth. The introduction of the currency board in 1997, which has pegged the exchange rate to the German Deutschemark, has led to a significant stabilization. However, fixing the exchange rate is only a short run emergency measure. It remains to be seen whether short run stabilization will be supported by appropriate structural changes, which is necessary for a sustainable success of the reform (Gulde 1999).

To keep food prices at a low level the government established price ceiling for most agricultural products. This policy, combined with restrictions on exports, allowable price margins and the cost-plus pricing practices of food processors, has neither created production incentives in agriculture nor provided incentives for food processing enterprises to decrease costs and to increase efficiency (Davidova 1994). Instead, this structure has tended to establish and to conserve market distortions. As a reaction to the worsening of economic and social conditions, most Bulgarians have started to cultivate small plots or to rear domestic animals in an attempt to limit the perceived social risks inherent in the transition process (European Commission 1997).

Based on the conclusions of studies focusing on the degree of competition in the agro food chain (Ivanova et al. 1995, Swinnen 1997, Gorton et al. 1999) and on our own observations[1] it appears that the food processors in the Bulgarian agro food chain have been able to establish market power over the price for agricultural products.

[1]The authors conducted several case studies in the region of Plovdiv in June 1999 and interviewed coop-members, subsistence farmers, private farmers, retailers and food-processors.

3 The model

Our model is a neo-classical growth model with microfoundations for aggregate demand (see Obstfeld and Rogoff 1998 or Barro and Sala-i-Martin 1999). We describe a closed economy. There is an infinitely lived representative consumer and an infinite number of discrete time periods $t = 1, 2, ..., \infty$. In each period t, there is an independent investor and three sectors: primary agriculture, food and non-food manufacturing. These sectors produce respectively agricultural products and subsistence food, processed food products and nonfood products.

In each period, the production of each output requires both labor and capital. In addition, production of processed food requires primary agricultural products as intermediate inputs. Farmers produce subsistence food, which is sold to consumers, and raw products (agricultural goods), which they sell to food processors, or use as intermediate input for their own production. Agricultural farmers and nonfood firms of this economy are competitive, taking the prices of their respective output and inputs as given, and choosing nonnegative values of factor inputs to maximize profits.

In contrast to agricultural and nonfood producers, food processors are noncompetitive. A unique contribution of this paper is to presume that they act as oligopsonists by setting the price for intermediate agricultural goods. However, to be able to have this market power, food processors are involved in rent seeking activities. Following Shleifer and Vishny (1998), financing rent seeking activities incurs costs, that are independent from the actual level of production. In our model, these costs enter the profit function of food processors as fixed capital costs in addition to the variable costs of labor, capital and intermediate agricultural inputs. Food processors, then, maximize profits by choosing their input value and set the price for agricultural goods by choosing output.

The investor uses nonfood products to produce new physical capital under a constant returns to scale technology. Subject to capital accumulation constraints, the investor chooses a time path of investment to maximize the discounted profit over an infinite horizon and passes all profits to the representative consumer.

The representative consumer is endowed with labor ($\overline{L}$) at each period t and capital at time 0 (K_0). In each period, he/she receives income from labor payments and from renting out capital. He/she allocates this income to savings and consumption of nonfood and two types of food products, marketed and subsistence food, to maximize an intertemporal utility function subject to an intertemporal budget constraint.

3.1 Market arrangements

3.1.1 The consumer

Overall utility of the infinitely lived representative consumer is defined as the sum of discounted utility from consumption at time t (C_t) for all t:

$$U = \sum_{t=0}^{\infty} \left(\frac{1}{1+\rho} \right)^t u(C_t) \tag{1}$$

where ρ is the rate of consumer time preference and $u(C_t)$ defines the utility from consumption of C_t at time t. As in the standard assumptions for the neoclassical growth model we assume that $u(C)$ is increasing in C, concave and satisfies Inada conditions[2]. The representative consumer chooses non negative values of C_t, and K_{t+1} for all t given K_0, and given sequences $\{p_t, p_{k,t}, r_t, w_t\}_{t=0}^{\infty}$ to maximize (1) subject to the intertemporal budget constraint

$$p_t C_t + p_{k,t} S_t = w_t \overline{L} + r_t p_{k,t} K_t \text{ for all } t \tag{2}$$

where p_t is the price of the aggregate consumption composite, $p_{k,t}$ is the price of capital, r_t is the interest rate of capital and w_t is the labor wage rate. Savings in the period t (S_t) define the value of capital in period $t+1$ (K_{t+1}):

$$p_{k,t} S_t = p_{k,t} \left(K_{t+1} - (1-\delta) K_t \right) \tag{3}$$

where δ is the depreciation rate of capital (which is assumed constant). Let L define the Lagrangian for the consumer's maximization problem:

$$\begin{aligned} L \equiv & \sum_{t=0}^{\infty} \left(\frac{1}{1+\rho} \right)^t u(C_t) \\ & + \sum_{t=0}^{\infty} \lambda_t \left[w_t \overline{L} - p_t C_t - p_{k,t} K_{t+1} + p_{k,t} (1 + r_t - \delta) K_t \right] \end{aligned}$$

then, the Euler conditions for the consumer's problem are

$$C_t: \quad \left(\tfrac{1}{1+\rho} \right)^t u'(C_t) - \lambda_t p_t = 0 \tag{4}$$

$$K_{t+1}: \quad -\lambda_t p_{k,t} + \lambda_{t+1} p_{k,t+1} (1 + r_{t+1} - \delta) = 0 \tag{5}$$

[2] That is: $u'(c) > 0$; $u''(c) < 0$ and $u'(c) \longrightarrow \infty$ as $c \longrightarrow 0$; $u''(c) \longrightarrow 0$ as $c \longrightarrow \infty$ (Barro, Sala-i-Martin, 1999).

and the transversality condition:

$$\lim_{t\to\infty} \lambda_t K_{t+1} = 0 \tag{6}$$

Substituting (4) into (5) and reorganizing yields:

$$\frac{u'(C_t)}{u'(C_{t+1})} = \left(\frac{1}{1+\rho}\right) \frac{p_t}{p_{t+1}} \frac{(1 + r_{t+1} - \delta)\, p_{k,t+1}}{p_{k,t}} \tag{7}$$

which implies that the marginal rate of substitution between consumption at t and $t+1$ equals the corresponding intertemporal price ratios times $\frac{(1+r_{t+1}-\delta)}{1+\rho}$. In our model, equation (7), the law of motion of capital (3) and the transversality condition (6) determine the sequence of aggregate consumption (C_t) and savings (S_t) simultaneously.

Aggregate consumption is a Cobb-Douglas aggregate from the consumption of food ($C_{f,t}$) and nonfood commodities ($C_{nf,t}$) given by:

$$C_t = C_{f,t}^{\beta_f} C_{nf,t}^{1-\beta_f} \text{ with } 0 < \beta_f < 1 \tag{8}$$

To allow for substitution between marketed (CMa_t) and subsistence food (CS_t), $C_{f,t}$ is defined as a *constant elasticity of substitution* (CES) composite given by:

$$C_{f,t} = \left(\mu CMa_t^{\rho_f} + (1-\mu)\, CS_t^{\rho_f}\right)^{\frac{1}{\rho_f}} \tag{9}$$

where the elasticity of substitution between marketed and subsistence food is given by $\sigma_S = \frac{1}{1-\rho_f}$.

3.1.2 Competitive Industries

Agricultural producers produce an output composite $\left(Y_A^{tot}\right)$ that consists of two different goods, agricultural raw products (Y_A) and subsistence food (Y_S). The production function for Y_A^{tot} is a fixed proportion combination of intermediate agricultural raw products (I_A) and value added, which is a Cobb-Douglas function of labor (L_A) and capital (K_A). Formally:

$$Y_A^{tot} = \min\left\{\left(\theta_A K_A^{\alpha_A} L_A^{1-\alpha_A}\right), BI_A\right\}$$

with $0 < \alpha_A < 1$ and $B > 0$ where $\frac{1}{B}$ is the amount of (agricultural) intermediates necessary to produce one unit of output. Farmers sell their output of agricultural goods to food processors, and use it for the production of

Y_A^{tot}. We differentiate aggregate output (Y_A^{tot}) according to the distribution channel by a *constant elasticity of transformation* (CET) composite of raw products (Y_A) and subsistence food (Y_S):

$$Y_A^{tot} = \left(\mu_A Y_A^{\rho_a} + (1-\mu_A)\, Y_S^{\rho_a}\right)^{\frac{1}{\rho_a}} \tag{10}$$

where ρ_a controls the (constant) elasticity of transformation[3]. Agricultural producers' problem can be described in the following way: first, they take the rental rate of capital and prices for labor and capital (r, w, p_k) as given and choose non negative values for labor (L_A) and capital (K_A) to minimize value added costs of producing one unit of the output composite:

$$MC_{K,L}^A \equiv \min wL_A + rpkK_A \tag{11}$$

$$s.t. \quad \theta_A K_A^{\alpha_A} L_A^{1-\alpha_A} = 1$$

for $0 < \alpha_A < 1$. Then, they take prices for raw products (p_a) and subsistence food (p_s) as given and choose non negative values of raw products (Y_A) and subsistence food (Y_S) to maximize sales revenue from one unit of the output composite:

$$REV_{Y_A,Y_S}^A \equiv \max p_a Y_A + p_s Y_S \tag{12}$$

$$s.t. \quad \left(\mu_A Y_A^{\rho_a} + (1-\mu_A)\, Y_S^{\rho_a}\right)^{\frac{1}{\rho_a}} = 1$$

Finally, they take prices of intermediate inputs (p_a) as given and choose Y_A^{tot} and I_A to maximize profits:

$$\max Y_A^{tot}\left(REV_{Y_A,Y_S}^A - MC_{K,L}^A\right) - p_a I_A \tag{13}$$

$$s.t. \quad Y_A^{tot} = BI_A$$

[3]The elasticity of transformation is given by $\sigma_a = \frac{1}{1-\rho_a}$.

