AN ANALYSIS OF PRICE POLICIES FOR WHEAT AND RICE IN CHINA

BY

HUI JIAO

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This paper presents a quantitative analysis of the Chinese wheat and rice industries. The specific purpose is to analyze government policies for wheat and rice, and their impacts on industry performance. Dynamic relationships among prices, quantities and total GNP are investigated with a vector autoregression using Chinese data.

Government intervention in domestic commodity markets is quite common in China. The Chinese government is not only heavily involved in production, but also in marketing and distribution of most commodities, especially agricultural products. Production planning and collection rationing are used to reduce the need for food imports. Grain price policy is used as an economic tool to promote the government's objectives of maintaining price stability and containing inflation. Rice and wheat are an important constituent of Chinese food consumption, and these grains are also a big part of agricultural production. Sixty percent of the total agricultural output value is from grain production, and fifty seven percent of total output of grain is from rice and wheat (Niu 1987). The price is not a result of market equilibrium between supply and demand in China. Rather, the price is a measure of the government's distribution objectives among different sectors.

It is known that China is different from market economies in its institutions. For example, most western countries have a market system, and prices are determined by the equilibrium of supply and demand. China is a socialist country and administers a planned economy. No free markets were allowed to exist before the economic reform of 1979. Thus, conventional supply and demand analysis cannot explain the price level since prices of commodities are not determined in a market.

This paper consists of six sections. The next section discusses VAR models. The following section is an overview of Chinese grain policy. Section four reports on setting up the models. Results are presented in section five, and section six contains conclusions.

VECTOR AUTOREGRESSIONS

Vector autoregressive processes are autoregressive processes with more than one variable. They are different from moving average models. In a moving average model, a time series is described completely by a weighted sum of current and lagged random disturbances. In the vector autoregressive model, the current value of each variable is expressed as a function of lagged values of the selected variables and a random disturbance term. The random disturbances are assumed to be independently distributed across time. No variable is assumed to be exogenous a priori, and mo variable is excluded from the autoregressive equation for any other variable.

The VAR method starts with selection of a set of variables perceived as relevant to an economic issue under investigation. The modeling begins with estimation of a set of regression equations in which the current values of each variable depends on the past values of a set of variables. The mathematical representation of a VAR model with three variables and one lag is as follows:

$$Y_t = A + V_{11}Y_{t-1} + V_{12}X_{t-1} + V_{13}Z_{t-1} + E_t$$
$$X_t = B + V_{21}Y_{t-1} + V_{22}X_{t-1} + V_{23}Z_{t-1} + E_t$$
$$Z_t = C + V_{31}Y_{t-1} + V_{32}X_{t-1} + V_{33}Z_{t-1} + E_t$$

where Y, X, and Z are variables; A, B, and C are constant terms; V's are coefficients of t he variables; and E's are disturbance terms.

There are some important steps in estimating a VAR. First, if the data are not stationary, they should be transformed to induce stationarity. This is because if the process is nonstationary, it will often be difficult to represent the time series over past and future intervals of time by a simple algebraic model. If the data set is generated by a stationary process, it is possible to model the process via an equation with fixed coefficients that can be estimated from past data. If a stochastic process is stationary, then its joint distribution is invariant with respect to displacement in time. The probability distribution is the same for all time and its shape can be inferred by looking at a histogram of the observations that make up the observed series. In other words, all the random vectors have the same mean vector E[Y]=M for all t; the variances of all involved random variables are finite; and the covariance matrices of vectors Y and Y that are K periods apart only depend on K. These properties imply that the time series under consideration must not have trends, fixed seasonal patterns, or time-varying variances.

Second, is the problem of choosing lag length. According to orden (1985), there are three criteria for choosing a lag length.

A. Lag length should be more than an annual lag structure since there is an argument that regularities in economic data may be missed by using less than an annual lag structure (four quarters or twelve months depending on the frequency of observations).

B. Two specific lag lengths can be compared using the asymptotic Chi-square distribution of the log likelihood ratio to test the null hypothesis of zero coefficients on the terms excluded from the constrained model. This criterion for choosing lag length is based on maximizing the log likelihood function while adjusting for the number of parameters to be estimated.

C. An alternative approach is to choose a VAR model order using the AIC and SC criteria.

$$AIC(n) = \ln \det(\varepsilon n) + 2M^2 n/T$$

$$SC(n) = \ln \det(\varepsilon n) + M^2 n \ln T/T$$

where T is the sample size, M is the number variables in the system. εn is an estimate of the residual covariance matrix obtained with a VAR(n) model. The order p is chosen when the AIC or SC criterion is minimized.

Third, there is the problem of a large number of parameters to estimate relative to the number of available observations. One approach is Tiao and Box's exclusion-of-variables approach. Tiao and Box suggest deleting from each equation those variables with statistically insignificant coefficients. Another way to approach the exclusion-of-variables technique is suggested by Hsiao. He considers each equation in isolation. A subset of all of the potential right-hand-side variables for an equation is chosen based on the minimization of a criterion which is a function of the number of explanatory variables and the estimated variance of the error term.

Using an index model is another approach. It requires all cross-variable relations in an m variable autoregression be expressible as common dependence of the m variables on k "indexes", which are themselves linear combinations of past values of variables in the system.

Using the vector autoregressive model has some advantages. First, it does not impose a priori restrictions on the type of interrelations between variables. Second, the VAR model can provide an appealing basis on which to assess the importance of alternative sources of instability in the agricultural sector, and a basis for evaluating potential impacts of alternative policies. Third, the vector autoregressive model provides useful characterizations of economic dynamics and policy interpretations associated with their outcomes. Fourth, the vector autoregressive model can be used as a forecasting model.

The disadvantage of using the VAR model is the degrees of freedom when introducing lags in the system. Another disadvantage of using a VAR process is that it is hard to choose the variables to include.

The data analyzed in the paper are collected at annual intervals over the period 1950 to 1980 from the Chinese Statistical Yearbook, 1983..

CHINESE GRAIN POLICY

Government intervention in agricultural commodity markets has been a consistent feature of agricultural policy in many developing countries. Chinese agriculture has long been characterized by government control over prices and a set production quota on all agricultural commodities.