Nonfood producers take p_{nf}, p_k, r and w as given and choose Y_{NF}, L_{NF} and K_{NF} to maximize profits for all t, that is:

$$\max p_{nf} Y_{NF} - rp_k K_{NF} - wL_{NF} \tag{14}$$

$$s.t.$$
$$Y_{NF} = \theta_{NF} K_{NF}^{\alpha_{NF}} L_{NF}^{1-\alpha_{NF}}$$

where Y_{NF}, K_{NF} and L_{NF} are output capital and labor employed in the production of non-food goods, p_{nf} denotes the price of the non-food commodity and $0 < \alpha_{NF} < 1$.

3.1.3 Noncompetitive Industry

The production of processed food (Y_F) uses as inputs agricultural goods denoted by I_F, labor (L_F) and capital (K_F). The technology to produce Y_F is represented by a Leontief technology of the form

$$Y_F = \min \left\{ \theta_F K_F^{\alpha_F} L_F^{1-\alpha_F}, AI_F \right\} \text{ with } 0 < \alpha_F < 1 \tag{15}$$

We assume that, due to the imperfect market structure, food processors have market power over the price of agricultural goods (p_a) which they use as intermediate inputs. To sustain this market imperfection, food processing firms face a cost which uses a fixed amount of capital $K_{fix,g}$ for rent seeking activities. Adding a fixed cost into the profit function of an individual firm introduces a wedge between total unit and marginal costs of production. This leads to increasing returns to scale in production and therefore we have firm level differentiation. Thus, there are n number of food processors indexed by g.

The problem of firm g is to choose non negative values of $I_{F,g}$, $K_{F,g}$ and $L_{F,g}$ given $K_{fix,g}$, p_f, p_k, r and w and to set a value of p_a by choosing $Y_{F,g}$ taking the output of other food processor as given to solve:

$$\max p_f Y_{F,g} - rp_k K_{F,g} - wL_{F,g} - p_a I_{F,g} - rp_k K_{fix,g}$$

$$s.t.$$
$$Y_F = \min \left\{ \left(\theta_F K_F^{\alpha_F} L_F^{1-\alpha_F} \right), AI_F \right\} \tag{16}$$

where p_f denotes the price for food. Problem (16) can be rewritten as:

$$\max \left(p_f - MC_{K,L}^{F,g} - \frac{p_a}{A} \right) Y_{F,g} - rp_k K_{fix,g} \tag{17}$$

where $MC_{K,L}^{F,g}$ denotes the labor and capital minimizing cost of producing a unit of the food commodity:

$$\begin{aligned} MC_{K,L}^{F,g} &= \min rp_k K_{F,g} + wL_{F,g} \\ s.t. & \\ & \theta_F K_F^{\alpha_F} L_F^{1-\alpha_F} = 1 \end{aligned}$$

To solve the remaining part of the profit maximization problem, the choice of the price of agricultural goods (p_a), we modify the profit function. Leontief technology and cost minimization imply that the intermediate demand of firm g for agricultural goods for a given level of output ($Y_{F,g}$) is given by $I_{F,g} = \frac{Y_{F,g}}{A}$. Since market supply of agricultural goods (Y_A^S)[4] equals intermediate demand of food processors, then we have:

$$Y_A^S = \sum_{g=1}^{n} I_{F,g} = \frac{1}{A}\sum_{g=1}^{n} Y_{F,g} \tag{18}$$

Assuming symmetry among firms it follows:

$$I_{F,g} = \frac{Y_A^S}{n} = \frac{1}{nA}\sum_{g=1}^{n} Y_{F,g} \tag{19}$$

Substituting (19) into the profit function of firm g ($\pi_{F,g}$) we get:

$$\max p_f Y_{F,g} - MC_{K,L}^{F,g} Y_{F,g} - p_a \frac{1}{nA}\sum_{g=1}^{n} Y_{F,g} - rp_k K_{fix,g} \tag{20}$$

Similar to the *Cournot* specification of imperfect competition (see for instance Kehoe and Kehoe 1994) we assume that firms choose their output ($Y_{F,g}$) given the output of other firms to maximize profits. The fist order condition for this problem is:

$$\frac{\partial \pi_{F,g}}{\partial Y_{F,g}} = p_f - MC_{K,L}^{F,g} - p_a \frac{1}{nA} = 0 \tag{21}$$

This equation has the same implication as the *Lerner condition* under *Cournot competition*, namely, that marginal revenue equals marginal costs. Solving for p_a gives:

$$p_a = \left(p_f - MC_{K,L}^{F,g}\right) nA \tag{22}$$

[4] This is production of raw products minus intermediate demand in agriculture ($Y_A^S = Y_A - I_A$).

Assuming free entry and exit, the number of firms n adjust such that profits equal to zero. This is consistent with Posners *rent dissipation axiom* that the *total expenditure by firms to obtain the rent is equal to the amount of the rent* (Tirole 1988). Substituting the profit maximizing price (22) into the profit function (20), setting profits equal to zero and using $I_{F,g} = \frac{Y_{F,g}}{A}$ we solve for n:

$$n = \frac{rp_k K_{fix,g} + MC^F_{K,L} Y_{F,g} - p_f Y_{F,g}}{MC^F_{K,L} Y_{F,g} - p_f Y_{F,g}}$$

since profits equal to zero, this is equivalent to:

$$n = \frac{p_a I_{F,g}}{p_f Y_{F,g} - MC^F_{K,L} Y_{F,g}} = \frac{p_a I_{F,g}}{p_a I_{F,g} + rp_k K_{fix,g}} \tag{23}$$

Equation (23) is the ratio of remuneration to intermediates over the sum of intermediates remuneration plus rent seeking expenditures. When n equals one (that is $K_{fix,g} = 0$) perfect competition prevails and the closer n is to zero, the higher the degree of imperfect competition. Thus, n can not necessarily be interpreted as the number of firms, but rather as an index that measures the degree of imperfect competition. Also, from (22), the price for intermediates (p_a) increases the closer n goes to one. This is consistent with the *Lerner* condition under *Cournot competition*, where an increasing number of firms also reduces the degree of imperfect competition.

Since by assumption firms are symmetric, the final demand for marketed food (CMA_f) equals output of firm g times n. Thus:

$$Y_{F,g} = \frac{CMA_f}{n} \tag{24}$$

Substituting (23) into (24) we solve for the output of firm g:

$$Y_{F,g} = CMA_f - \frac{rp_k K_{fix,g}}{MC^F_{K,L} - p_f} \tag{25}$$

for all t.

3.1.4 Investment

In our model, investment is specified as in Diao et al. (1997). To obtain a shadow price of the investment good we separate pricing decisions for investment and capital from consumers' consumption and savings decisions.

Therefore, an independent investor decides on investment and passes profits to the representative consumer. The problem of this investor is to maximize discounted profits over the infinite horizon:

$$\max \sum_{t=1}^{\infty} \frac{1}{\prod\limits_{s=0}^{t}(1+r_s-\delta)} \left(r_t pk_t K_t - v_t INV_t\right) \tag{26}$$

subject to the constraint that capital stock in $t+1$ equals capital stock in t minus depreciation plus investment.

$$K_{(t+1)} = (1-\delta)\, K_t + INV_t \tag{27}$$

where v_t is the value of one unit of the investment good at time t. New physical capital (INV_t) is produced by a constant returns to scale technology using nonfood commodities:

$$INV_t = INV(ID_{nf,t}) \tag{28}$$

where $ID_{nf,t}$ is demand for nonfood goods for production of capital at time t. At equilibrium, for $INV_t > 0$, the value of each unit of capital equipment equals its unit cost p_t^{INV} $\left(v_t INV_t = p_t^{INV} INV_t\right)$. Then, define:

$$\begin{aligned} L \equiv & \sum_{t=0}^{\infty} \frac{1}{\prod\limits_{s=0}^{t}(1+r_s-\delta)} \left(r_t pk_t K_t - p_t^{INV} INV_t\right) \\ & + \sum_{t=0}^{\infty} \frac{\gamma_t}{\prod\limits_{s=0}^{t}(1+r_s-\delta)} \left[(1-\delta)\, K_t + INV_t - K_{(t+1)}\right] \end{aligned} \tag{29}$$

From the first order condition with respect to INV_t, the shadow price of one unit of capital (γ_t) equals the cost of producing this unit:

$$p_t^{INV} = \gamma_t \tag{30}$$

The first order condition with respect to capital (K_t) is given by:

$$K_t : \frac{r_t pk_t}{\prod\limits_{s=0}^{t}(1+r_s-\delta)} + \gamma_t \frac{(1-\delta)}{\prod\limits_{s=0}^{t}(1+r_s-\delta)} - \gamma_{(t-1)} \frac{1}{\prod\limits_{s=0}^{t-1}(1+r_s-\delta)} = 0 \tag{31}$$

To obtain the non arbitrage condition we substitute (30) into (31)and reorganize to get:

$$r_t p_{t-1}^{INV} = r_t pk_t + \delta \left(p_{t-1}^{INV} - p_t^{INV}\right) + p_t^{INV} - p_{t-1}^{INV} \tag{32}$$

Thus, in equilibrium, the return from one investment good at time $t-1$ $(r_t p_{t-1}^{INV})$ equals total returns from one unit of capital at time t. This returns include "dividends" from capital ownership in t $(r_t pk_t)$ minus losses from depreciation $(\delta p_{t-1}^{INV} - \delta p_t^{INV})$ plus an additional capital gain if costs to produce capital change over time $(p_t^{INV} - p_{t-1}^{INV})$.

3.1.5 Market clearing

Market clearing on commodity markets is given by: total production of agricultural raw products equals intermediate demand

$$Y_{A,t} = I_{A,t} + I_{F,t}, \tag{33}$$

supply of food products equals demand for marketed food

$$Y_{F,t} = CMa_t, \tag{34}$$

production of subsistence food covers demand for subsistence food

$$Y_{S,t} = CS_t \tag{35}$$

and production of non food commodities equals final and investment demand

$$Y_{NF,t} = C_{nf,t} + ID_{nf,t} \tag{36}$$

for all t.

Capital in our model is used as variable input in production. Additionally, a fix amount of it is used for rent seeking activities $(K_{fix}^F = n \cdot K_{fix,g})$. Therefore, market clearing on the factor markets is given by:

$$\begin{array}{rcl} K_{A,t} + n\left(K_{F,g,t} + K_{fix,g,t}\right) + K_{NF,t} & = & \overline{K}_t \\ L_{A,t} + L_{F,t} + L_{NF,t} & = & \overline{L} \end{array} \tag{37}$$

for all t.

3.1.6 Equilibrium

An equilibrium for this model is a sequence of prices

$$\left\{p_t,\, p_{a,t},\, p_{f,t},\, p_{nf},\, p_{s,t},\, p_t^{INV},\, p_{k,t},\, w_t,\, r_t\right\}_{t=0}^{\infty},$$

allocation

$$\{C_t, CMa_t, CS_t, C_{nf,t}, INV_t, K_{t+1}, Y_{A,t}^{tot}, \{Y_{i,t}\}_{i\in\{A,F,NF,S\}},$$
$$\left\{\ K_{i,t}{}^{5},\ L_{i,t}\right\}_{i\in\{A,F,NF\}}, I_{i\in\{A,F\}}, ID_{nf,t}\}_{t=0}^{\infty}$$

and the number of firms in the noncompetitive sector, $\{n_t\}_{t=0}^{\infty}$, such that the consumer's problem (1), the firms' problem (11 to 13, 14 and 20), the investors problem (26) and the market clearing conditions (33 to 37) are satisfied.

3.1.7 Steady state

An steady state is an equilibrium as defined above such that for some initial K_0, all prices p_t, $p_{a,t}$, $p_{f,t}$, $p_{s,t}$, p_t^{INV}, $p_{k,t}$, w_t, r_t and C_t, CMa_t, CS_t, INV_t, $K_{t+1}\left\{Y_{i,t},\ K_{i,t},\ L_{i,t}\right\}_{i\in\{A,S,F\}}$, $I_{i\in\{A,S,F\}}$ and n_t are constant for all t.

4 Empirical application

4.1 Extensions

We apply and calibrate the model to the Bulgarian economy using a *social accounting matrix* (SAM). The structure of this data requires some extensions. First, the SAM reports intermediate and investment demand for agricultural, food and nonfood commodities by each sector. We consider this by assuming that output of sector J is a fixed proportion of intermediate inputs and value added, which in turn is a Cobb-Douglas aggregate of labor and installed capital:

$$Y_J = \min\left\{\theta_J K_J^{\alpha_J} L_J^{1-\alpha_J},\ A_{a,J}I_{a,J},\ A_{f,J}I_{f,J},\ A_{nf,J}I_{nf,J}\right\} \text{ with } 0<\alpha_J<1$$

where $I_{i,J}$ is intermediate demand for commodity $i \in \{a, f, nf\}$ by sector J $\in \{A, F, NF\}$. Furthermore, new physical capital (INV_t) is now produced by a constant returns to scale technology using all three commodities:

$$INV_t = INV(ID_{a,t},\ ID_{f,t},\ ID_{nf,t})$$

Second, since Bulgarian consumers also demand agricultural products, we re-define the consumption composite (8) as a Cobb-Douglas composite of agricultural-, food- and nonfood commodities:

$$C_t = \theta_C C_a^{\beta_a} C_f^{\beta_f} C_{nf}^{1-\beta_a-\beta_f} \text{ with } 0 < \beta_i < 1 \tag{38}$$

We assume that consumers do not buy agricultural raw products from farmers, but rather, they buy them from retailers (an assumption that is not far from reality for the Bulgarian case). We therefore aggregate food processors and retailers. Then, the representative food processing firm sells a fraction of raw products to consumers and uses the rest as intermediate input for food production.

Assuming this marketing structure, the problem of the representative food processing (and trading) firm is to choose non negative values of capital ($K_{F,g}$), labor ($L_{F,g}$) and intermediate inputs ($I_{i;F,g}$), (for the production of food), the amount of raw product that is bought from agricultural producers I_{Rg} to be sold to consumers $Y_{Ca,g}$ (which, in equilibrium equals consumers demand of agricultural goods divided by the number of firms $\left(\frac{C_a}{n}\right)$), given prices for commodity $i \neq a$ ($p_{i\neq a}$), as well as factor prices for capital and labor (p_k, r and w) and to set a value of p_a by choosing $Y_{F,g}$ taking the output of other food processor as given to solve:

$$\max p_f Y_{F,g} + p_a \left(Y_{Ca,g} - I_{R,g}\right) - rp_k K_{F,g} - wL_{F,g} - \sum_{i\in\{a,f,nf\}} p_i I_{i;F,g} - rp_k K_{fix,g} \tag{39}$$

$s.t.$

$$Y_F = \min\left\{\left(\theta_F K_F^{\alpha_F} L_F^{1-\alpha_F}\right), A_{a,F}I_{a,F},\ A_{f,F}I_{f,F},\ A_{nf,F}I_{nf,F}\right\}$$
$$Y_{Ca,g} = I_{R,g}$$

since the representative food processing firm maximizes profits by choosing output, this extension does not affect the first order condition of their problem (21) and thus, (22) still sets the profit maximizing price p_a.

The third extension is the consideration of the public budget. Therefore, we introduce a government agent who receives income from taxes and tariffs, provides public nonfood goods and services at a given level $\overline{G}$ and pays transfers (T) to the representative consumer. The SAM reports revenue from taxation on labor and capital income, consumption tax and tariffs on imports. Therefore, the public budget constraint, in a sequential market setting, is given by

$$p_{nf,t}\left(1+\tau_{c_{nf}}\right)\overline{G}_t + T_t = \sum_{i\in\{a,f,nf\}} \tau_{c_i} p_{i,t} C_{i,t} + \tau_{c_{nf}} p_{nf,t} \overline{G}_t$$
$$+ \sum_{i\in\{a,f,nf\}} t_i^{IM} p_{i,t}^{IM} IM_{i,t} + \sum_{J\in\{A,F,NF\}} \tau_L w_t L_{J,t} + \tau_K r_t p_{k,t} K_{J,t} \text{ for all } t \tag{40}$$

where τ_{c_i} is the consumption tax rate for commodity i, τ_L and τ_K are labor and profit tax rate, respectively, and t_i^{IM} is the tariff rate for commodity i. Additionally, we also need to re-write the budget constraint of the representative consumer (2):

$$\sum_{i\in\{a,f,nf\}} p_{i,t}\left(1+\tau_{c_i}\right) C_{i,t} + p_{k,t} S_t$$
$$= w_t\left(1+\tau_L\right)\overline{L} + r_t p_{k,t}\left(1+\tau_K\right) K_t + T_t \text{ for all } t \tag{41}$$

Since we do not consider explicitly the impact of public goods provision on consumers' welfare, we endogenize the rate of consumption tax (τ_{c_i}) subject to an equal yield constraint $(\overline{G}_t = \overline{G})$. Thus, any change in tariff or tax policy affects the consumption taxes rate such that the real value of government expenditures remains constant.