To understand Chinese grain policy, one has to examine its socialist system and institutions. Two important features in the Chinese economic system are related to grain policy. One is that government planning plays a large role in resource allocation, and the other is the extent of collective farming and state ownership in both industry and commerce. Since the Chinese communist party has taken power, the peasants have been organized into the commune system. China began enforcing a system of planning on food grain production and marketing in 1953, in the form of compulsory delivery quotas. The peasants were not allowed to sell their grain by private trade.

Chinese grain pricing policy has been influenced by national objectives. One of these objectives is to achieve an even distribution of wealth and basic needs, and another is stabilization of living standards.

Chinese grain prices were relatively stable over the past 30 years. The government controls the price with the aim of stabilizing consumer's income and containing inflation.

Chinese grain price policy changes from time to time, but basically can be divided into four periods according to An (1987).

The first period is from 1949 to 1957; the second period is from 1958 to 1966; the third period is from 1967 to 1978; and the fourth is from 1979 to 1986. The government's purpose in controlling prices of grain and grain quotas is to stabilize incomes and reach self - sufficiency in food. Changes in grain pricing policy have reflected changes in the priorities assigned to various national goals. Data on GNP and production of rice and wheat over these periods are shown in Table 1.

First Period (1949-1957)

This period was characterized by a quick recovery and a boom in agricultural grain production. Grain prices were strictly controlled and the role of the market in resource allocation was reduced. The purpose was to get grain to urban areas at low prices since supplies were short following the civil war. The total quantity of grain produced increased 72.3% from 1949 to 1957. The reasons for this were policies of self - reliance and adoption of measures suited to local conditions. Of course, another important reason for the high growth rate is that agricultural productivity was unusually low during the civil war.

The Second Period (1958 - 1966)

This period is called the "Great Leap Forward". State control of grain trade was stronger than before. The government told the people that the communist society would come soon if we work together and eat together. This period witnessed a sharp decline in the growth of grain production. The annual growth rate of grain declined to one percent from six percent. An important change was the retreat from high level collectivization. Every peasant was now organized into commune systems. All procedures from planning to marketing were centrally controlled. Authority for decision-making was shifted down from the commune to the production teams.

Various price and quasi-price measures were employed to encourage agricultural production. The government procurement price for grain was increased sharply in the period from 1961 to 1966. In 1960, the state began to give a 10% price bonus to production teams for deliveries to the state in excess of a certain fixed amount per team member. Price bonuses were used in combination with various material incentive programs which awarded farmers the right to buy goods in short supply in return for deliveries of grain to the state. By tying sales of otherwise unavailable commodities to deliveries, the state effectively raised the returns for grain delivered to the state.

Material incentive programs for grain began in 1961. For each 50 kg of grain sold to the state above the quota, the state would award the right to buy 10 chi cotton cloth and a pair of rubber galoshes.

Third Period (1967-1978)

This period is related to the political movement of the Cultural Revolution. During this ten year period, pricing policy was administered primarily to maintain price stability, and only for a brief period were agricultural prices used to influence resource allocation.

The government relied on other policy instruments for production planning and commercial planning. Increased grain production was promoted by enforcing mandatory sown area targets for grain, and self-sufficiency was enhanced by purchasing but not selling grain and oils in rural areas.

Economic Reform (1978 - 1986)

Price policy has played an important role in the recent reform program. Agricultural price policy has gone through two stages since 1977. The state used prices to increase rural incomes and to influence the level and composition of agricultural output. Pricing during these years for the most part consisted of adjustments in planned prices, bonuses and quotas rather than major changes in the pricing or procurement system.

Quota price revisions were reinforced by increasing above quota price bonuses, reducing quota levels, and the selective use of encouragement sales. New grain prices were set equal to 30% times the old quota price plus 70% times the above quota price. With price reform, the government began to reduce the scope of state planned commerce and allow the market to play a greater role in price determination and resource allocation.

The state also took steps to make planned prices somewhat more responsive to market forces. For example, enlarging the role of 'negotiated' prices in state commerce. These prices were to be decided on the basis of regional, yearly, seasonal, varietal and quality considerations, following supply and demand trends.

SPECIFYING THE VAR MODELS

In this paper, two VAR models are specified. One is for rice, and the other is for wheat. Three variables are selected in each model. The price of rice, the quantity of rice and GNP are included in the rice model and the price of wheat, the quantity of wheat and the GNP are included in the wheat model. A likelihood ratio test is used as a criterion for choosing lag length. The covariance matrices are used to generate the Chi-squared statistics.

$$(T-c)\ [\text{Log det } \varepsilon_1 - \text{Log det } \varepsilon_2]$$

where ε_1 and ε_2 are the covariance matrices of the restricted and unrestricted models, T is the number of observations, c is multiplier correction which equals the number of variables in each unrestricted equation. The likelihood ratio test in this paper is used to test a two lag specification against a one lag specification. The results indicate that one lag is adequate in both the rice and wheat models.

The representation of the rice model is as follows:

$$PR_t = V_{11} + A_{11}PR_{t-1} + A_{12}QR_{t-1} + A_{13}GNP_{t-1} + E_{11}t$$

$$QR_t = V_{21} + A_{21}PR_{t-1} + A_{22}QR_{t-1} + A_{23}GNP_{t-1} + E_{21}t$$

$$GNP_t = V_{31} + A_{31}PR_{t-1} + A_{32}QR_{t-1} + A_{33}GNP_{t-1} + E_{31}t$$

The representation for wheat model is:

$$PW_t = V_{11} + A_{11}PW_{t-1} + A_{12}QW_{t-1} + A_{13}GNP_{t-1} + E_{11}t$$

$$QW_t = V_{21} + A_{21}PW_{t-1} + A_{22}QW_{t-1} + A_{23}GNP_{t-1} + E_{21}t$$

$$GNP_t = V_{31} + A_{31}PW_{t-1} + A_{32}QW_{t-1} + A_{33}GNP_{t-1} + E_{31}t$$

Where PR – the price of rice

QR – the quantity of rice

PW – the price of wheat

QW – the quantity of wheat

GNP – the Gross National Product

t – the time period

A's – coefficients

V's – constant terms

E – error terms

The VAR models were fitted to natural logarithms of the data using the program RATS. From the residuals of the autoregressive representation, it can be determined whether or not there were large innovations in production and prices at particular points in time. If there are not, then observed changes in prices and production, even if they are large, can be explained by usual patterns given past values of the variables in the system. If there are positive price innovations, but not innovations in production then it would not seem reasonable to attribute the observed price behavior to production since even if production is low it is not unexpectedly low, and hence should not cause unexpected price effects. If, on the other hand, both price and production shocks did occur near t, it would be appropriate to attribute the unusual price movements to the unexpected production levels only if the impulse response functions suggested a substantial effect of production shocks on subsequent prices. If not, it would be more reasonable to conclude that the production innovations are not the cause of the high prices.