The fourth extension is that we have to consider foreign trade in our model. Therefore, we open the economy using the Armington specification, which introduces imperfect substitution between goods, produced and consumed domestically, and foreign goods. Therefore, private consumption (C_i), intermediate inputs $(I_{i,J})$ and investment demand (INV_i) for commodity i is defined as a Cobb-Douglas composite of demand for domestically produced $(CD_i, ID_{i,J}, INVD_i)$ and imported goods $(CIM_i, IID_{i,J}, INVIM_i)$:

$$\begin{aligned} C_i &= CD_i^{\gamma_i} CIM_i^{1-\gamma_i} \\ I_{i,J} &= ID_{i,J}^{\gamma_i} IIM_{i,J}^{1-\gamma_i} \\ INV_i &= INVD_{i,J}^{\gamma_i} INVIM_{i,J}^{1-\gamma_i} \quad \text{with } 0<\gamma_i<1 \end{aligned}$$

Since we consider marketed and subsistence food to be imperfect substitutes, domestic food demand (CD_f) is defined as a CES composite as in (9):

$$CD_f = \left(\mu CMa^{\rho_f} + (1-\mu)\, CS^{\rho_f}\right)^{\frac{1}{\rho_f}} \tag{42}$$

Accordingly, public demand $\overline{G}$ is a composite of domestic (GD_{nf}) and foreign demand (GIM_{nf}) for nonfood commodities:

$$\overline{G} = GD_{nf}^{\gamma_{nf}} GIM_{nf}^{1-\gamma_{nf}}$$

On the supply side, production of commodity i is a Cobb-Douglas composite of sales on domestic (YD_i) and foreign markets (YEX_i):

$$Y_i = YD_i^{\nu_i} YEX_i^{1-\nu_i} \text{ with } 0 < \nu_i < 1$$

Finally, we re-write market clearing equations (33, 34 and 36) such that domestic output (Y_i) equals domestic intermediate, private, public and investment demand

$$YD_i = \sum_{J \in \{A,F,NF\}} ID_{i,J} + CD_i + CMA_i + GD_i + INVD_i \text{ for all } t$$

subsistence production equals subsistence demand

$$Y_s = CS \text{ for all } t$$

and imports (IM_i) equals import demand

$$IM_i = \sum_{J \in \{A,F,NF\}} IIM_{i,J} + CIM_i + GIM_i + INVIM_i \text{ for all } t$$

Trade balance implies:

$$\sum_i p_i^{IM} \left(1 + t_i^{IM}\right) IM_i = \sum_i EX_i \text{ for all } t$$

4.2 Calibration

The calibration of a competitive general equilibrium model is a standard procedure (see for instance Srinivasan and Whalley 1986). Therefore, we instead focus the discussion on the calibration of the parameters used for the oligopsonistic specification, namely the number of firms (n), the individual firm's output $(Y_{F,g})$ and the fix amount of capital used for rent seeking per firm $(K_{fix,g})$.

Using the values for shift and share parameters from the standard calibration procedure, we calibrate the number of firms (n) from (22):

$$p_a = \left(p_f - MC_{K,L}^{F,g}\right) nA$$

where marginal costs of production with respect to labor and capital are given by

$$MC_{K,L}^{F,g} = \frac{K_F^{DATA} + L_F^{DATA}}{Y_F^{DATA}}$$

therefore:

$$\widehat{n} = \frac{p_a}{\left(p_f - \frac{K_F^{DATA}+L_F^{DATA}}{Y_F^{DATA}}\right)\widehat{A}}$$

Where ($\widehat{\ }$) denotes the calibration estimates, superscript (^{DATA}) indicates data values and Y_F^{DATA}, K_F^{DATA} and L_F^{DATA} denote values for output, return to capital and labor remuneration in sector F. Once we have estimated the number of firms, then, we calibrate the individual output per firm from:

$$Y_{F,g} = \frac{Y_F^{DATA}}{\widehat{n}}$$

To calibrate the capital used for rent seeking activities ($K_{fix,g}$) we use information about the sectoral value of these costs ($K_{fix}^F = nK_{fix,g}$). We follow the study by Gorton et al. (1999), which estimates producer and consumer subsidy equivalents (PSE/CSE) as an indicator of the level of protection in the Bulgarian agro food chain (see Ivanova et al. 1995 for an introduction in the methodology). Assuming, that positive levels are in part due to the market power over the price for agricultural raw products and that processors and traders use this rent for covering rent seeking expenditures, we use these results to estimate K_{fix}^F. However, some adjustments should be mentioned: first, we use a different aggregation scheme than Gorton et al., in particular, our model does not differentiate between processors and retailers. Second, Gorton et al.'s calculations for processors and traders depend on critical assumptions concerning exchange rate and reference world market prices (Swinnen 1997).

Protection levels for each stage of the food chain (expressed as $\%PSE$, the rent from protection as percentage of the value of output at domestic prices) for the five main commodities (table 1) suggest the magnitude of income transfers to food processors. In addition to the benchmark year of our model, 1994, we also present information for 1996 to emphasize, that the observed redistribution of income between farmers and processors/traders is consistent over time and of a similar magnitude.

table 1: %PSEs for five key commodities for Bulgarian food supply chains

	1994	**1996**
Farm	-26	-7
Processing	8	20
Retail	41	19
Consumer (CSE)	-33	1

source: Gorton et al. (1999)

Food processors and especially traders received positive rents of about 8 to 41 percent of their domestic sales value. Since for both years, a border tariff was placed on food imports, part of the rents is due to protection by trade policy rather than the result of imperfect competition. However, for both years, there was also a tariff on imports of agricultural products. This reduces protection of food processors and in particular, it protects primary producers. But since the reported %PSE figures for farmers show negative levels, we conclude, that part of the positive rents for food processors and traders and the negative rents for farmers are due to processor's market power over farm gate prices. Therefore, we use the results reported in table 1 as a rough indicator for the level of income redistribution due to oligopsonistic competition. By choosing a relatively low value we ensure that we underestimate rather than overestimate the influence of oligopsonistic competition. In a previous, static version of the model we show, that results of policy experiments are stable when the level of redistributed income exceeds a minimum level of 8 percent of the domestic sales value (Pavel 1999). Given the estimations by Gorton et al. (table 1) this appears to be below the real level of distortions. As we also know from previous experiments, assuming that the value of redistribution equals 15 percent of the domestic sales value (which corresponds to %PSE of -10 for farmers) does not lead to an overestimation of the protection due to market imperfections. Therefore, we assume that:

$$\widehat{K}_{fix}^{F} = 0.15 \cdot Y_F^{DATA}$$

Using the value for n, we can now calibrate the individual firm's expenditure for rent seeking ($K_{fix,g}$).

4.3 Data

The model is based on 1994 National Accounts data including adjustments for hidden economy activities and production of subsistence food accounting for 26 percent of private food consumption (see OECD 1996 or NSI 1997 for a detailed description of data and methodology). In order to apply the developed framework of oligopsonistic competition to this data, two major changes are necessary:

First, sales as well as demanded values are given on producer price level and therefore exclude trade margins. Instead, margins of all commodities are reported as sold and demanded value in a separate traders account. According to the aggregation scheme used for this study, this account belongs to non-food activities. However, as discussed above, retailers rather than processors receive the biggest fraction of rents (see table 1). Since we also assume that food processors maximize profits and set price p_a, we include trade margins of retailers into sales and demanded values for food activities. We do this adjustment by assuming an 18 percent margin on food products and 30 percent on agricultural products for final demand, and 4 percent on food products and 9 percent on agricultural products for intermediate demand .

Second, since we assume that part of the total return to capital in food production is due to fixed costs of rent seeking activities, we estimate the return from production of food (K_F) by substracting fixed costs from the total return as given by the data (K_F^{DATA}):

$$K_F = K_F^{DATA} - \widehat{K}_{fix}^F$$

5 Policy simulations

In the benchmark equilibrium, both policy distortions caused by the taxes and tariffs (table 2) as well as oligopsonistic competition in the food chain distort the economy.

table 2: level of policy distortions in benchmark equilibrium

	agriculture	**food**	**non-food**
import tariffs $\left(t_i^{IM}\right)$	5.2%	16.3%	3.6%
consumption tax (τ_{c_i})	6.3%	23.1%	12.6%

source: own calculations

In our experiments we study the partial impact of both kinds of distortions on production and welfare. Therefore, we start with excluding policy distortions under the present level of imperfect competition. Then, we simulate perfect competition under the given level of policy distortions by eliminating oligopsonistic competition. In order to capture the full potential of replacing all kinds of distortions, we run a third simulation with an un-distorted economy. Experiments are defined as:

1. **policy**: liberalizing foreign trade ($t_i^{IM} = 0$) and replacing consumption tax rates by commodity (τ_{C_i}) with a uniform rate (τ_C) enforcing a constant real value of public expenditure. For the Bulgarian government, pressure for reforming the tax system arises from the country's aspiration to join the European Union and is also main demand of international advisors such as World Bank and IMF (Bogetic and Varga 1995), whereas tariff reform is also enforced by it's WTO membership.