RESULTS OF THE ANALYSIS

The R-square and standard deviation of errors associated with the rice model are shown in Table 2; with the wheat model shown in Table 3. The value of R-square is much lower for the quantity of wheat than for the other variables.

The results of separate F-tests for the null hypothesis that coefficients on lags associated with a particular variable are zero are reported for rice in Table 4, and for wheat in Table 5. Elements in the tables are the significance level of the corresponding F-statistics. This gives the probability of observing the computed value of F under the assumption that the null hypothesis is true. Cases for which there is evidence for rejecting the null hypothesis at the 95 percent confidence level are underlined.

The F-test results presented in Table 4 and Table 5 suggest some interactions among the variables in both the rice and wheat models. In particular, there is evidence that lagged price of rice and GNP, as well as lagged quantity of rice, affect the current quantity of rice. And that lagged quantity of rice and GNP, as well as lagged price of rice, affect current price of rice also. There is also evidence that the quantity of rice impacts on GNP. Lagged quantity of rice and lagged quantity of wheat are significant in the VAR models for GNP. In contrast, the effects of lagged prices of both rice and wheat on GNP are not significant. The effect of lagged quantity on price is not significant in the wheat model. In all, there are more interactions among the variables in the rice model than in the wheat model. In the rice model, every variable affects other variables significantly, except the lagged price of rice on GNP. In contrast, the wheat model shows a different picture. Only effects of lagged price on quantity, and lagged quantity on GNP are significant. There is evidence for rejecting the null hypothesis on the coefficients for own lags in both the rice and wheat models.

The moving average representation provides a measure of the impacts of variables in the model on one another. Future values of the variables are forecast assuming future shocks are zero. These shocks not only refer to political and economic shifts, but also capture technological innovations. Since these shocks are random, the variance of these forecast errors can be computed. A decomposition of forecast error variance identifies the percentage of the variance in forecasts attributable to each variable. A decomposition provides a preliminary assessment of interactions among variables in the model. The usual procedure is to choose a particular ordering of the variables in the model and then remove from the shocks to each variable that portion that is explained by contemporaneous shocks to variables earlier in the order. This procedure can solve the problem that the errors associated with each variable in a VAR model may be contemporaneously correlated. It is know as the orthogonal ordering.

The decompositions of forecast error variance for forecast horizons one through ten years ahead are shown for the three variable rice VAR model in Table 6, and wheat VAR model in Table 7. The decomposition of variance for the rice and wheat models is useful in identifying channels of influence between the variables. In the rice model, only the price of rice has over 60 percent of its forecast error variance explained by own innovations. In fact, price shocks are the dominant source of uncertainty in rice quantity and total GNP for long forecast horizons. This indicates the importance of rice in the total economy and, therefore, the crucial role of rice price policy. In the wheat model, own shocks explain the highest proportion of forecast error variance for wheat price and quantity over long forecast horizons, however, wheat quantity shocks are the major source of GNP forecast errors.

As Orden (1985 p.8.) says, "A more natural approach to a VAR model is to distinguish between the expected evolution of the economy and deviations from this evolution that occur over time as a result of unexpected shocks to specific variables at particular moments in time. These deviations from the natural evolution are measured by the error terms of the autoregressive equations". In a moving average model, a time series is described completely by a weighted sum of current and lagged disturbances. The coefficients of the moving average representation describe exactly how a shock to a particular variable at one moment in time shifts the expected time path of each variable in the model compared to its expected evolution had the shock not occurred. These effects are known as impulse response functions. The impulse response functions trace out how current values of each variable have been affected by shocks in the past or how expected future values of each variables are affected by a shock today. These impacts are intractable in the autoregressive model because a specific shock has both direct and indirect effects on the evolution of each variable.

The impulse response functions estimated for the VAR of rice are presented in Figures 1 through 3, and wheat is shown in Figures 4 through 6. Each figure illustrates the responses of a specific variable over a period of ten years to a one standard deviation positive orthogonal shock in each other variable. Orthogonalization is in the order PR, QR, GNP in the rice model, PW, QW, GNP in the wheat model.

Responses of the price of rice are shown in Figure 1. The responses of the rice price to its own innovations are greater than to the innovations in other variables. This is consistent with the decomposition of variance which suggests most of the forecast variance for the price of rice is due to own innovations. This suggests that rice price policy is not very sensitive to changes in GNP or the quantity of rice being produced.

The influence of each shock on the quantity of rice is illustrated in Figure 2. The effect of an own innovation in the quantity of rice declines over time, while innovations in the price of rice show relatively big effects. This is consistent with the decomposition of variance which suggests that the forecast variance of quantity of rice is affected by the innovations in the price of rice. This means if there is a change in the rice price policies, the rice production will respond significantly, especially in the long run. The responses of quantity of rice to the innovations in GNP show relatively small effects.

Figure 3 illustrates the responses of GNP to positive one standard deviation orthogonal innovations. The effects of an own innovation in GNP declines over time, while the effects of innovations in PR increases over time. GNP is shown to be relatively responsive to all variables compared with the illustrations of Figure 1 and Figure 2. From this figure, it can be seen that changes in the rice price and quantity have big impacts in GNP, since GNP shows effective responses to innovations in the price of rice and the rice quantity.

The response of the wheat price to a positive one standard deviation orthogonal innovation is illustrated in Figure 4. Again, the effect of an own innovation decreases over time, while innovations in the other two variables show relatively small effects compared with the responses to own innovations. This is similar to the rice price's responses to the innovations in rice quantity and GNP. The wheat price, too, is not sensitive to the output of the wheat and GNP. This suggests that grain price policies are determined by other objectives and do not respond significantly to output and GNP changes.