2. **market**: eliminating oligopsonistic competition in the food chain under pre-existing tax and tariff rates by setting rent seeking expenditures equal to zero ($K_{fix,g} = 0$). While the standard presentation of increasing returns provided in the literature (see for instance Helpman and Krugman 1985) assumes fixed costs components to be a natural part of production (which then leads to firm level specification and imperfect competition), the fixed cost component $K_{fix,g}$ in our model is interpreted as rent seeking expenditure for keeping an imperfect market structure, and therefore, it is not necessarily needed for production. Hence, a policy aiming to eliminate these market imperfections (i.e. anti corruption measures) also eliminates the possibility for rent seeking behavior and therefore, firms are no longer able to allocate economic resources to these activities.

3. **totReform**: combines scenarios 1 and 2.

For all three scenarios, consumption tax rate (τ_C) adjusts such that the real value of public expenditures remains constant.

5.1 Simulation results

Results from the policy scenario are reported in Table 3. The results shows no significant gains in welfare and a small decline in the long run GDP of one percent. However, when oligopsonistic competition is removed, welfare increases by 5 percent in the market scenario and GDP by 4.2 percent at the new steady state level. Combining both scenarios, that is simulating a completely un-distorted economy, leads to a slightly lower long run level of GDP than under the market scenario and a welfare increase of about 5.1 percent. These first results suggest that the model is able to replicate the stagnation of GDP after market liberalization. The results suggest that given noncompetitive behavior of some agents in the economy, the reduction of policy distortions does not necessarily lead to a significant improvement in welfare. Instead, the results show that the price setting behavior of food processors and traders has strong implications for the economy as a whole. The behavior leading to these results is described below.

table 3: welfare and long run GDP (percent deviation from base values)

	policy	**market**	**totReform**
welfare*	0	8.8	9.1
GDP (long run)	-0.8	6.3	5.8

* measured as equivalent variation in representative consumer's income

Figure 1 shows GDP, consumption investment and capital under the three scenarios. Prices for food and initial prices for nonfood decline when tariffs are canceled in the policy scenario (figure 2). Since consumers discount future consumption, it causes consumption grows rapidly in the early periods. Over time, consumption decreases and the new steady state level is below the benchmark. For the entire model horizon, investment and capital are below the initial level, indicating that the "liberalized" economy requires a smaller capital stock. Thus, this scenario does not lead to a significant increase in welfare. Moreover, GDP also decreases, yet to a small extend (0.8 percent). However, when the reform focuses on eliminating imperfect competition (market), we observe a large income effect. Consumption grows more rapidly (figure 1) and remains relatively constant on the new level indicating the positive effect of increasing competition on the representative consumers' "real" income. Corresponding to the growing GDP, investment and the capital stock also increase significantly.

With the initial fall in prices under the policy scenario, nonfood output decreases and agricultural output remains almost constant, whereas food processors increase production by about 9 percent (figure 3). Food products have the highest initial tariff rate. Canceling these tariffs in the policy scenario reduces the price of marketed food. With the lower price, food processors increase their exports by almost 20 percent. Therefore, food production raises, although prices are below the initial level. However, agricultural production does not match the expansion of food production. Instead, food processors meet their increasing demand for intermediate inputs by expanding imports (figure 4).

The shift to perfect competition (market) has a significant impact on the price for agricultural output since it is no longer confined to domestic food processors. This favors production of agricultural raw products and reduces incentives for producing subsistence food. With declining amount of subsistence production, corresponding prices increase relative to marketed food prices. This change in price ratio shifts consumers' demand towards marketed food where prices go down with increasing demand. Additionally, decreasing food prices expand food exports (figure 4), however to a lower extend than under the policy scenario.

The strong reactions of the model on shocks introduced in our scenarios indicate that the economy is initially very distorted. The reduction of distortions (partially or completely) reduces output of nonfood significantly. Furthermore, canceling all distortions increases the price of labor relative to the rental rate of capital (figure 5). Therefore, from the Stolper-Samuelson theorem, the economy has a comparative advantage in labor intensive (agriculture), rather than in capital incentive (nonfood) production. For the food sector however, effects are ambiguous. Production of food has the highest capital intensity, and therefore, the economy has no comparative advantage in food production. On the other hand, increasing food production reduces production of subsistence food, and resources are used in production of agricultural raw products, where the economy has a comparative advantage. Having this in mind, we can explain the reduction of GDP and the insignificant welfare gains from the removal of policy distortions. Although this policy reduces the production of nonfood products and increases food production, food processors are still able to set the price for raw products. Therefore, the increasing production of food in the policy scenario has almost no impact on agricultural production since food processors simply increase demand for imports on the basis of the price they set for maximizing profits. Since a significant improvement in welfare can only be expected from policies, which allocate resources to activities where the economy has a comparative advantage (agriculture), we do not observe such an improvement as long as a policy reform simply focus on removing tariff and tax distortions. In our model however, this is only possible if the oligopsonistic market power of food processors is removed and higher relative prices give an incentive for selling agricultural raw products on the market.

6 Conclusions

In this paper we provide a formal explanation of why some transition economies in Central and Eastern Europe seem to stagnate at a low level of economic performance. We argue that the new equilibrium, which these economies have achieved within their transition, is not a competitive one. Therefore, we develop a dynamic general equilibrium model, where noncompetitive industries have oligopsonistic market power over their intermediates. We apply this model to the case of Bulgaria, where we found evidence for the existence of such kind of noncompetitive behavior of food processors. Using this application, we simulate two shocks, the removal of all price distortions caused by policy and the elimination of oligopsonistic competition. Our results show that the Bulgarian economy is initially very distorted. These distortions push resources out of activities where the economy has a comparative advantage. Results also show that only the reduction of oligopsonistic competition leads to a significant improvement in the allocation of resources and thus, to a positive effect on welfare. Furthermore, we found that for the given level of policy distortions, there is almost no impact of liberalization on welfare and growth. We explain this by the behavior of oligopsonistic competitors who are able to set a low price for intermediates. With this practice being kept in a liberalized economy, there will be no price incentive on production for the sector that suffers under market imperfection and thus, an efficient allocation of resources can not be achieved.

Our model provides an idea about the priority of different aspects of reform policies based on a formal framework. However, for a more appropriate consideration of dynamic gains from liberalization, an additional scenario should simulate the liberalization of the capital account (see Diao et al. 1997, Keuschnigg and Kohler 1997). Furthermore, for the discussion of implications on economic growth, an extension of the model can focus on the issue of who receives the benefits from rent seeking. Two cases come to mind: one, where the rents from rent seeking leave the country, maybe because they are deposited on a foreign bank account, and the other, where the rents are kept in the economy, as we assume in the present model.

From a policy maker's point of view, our results emphasize that for the case of Bulgaria, improving welfare and efficiency requires a much deeper reform than just canceling tax and tariff distortions. Instead, policy should focus on the elimination of noncompetitive behavior and market imperfections. Some possibilities of how this could be achieved have been discussed in the literature already. North (1981) provides a general introduction into anti-rent seeking ideology. Shleifer and Vishny (1998) discuss this issue related to transition economies and strengthen the importance of property rights protection. The World Bank (1997) suggests concrete measures for transition economies such as expediting privatization and liquidation of state-owned enterprises, establishing a stable enabling environment and improving market transparency. What our results contribute to this discussion is that they underline the high importance of this aspect of reform by showing that improving welfare and efficiency and achieving positive growth rates requires a more sophisticated reform package than just eliminating tax and tariff distortions.

Acknowledgement 1 *The authors would like to thank Terry L. Roe and Rodney Smith, and participants of the Economic Development Center Workshop, University of Minnesota, for very useful comments. Pavel gratefully acknowledges financial support of the Volkswagen Foundation and the German Academic Exchange Service (DAAD).*

References

[1] Aslund, J., Boone, P. and Johnson, S. (1996). How to stabilize? Lessons from post-communist Countries. Brookings Papers on Economic Activity. Brookings Institution.

[2] Barro, R.J. and Sala-i-Martin, X. (1999). Economic growth. Cambridge: MIT Press.

[3] Blanchard, O. (1997). The economics of post communist transition. Oxford: Clarendon Press.

[4] Bogetic, Z. and Varga, J. (1995). The Introduction of the value-added tax in Bulgaria. In: Bogetic, Z. and A. L. Hillmann. Financing Government in transition: Bulgaria. The World Bank. Washington, D.C.

[5] Davidova, S. (1994). Changes in agricultural policies and restructuring of Bulgarian agriculture: an overview. In: Swinnen, J.F.M. (ed.): Policy and institutional Reform in Central European agriculture. LICOS Studies on the transition in Central and Eastern Europe, No. 1. Aldershot; Avebury, pp. 31-77.

[6] De Melo, M., Denizer, C. and Gelb, A. (1996). Patterns of transition from plan to market. The World Bank Economic Review (Vol. 10).

[7] Diao, X., Roe, T. and Yelden, E. (1997). A simple dynamic applied general equilibrium model of an open economy: transitional dynamics and trade policy. Journal of Economic Development (Vol. 23).

[8] European Commission. (1997). Commission Opinion on Bulgaria's Application for Membership of the European Union. Brussels.

[9] Fischer, S., Sahay, R. and Vegh, C.A. (1996). Stabilization and Growth in transition Economies: the Early Experience. Journal of Economic Perspectives (Vol. 10).

[10] Gorton, M., Buckwell, A. and Davidova, S. (1999). Transfers and Distortions along CEEC Food supply chains. Working Paper 2/09. University of London, Wye College.

[11] Gulde, A.-M. (1999). The Role of the Currency Board in Bulgaria's Stabilization. IMF Policy Discussion Paper. Washington, D.C.

[12] Helpman, E. and Krugman, P. (1985). Market structure and foreign Trade. Cambridge: MIT Press.

[13] Hernandez-Cata, E. (1997). Liberalization and the Behavior of Output during the transition from plan to market. IMF Working Paper, Washington, D.C.

[14] Ivanova, N., Lingard, J., Buckwell, A. and Burrell, A. (1995). Impact of changes in agricultural policy on the agro-food chain in Bulgaria. European Review of Agricultural Economics (Vol. 22).

[15] Kehoe, P. J. and Kehoe, T. J. (1994). A Primer on static applied general equilibrium models. Federal Reserve Bank of Minneapolis Quarterly Review. Volume 18, No. 1.

[16] Keuschnigg, C. and Kohler, W. (1997). Dynamics of trade liberalization. In: Francois, J.F. and Reinert, K.A. Applied methods for trade policy analysis - a handbook. Cambridge: University Press.

[17] North, D.C. (1981). Structure and change in economic history. New York: Norton.

[18] NSI (National Statistical Institute of Bulgaria). (1997). Main macroeconomic indicators. Sofia.

[19] Obstfeld, M. and Rogoff, K. (1998). Foundations of international macroeconomics. Cambridge: MIT Press.

[20] OECD. (1996). National Accounts for Bulgaria. Sources, Methods and Estimates. Paris.

[21] Pavel, F. (1999). Reducing policy and market distortions in transition - The case of the agri-food chain in Bulgaria. Working Paper. Humboldt University of Berlin (www.kato-projekt.de).

[22] Shleifer, A. and Vishny, R.W. (1998). The Grabbing Hand. Government Pathologies and their Cures. Cambridge: Harvard University Press.

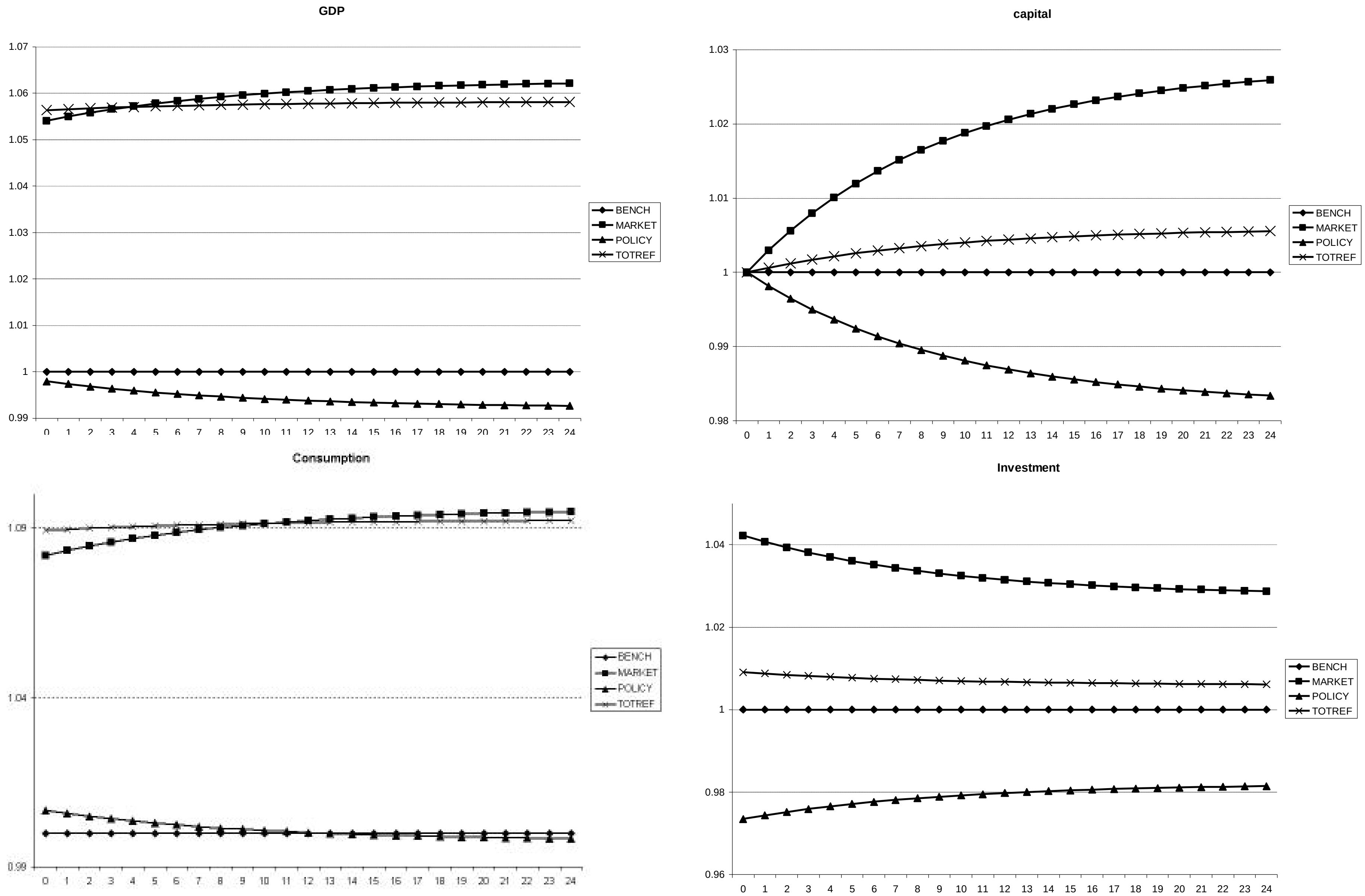
[23] Shoven, J. B. and Whalley, J. (1984). Applied general-equilibrium models of taxation and international trade. The Journal of Economic Literature (22).

[24] Srinivasan, T.N. and Whalley, J. (1986). General equilibrium trade policy modeling. Cambridge: MIT Press.

[25] Swinnen, J.F.M. (1997). On policy induced transfers during economic transition: The case of the wheat-flour-bread chain in Bulgaria. Policy Research Group; Working Paper No. 3.