The effects of each innovation on wheat quantity are shown in Figure 5. Response to a n own innovation persists over ten years, though the impact declines slowly over the period. The effects of innovations in PW increases over time. The responses of QW to innovations in GNP are relatively small compared with its responses to innovations in other variables. The decomposition of forecast variance suggests that the forecast variance for QW is not due to innovations in GNP. This result implies that the quota delivery policy has smaller effects than price policies. Although there is a response to own innovations, it is more sensitive to the innovations in the price variable.

Finally, the responses of GNP to innovations in each variable are shown in Figure 6. The responses to innovations in each variable persist, though the effect of an own innovation in GNP declines slowly over time. In contrast to the GNP variable in the rice model, GNP is not sensitive to the innovations in the price and quantity variables in the wheat model. This implies that GNP is more responsive to rice shocks than to wheat shocks, reflecting the importance of rice in the Chinese economy.

The dynamic interactions displayed by the impulse response functions have several implications. First, there is only slight evidence of impacts directly from GNP to either price or quantity in both the rice and wheat models. But the reverse is not true since GNP is sensitive and moves quickly in response to a shift in price and quantity in both the wheat and the rice models. Second, there is strong evidence of impacts directly from price to quantity. This implies that the price of wheat and rice should be viewed as a policy instrument in agricultural production since the quantity variables are very sensitive to price movement and move quickly in response to price changes.

CONCLUSION

This paper has examined some of the relationships among grain prices and quantities, and total GNP, in China. Historical Chinese agricultural price policies were summarized. The merit of a vector autoregressive model, in which the dynamics of these interactions are evaluated without a priori imposition of a particular economic theory was evaluated. The methodology underlying analysis with VAR models was reviewed. Two VAR models were then specified and interactions among prices, quantities and GNP were evaluated.

The results reported in this paper show evidence that a change in prices has a strong impact on production of both rice and wheat, which suggests that price should be viewed as a policy instrument in agricultural production. However, the government implements a fixed price system and a high degree of collectivisation in China. Also some feedback is observed since there is evidence of positive effects of quantity on price. Both price and quantity have slight impacts on GNP while GNP responses to innovations in price and quantity are not great. This is because rice and wheat only make up a small percentage in GNP, although they are big sectors in agricultural production. The empirical findings show strong one way causality from agriculture to GNP through general price fluctuations because the impacts of prices and quantities are positive on GNP, and their responses to GNP shocks are not positive, while significant feedback is not observed.

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Table 1. Economic Indicators of the Chinese Economy

YEAR	Q. OF WHEAT (10,000 TON)	Q. OF RICE (10,000 TON)	GNP (MILLION YEN)
1950	1450	5510	683
1951	1723	6056	820
1952	1813	6843	1015
1953	1828	7127	1241
1954	2334	7085	1346
1955	2297	7803	1415
1956	2480	8248	1639
1957	2364	8678	1606
1958	2259	8085	2138
1959	2218	6937	2548
1960	2217	5973	2679
1961	1425	5364	1978
1962	1667	6299	1800
1963	1848	7377	1956
1964	2084	8300	2268
1965	2522	8772	2695
1966	2528	9539	3062
1967	2849	9369	2774
1968	2746	9453	2648
1969	2729	9507	3184
1970	2919	10999	3800
1971	3258	11521	4203
1972	3599	11336	4396
1973	3523	12174	4776
1974	4087	12391	4859
1975	4531	12556	5379
1976	5039	12581	5433
1977	4108	12857	6003
1978	5384	13693	6846
1979	6273	14375	7642
1980	5521	13991	8531

Source: Chinese Statistical Yearbook 1984

TABLE 2.

Measure of Fit and Standard Deviation of Errors,
Three - Variable Model for Rice

Variable	R - Square	S.D. of Errors
PR	0.94	0.063
QR	0.95	0.065
GNP	0.98	0.092

TABLE 3.

Measure of Fit and Standard Deviation of Errors,
Three - Variable Model for Wheat

Variable	R - Square	S.D. of Errors
PW	0.92	0.061
QW	0.89	0.135
GNP	0.97	0.0002

TABLE 4.

Test of Null Hypotheses of Zero Coefficients on Lags of Specific Variables for the Rice Model

Dependent Variables	Lagged Variables		
	PR	**QR**	**GNP**
PR	0	0.06	0.004
QR	0.0004	0	0.007
GNP	0.49	0.001	0

TABLE 5.

Test of Null Hypotheses of Zero Coefficients on Lags of Specific Variables for the Wheat Model

Dependent Variables	Lagged Variables		
	PW	**QW**	**GNP**
PW	0	0.88	0.15
QW	0.05	0	0.26
GNP	0.22	0.02	0

TABLE 6.

Decomposition of Ten Year Ahead Forecast Variance for the Rice Model (Order of PR, QR, GNP)

		SHOCKS TO		
Error Variance in	YEAR	PR	QR	GNP
PR	1	100.00	0.00	0.00
	2	95.97	1.11	2.92
	3	88.79	2.18	9.03
	4	81.50	2.41	16.09
	5	75.79	2.22	21.99
	6	71.70	2.52	25.78
	7	68.75	3.78	27.47
	8	66.64	5.84	27.52
	9	65.37	8.08	26.55
	10	64.92	9.94	25.15
QR	1	4.59	95.41	0.00
	2	20.67	77.41	1.92
	3	34.88	61.98	3.15
	4	45.38	51.31	3.31
	5	52.48	44.50	2.96
	6	56.76	40.56	2.68
	7	58.89	38.27	2.85
	8	59.59	36.89	3.52
	9	59.53	35.97	4.51
	10	59.17	35.30	5.53
GNP	1	4.04	2.45	93.51
	2	2.37	14.11	83.52
	3	5.11	27.87	67.02
	4	13.38	36.28	50.34
	5	23.78	38.35	37.87
	6	33.30	36.91	29.79
	7	40.81	34.39	24.80
	8	46.25	31.94	21.81
	9	49.90	29.94	20.16
	10	52.19	28.42	19.39

TABLE 7.