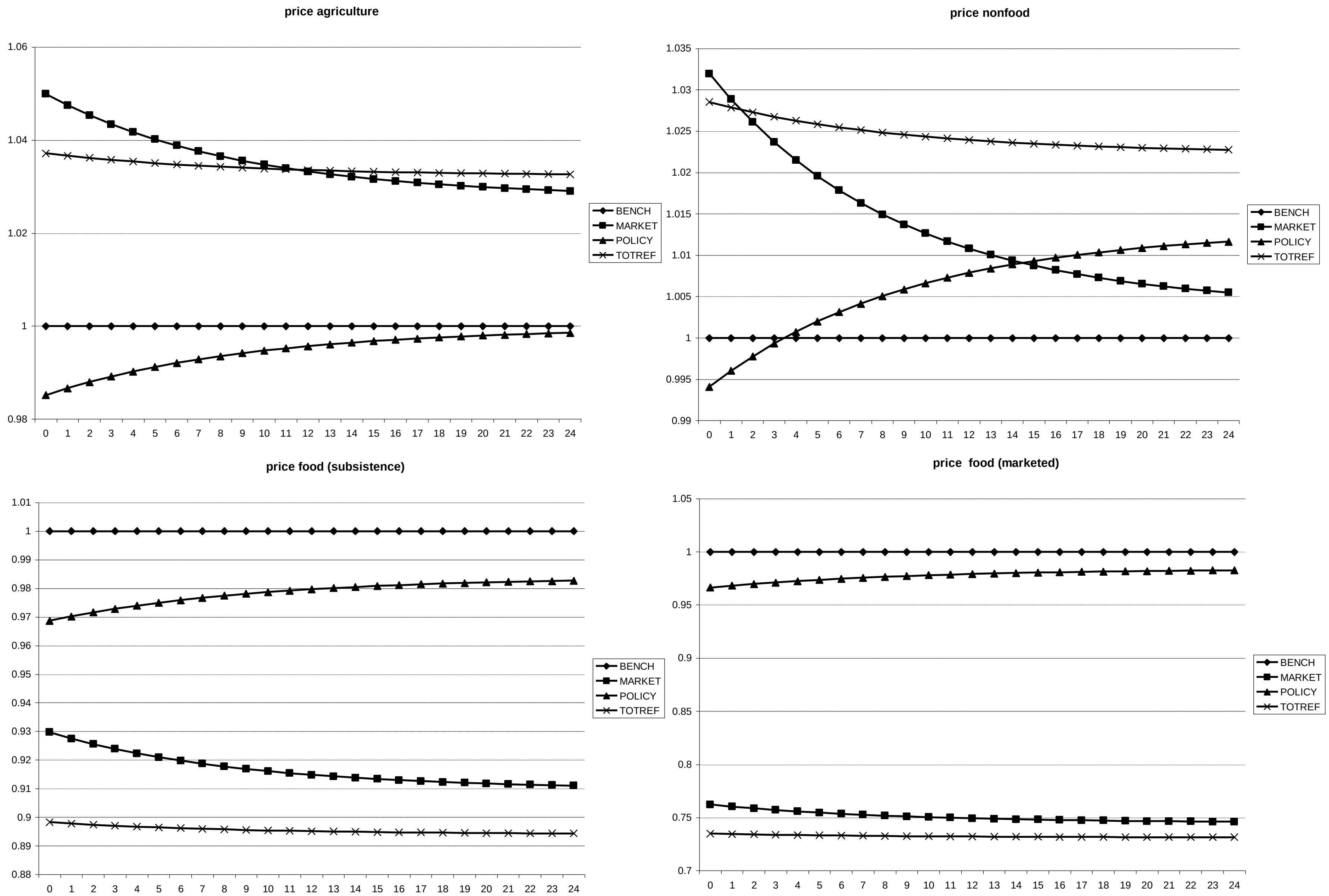
[26] The World Bank. (1997). The agrarian economies of Central and Eastern Europe and the Commonwealth of Independent States, Situation and Perspectives, World Bank Discussion Paper No. 387. Washington, D.C.

[27] Tirole, J. (1988). The theory of industrial Organization. Cambridge: MIT Press.



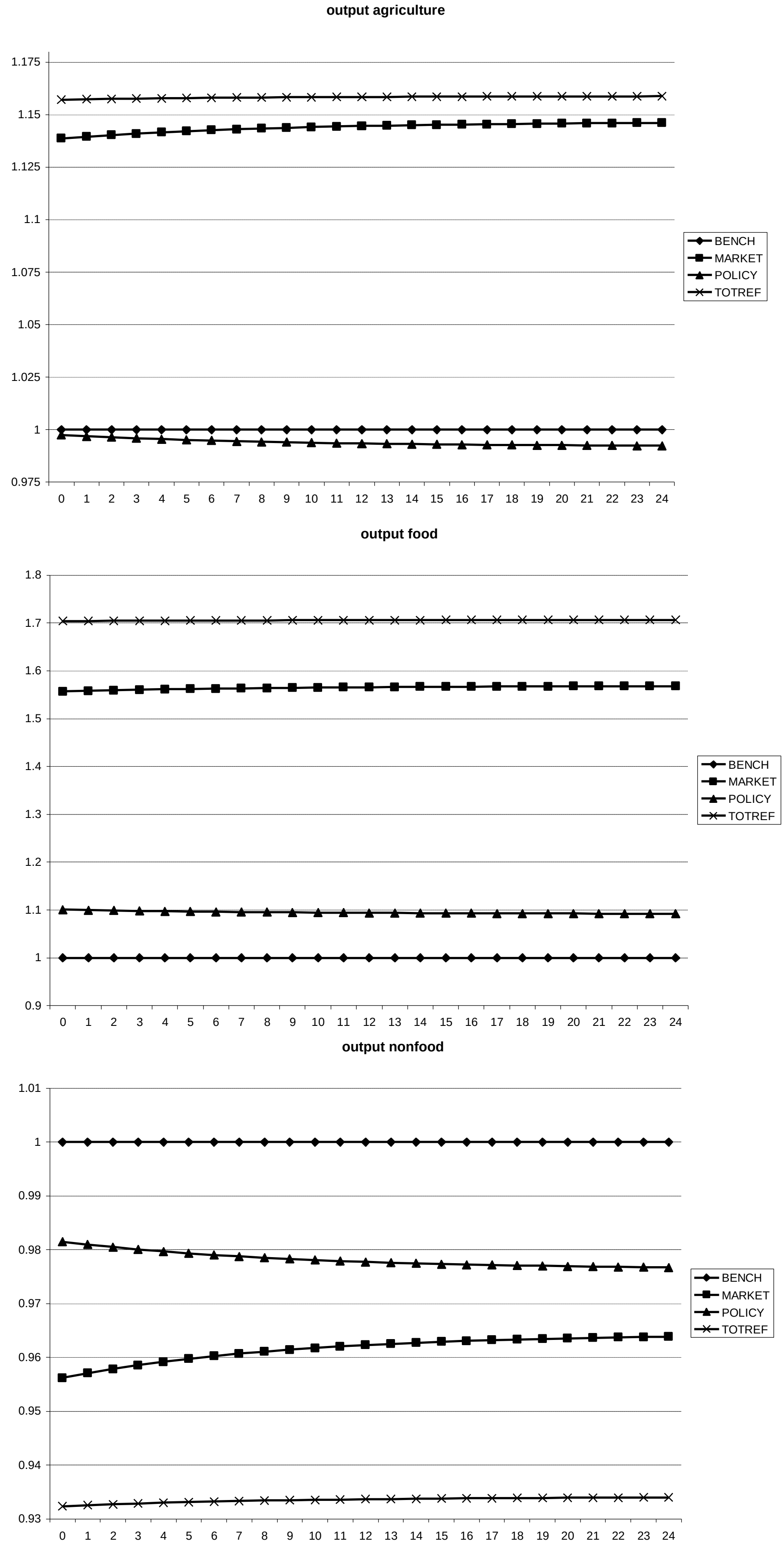
source: own calculations

Figure 1: GDP, capital stock, consumption and investment (deviation in percent)
BENCH is the benchmark steady state (equals one for all *t*)



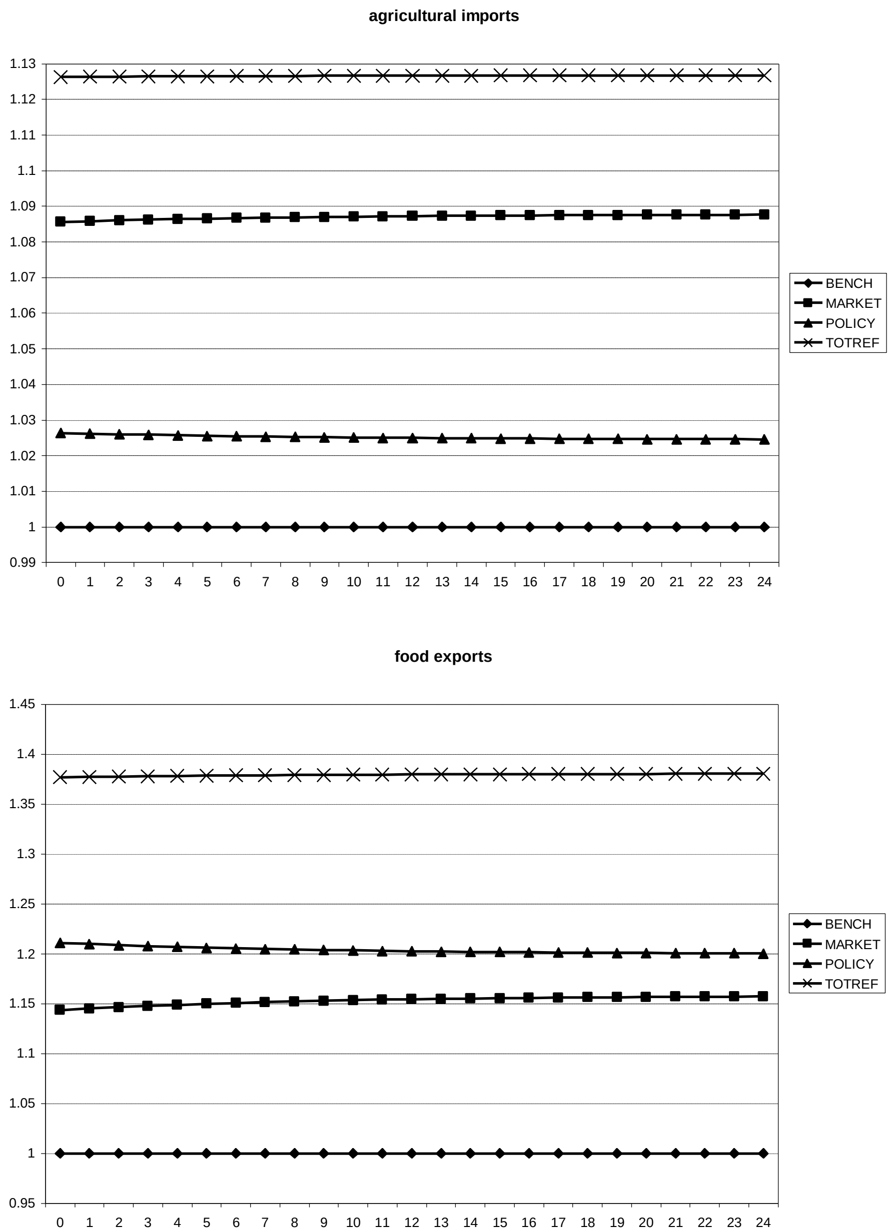
source: own calculations

Figure 2: output price of agriculture, nonfood, subsistence food and marketed food (deviation in percent)
BENCH is the benchmark steady state (equals one for all *t*)