Decomposition of Ten Year Ahead Forecast Variance for the Wheat Model (Order of PW, QW, GNP)

Error Variance in	YEAR	SHOCKS TO PW	SHOCKS TO QW	SHOCKS TO GNP
PW	1	100.00	0.00	0.00
	2	98.96	0.07	0.97
	3	96.98	0.48	2.54
	4	94.38	1.48	4.14
	5	91.42	3.17	5.41
	6	88.31	5.43	6.26
	7	85.22	8.06	6.72
	8	82.29	10.81	6.90
	9	79.61	13.50	6.89
	10	77.22	16.00	6.79
QW	1	6.29	93.71	0.00
	2	3.66	95.83	0.52
	3	4.58	94.36	1.07
	4	7.18	91.43	1.39
	5	10.24	88.27	1.50
	6	13.13	85.40	1.47
	7	15.62	82.99	1.39
	8	17.66	81.04	1.31
	9	19.28	79.48	1.24
	10	20.56	78.24	1.21
GNP	1	2.69	15.23	82.08
	2	1.66	28.74	69.60
	3	1.42	41.02	57.57
	4	2.34	50.20	47.46
	5	4.22	56.20	39.51
	6	6.62	59.72	33.66
	7	9.19	61.58	29.23
	8	11.68	62.43	25.90
	9	13.95	62.69	23.36
	10	15.95	62.66	21.39

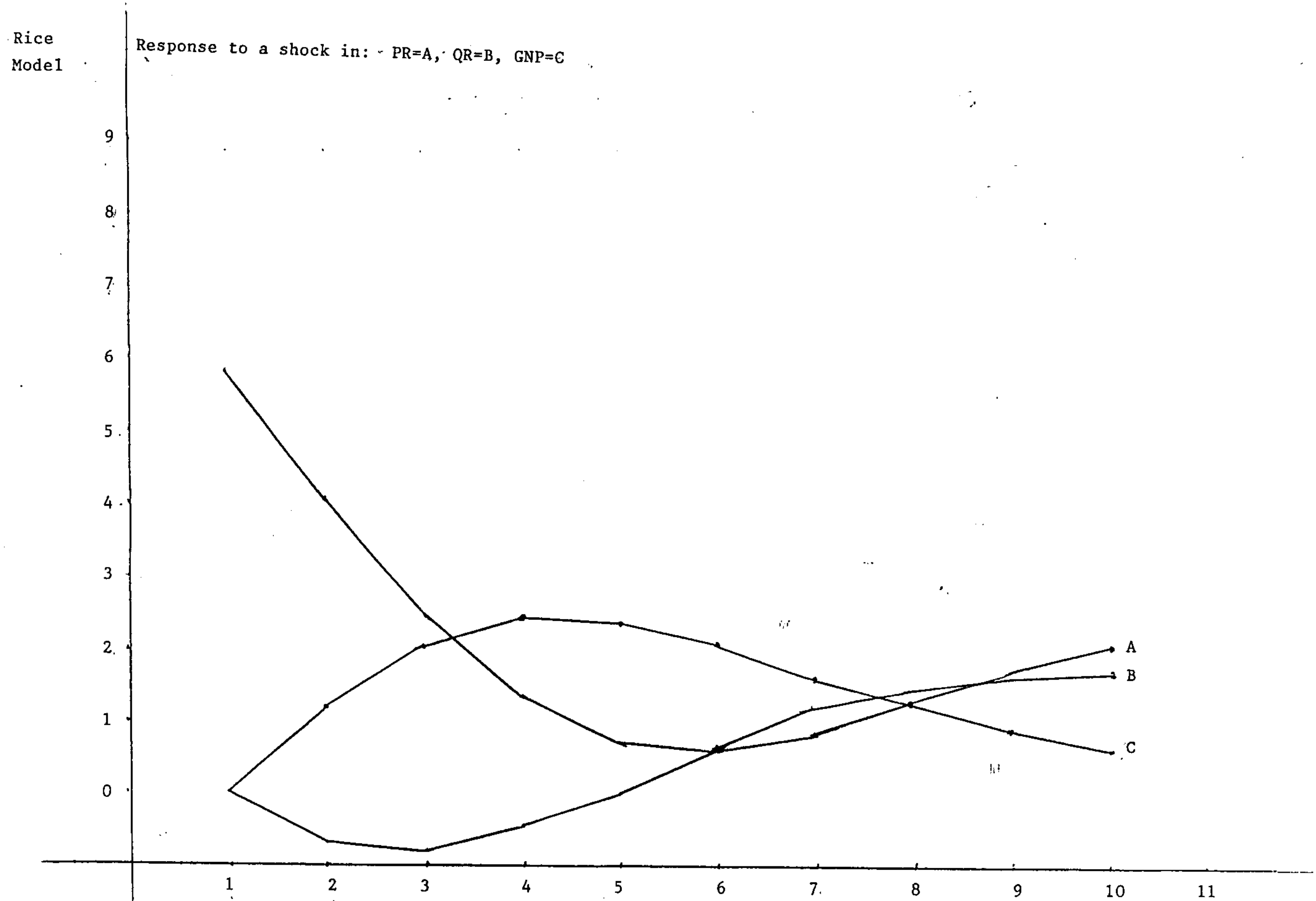

Figure 1. Response of rice price to positive one standard deviation orthogonal innovations