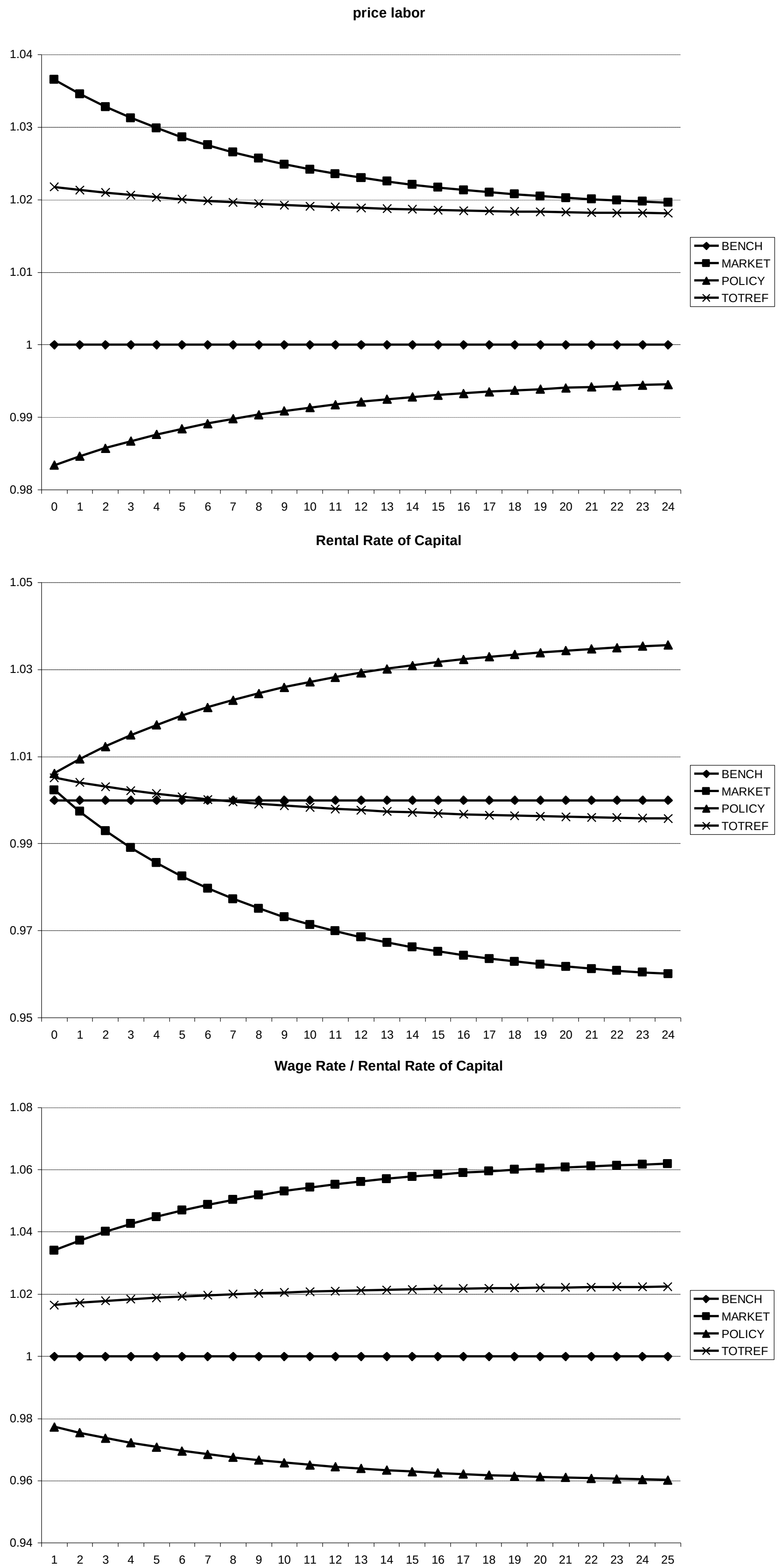
source: own calculations

Figure 3: output of agriculture, food and nonfood (deviation in percent)
BENCH is the benchmark steady state (equals one for all *t*)



source: own calculations

Figure 4: Imports of agricultural products; exports of food products (deviation in percent) BENCH is the benchmark steady state (equals one for all *t*)



source: own calculations

Figure 5: wage rate, rental rate of capital and wage rate / rental rate of capital (deviations in percent) BENCH is the benchmark steady state (equals one for all *t*)

RECENT BULLETINS

95-4 Diao, Xinshen and Terry L. Roe, "Environment, Welfare and Gains from Trade: A North-South Model in General Equilibrium." April 1995.

95-5 Fahima Aziz, "Nutrition, Health and Labor Productivity Analysis of Male and Female Workers: A Test of the Efficiency Wage Hypothesis." August 1995.

95-6 Elamin H. Elbasha and Terry L. Roe, "Environment in Three Classes of Endogenous Growth Models." August 1995.

95-7 Gopinath Munisamy and Terry L. Roe, "Sources of Sectoral Growth in an Economy Wide Context: The Case of U.S. Agriculture." August 1995.

95-8 Gopinath Munisamy and Terry L. Roe, "General Equilibrium Analysis of Supply and Factor Returns in U.S. Agriculture, 1949-91." August 1995.

95-9 Douglas Golin, "Do Taxes on Large Farms Impede Growth?: Evidence from Ghana." 1995.

96-1 X. Diao, E.H. Elbasha, T.L. Roe, and E. Yeldan, "A Dynamic CGE Model: An Application of R&D-Based Endogenous Growth Model Theory." May 1996.

96-2 Munisamy Gopinath and Terry L. Roe, "R&D Spillovers: Evidence from U.S. Food Processing, Farm Machinery and Agriculture." October 1996.

96-3 Xinshen Diao and Agapi Somwaru, "Dynamic Gains and Losses from Trade Reform: An Intertemporal General Equilibrium Model of the United States and MERCOSUR." October 1996.

96-4 Vernon Ruttan, "Sources of Technical Change: Induced Innovation, Evolutionary Theory and Path Dependence." October 1996.

97-1 Hung-Lin Tao and Thomas Stinson, "An Alternative Measure of the Human Capital Stock." April 1997.

98-1 Xinshen Diao, Terry L. Roe, and A. Erinc Yeldan, "How Fiscal (Mis)-Management May Impede Trade Reform: Lessons From an Intertemporal, Multi-Sector General Equilibrium Model for Turkey." January 1998.

98-2 Xinshen Diao, Terry Roe, and Erinc Yeldan, "Strategic Policies and Growth: An Applied Model of R&D-Driven Endogenous Growth." March 1998

98-3 Anna Maria Siti Kawuryan, "Educational Achievement and Sectoral Transition in the Indonesian Labor Force." March 1998.

98-4 Vernon W. Ruttan, "Growth Economics and Development Economics: What Should Developmental Economists Learn (if anything) from the New Growth Theory?" April 1998.

98-5 Xinshen Diao and Terry Roe, "The Effect of Sequencing Trade and Water Market Reform on Interest Groups in Irrigated Agriculture: An Intertemporal Economy-Wide Analysis of the Moroccan Case." November 1998.

98-6 Willis Peterson, "Monetary Instability and Economic Growth." November 1998.

99-1 Pei-Chien Lin and Terry Roe, "Growth Theory and Accounting for Growth of the Taiwanese Economy." July 1999.

99-2 H. Colby, X. Diao, and A. Somwaru, "Sources of Growth and Supply Response: A Cross-Commodity Analysis of China's Grain Sector." July 1999.

00-1 Beatriz Gaitan and Ferdinand Pavel, "Is 'Getting the Prices Right' Always Right? How Trade Liberalization Can Fail." March 2000.