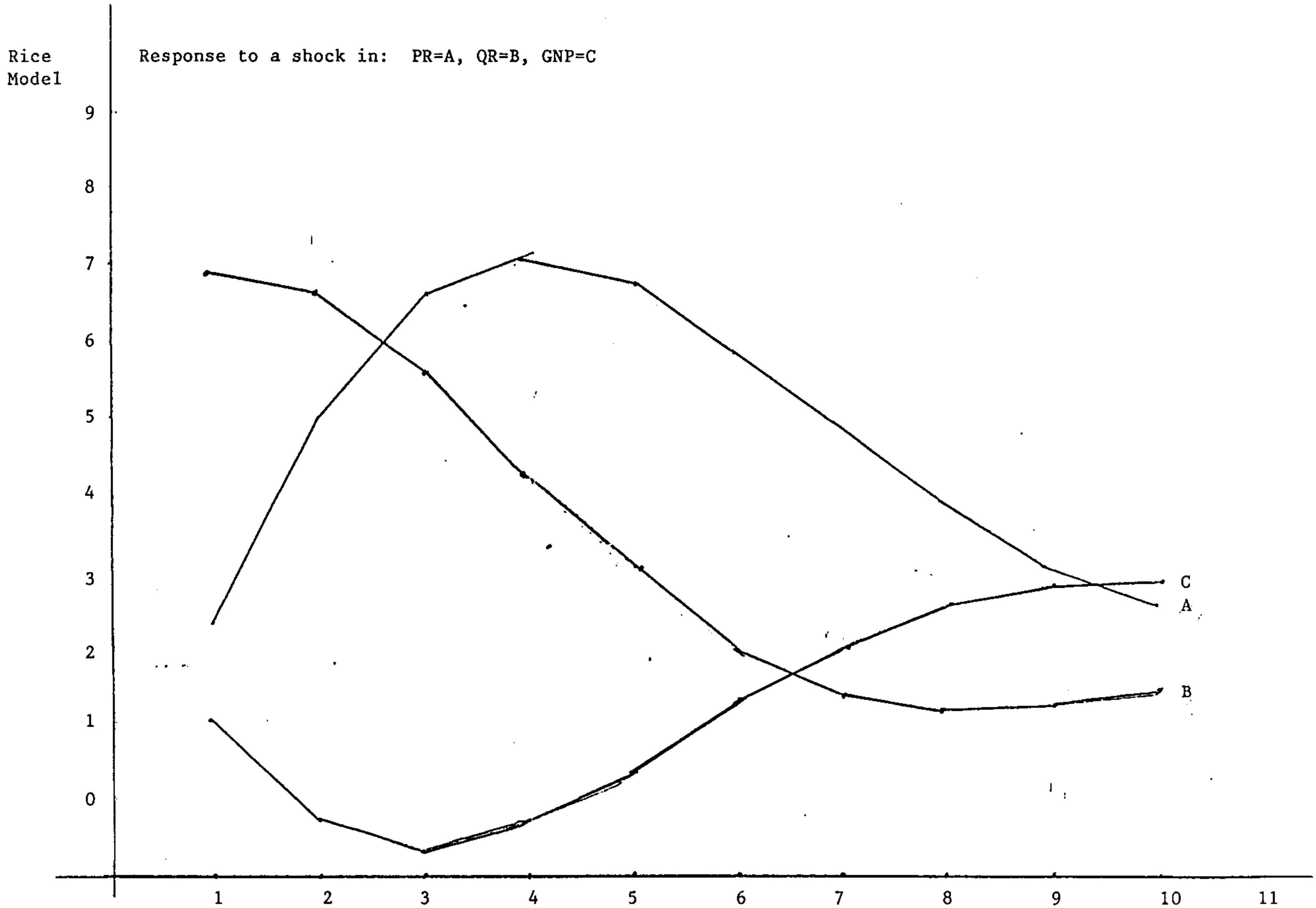

Figure 2. Response of quantity of rice to positive one standard deviation orthogonal innovations

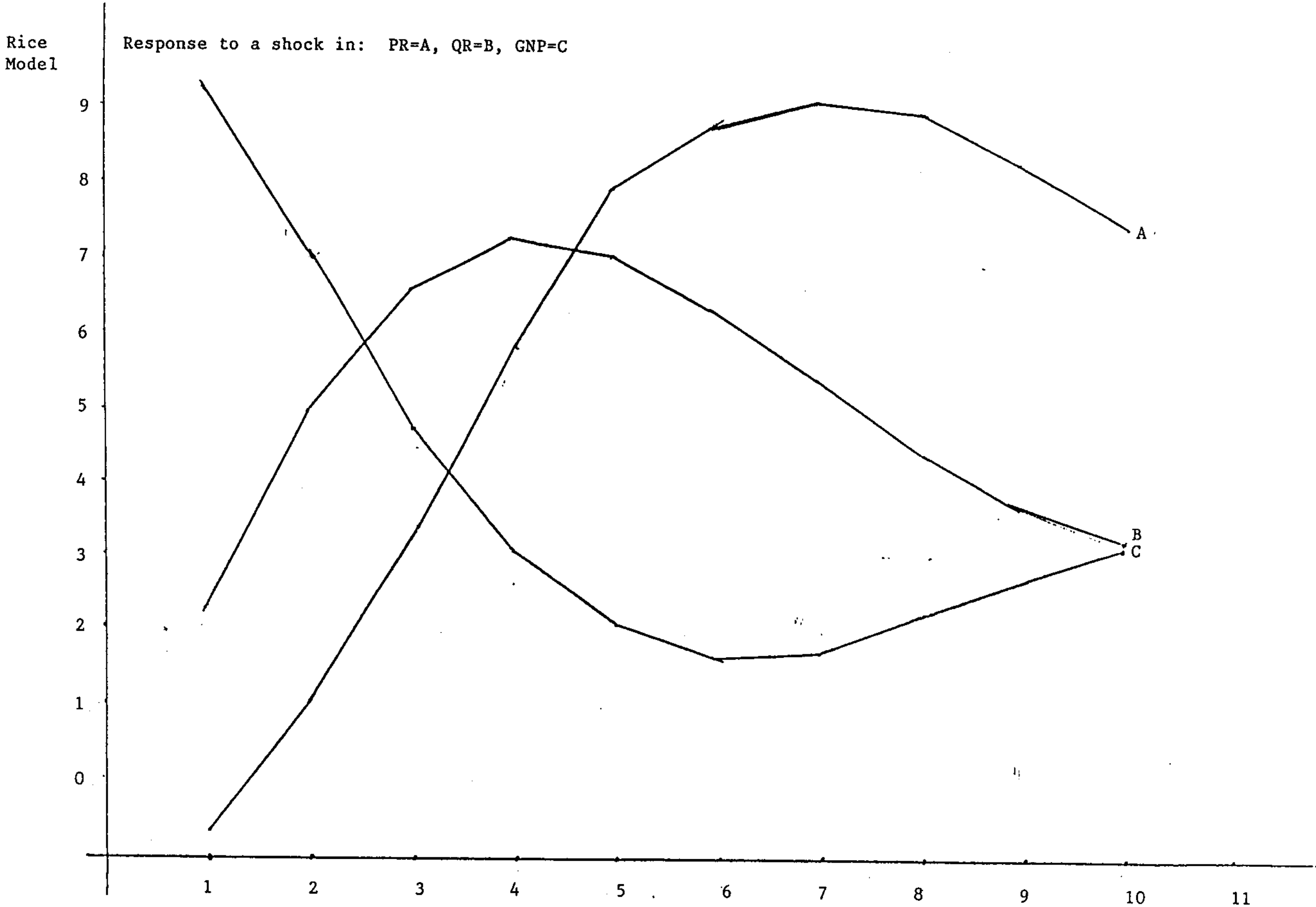

Figure 3. Response of GNP to positive one standard deviation orthogonal innovations

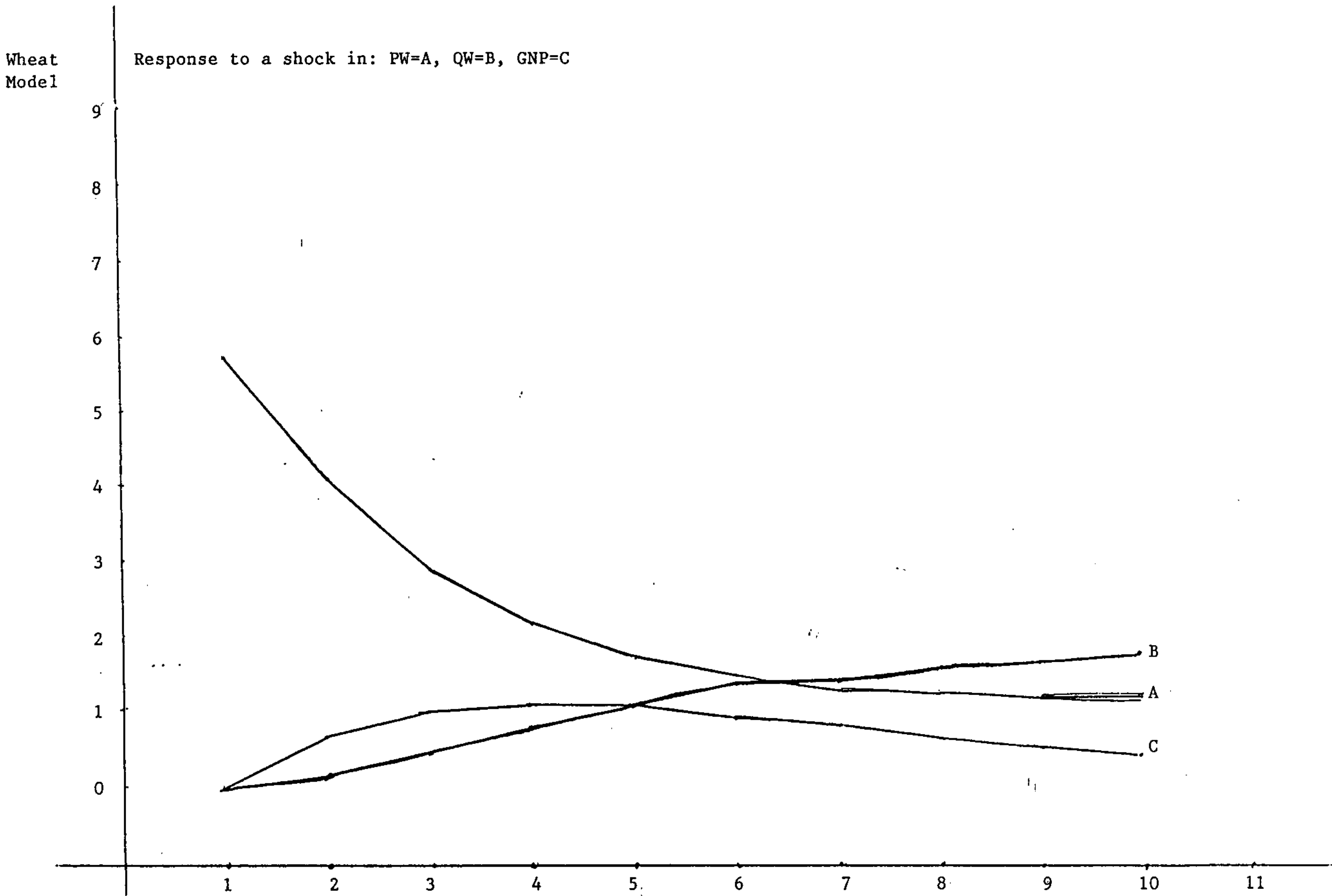

Figure 4. Response of price of wheat to positive one standard deviation orthogonal innovations

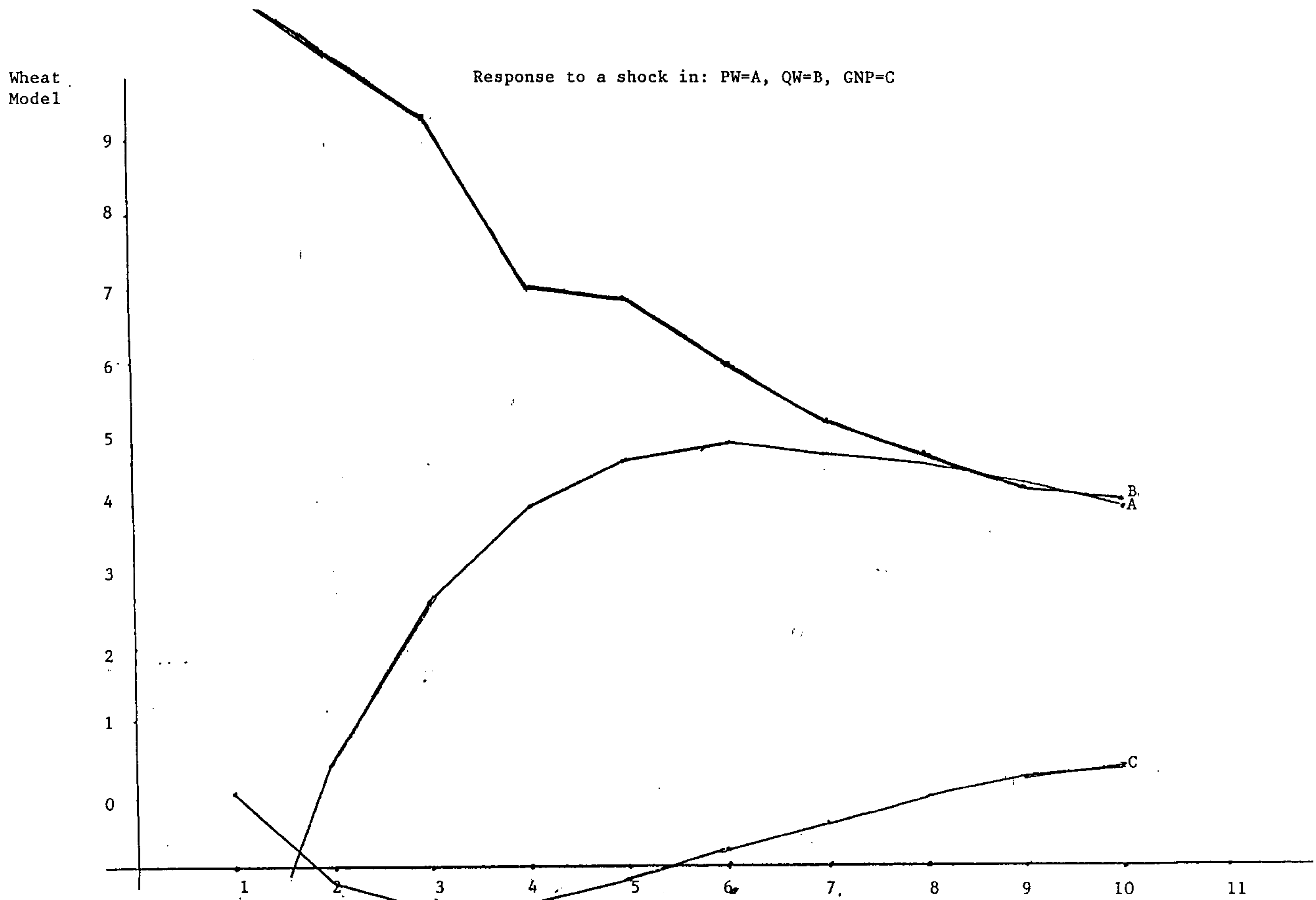

Figure 5. Response of quantity of wheat to positive one standard deviation orthogonal innovations

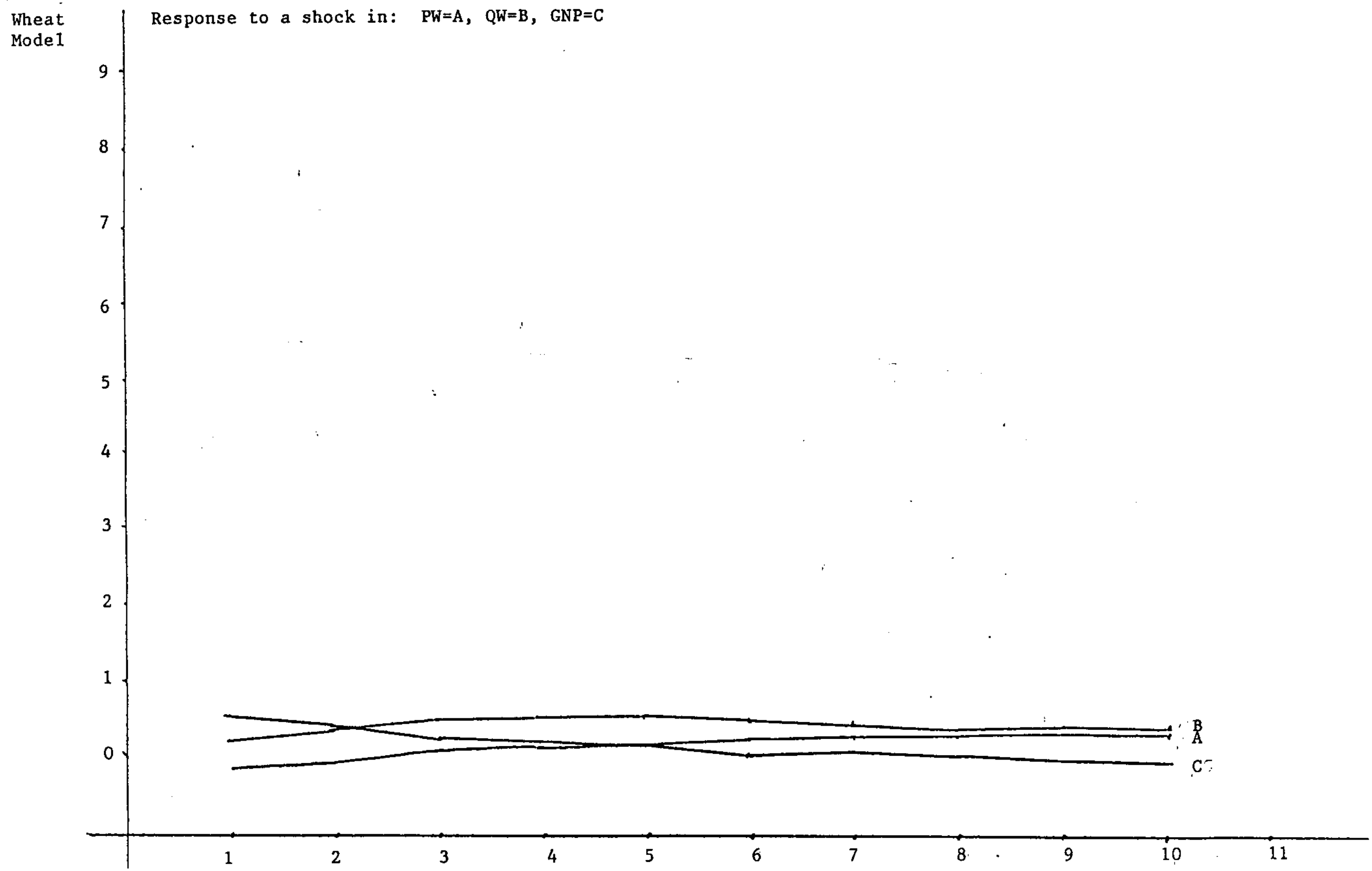

Figure 6. Response of GNP in wheat model to positive one standard deviation orthogonal innovations