Chapter Title: Price-Quantity Patterns in Business Cycles

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PRICE-QUANTITY PATTERNS IN BUSINESS CYCLES

THE method of defining the movements of commodity prices and quantities in business cycles described in the preceding chapter has been applied to each of the 64 commodities included in this study.[1] In appraising the results we may examine measures for individual commodities or averages for the entire group and its subdivisions. This discussion is confined, in the main, to averages defining the characteristic behavior of broad categories of goods. The present chapter deals with the interplay of prices and quantities during cycles in general business. The next chapter deals with commodity values, that is, with the patterns of buyers' outlays and sellers' revenues during business cycles. Throughout we are viewing the movements of these economic variables in the framework of reference cycles—a frame provided by the expansions and contractions of business at large.[2]

[1] Basic cyclical measurements for individual commodities will be published in a later monograph. Brief descriptions of the price and quantity series employed are given in Appendix Table 1. The number of separate commodities included is actually 56; two different sets of quantity records are used for each of 8 commodities. The 64 combinations included are those for which generally comparable price and physical volume data are available, on a monthly basis. The periods covered range from 14 to 80 years. Although the sample is limited it is large enough to give some substantive content to the averages and aggregates derived from it. The total value of the commodities included constituted in 1937 about one-third of the aggregate value of all agricultural commodities, raw minerals, and manufactured goods produced in the United States. The sample is not presented, however, as one containing in due proportions representatives of the various kinds of goods produced and exchanged in the United States in a given year.

It will be clear to a reader examining the detailed descriptions of the price and quantity series employed that the records for different commodities are by no means fully comparable. Some of the quantity series relate to production, some to imports, some to receipts at central markets, some to consumption, some to shipments. The price series are alike in that all relate to wholesale markets, but these markets vary widely in character, and in their place in the productive-distributive process. These limitations of the basic data are to be borne in mind in interpreting the interactions of prices and quantities and the apparent movements of monetary outlays. The derived measures are to be looked upon as approximations, only, to those the economic analyst would like to have.

[2] In the interpretation of the findings discussed in this section the reader will bear in mind the character of this framework. In particular, he will note the

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Individual Commodities

For light on the character of the patterns generated by corre-
lated movements of commodity prices and quantities in busi-
ness cycles and on the economic adjustments effected through
these two factors, we turn first to a summary of results covering
observations on 64 individual commodities. Table 6 shows the
magnitude of the joint cyclical variability of prices and quanti-
ties for each of the commodities covered, and indicates the
commodities for which the movements of prices or quantities,
or of the two factors combined, appear to represent a trust-
worthy (i.e., a statistically significant) cyclical pattern.

The average patterns for the 64 commodities in Table 6 show
an extraordinarily wide range in the amplitudes of the com-
bined price-quantity movements during reference cycles. From
167, the joint variability of flour, the measures rise to 11,519
for coke. The range above the median (1,640) is very much
wider than the range below. Products of heavy industry pre-
dominate among the 32 that lie above the median. These are,
typically, the products for which quantities produced, or prices,
or both, are peculiarly sensitive to business cycles. Yet in this
upper group are also wool, potatoes, lard, cotton, and a few
other commodities not originating in the heavy industry sector
of the economy. Commodities of agricultural origin predom-
inate in the lower half of the table, though here, in turn, are
some industrial products, notably coal, tin, zinc sheet, and
cement.

In these measures of joint variability we have the effects,
intermixed, of true cyclical movements of prices or quantities,
or of the two combined, and of fluctuations unrelated to busi-
ness cycles. We have attempted to distinguish the cyclically

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retention of intracycle trends. These trends are conceived to be elements of
the data on which business judgments and operating decisions are based, and
therefore properly to be retained in our study of the related patterns of
price and quantity movements. For our sample of production and price se-
ries, and of business cycles, production trends were rising, on the average (at
a rate of 0.1 percent of the average reference cycle base per month), and
price trends were declining (at an average rate of 0.1 percent per month).
These trend factors accentuate somewhat the lifting influence of production
during business expansions and the depressing influence of prices during
business contractions.

TABLE 6

64 Commodities in Order of Joint Cyclical Variability
of Prices and Quantities in Reference Framework

	JOINT VARIABILITY		JOINT VARIABILITY
*Coke	11,519	*Pork	1,630
*Iron ore	8,107	*Tin	1,628
*Glass	7,260	*Silk, raw	1,565
*Steel, scrap	6,851	*Coal, bituminous	1,511
*Pig iron (merchant)	6,477	*Sheep (slaughter)	1,477
*Steel, plates	5,538	*Asphalt	1,439
*Steel, sheet	5,392	*Zinc, sheet	1,362
*Steel, structural	5,140	*Leather	1,212
*Steel, billets	4,790	*Butter (production)	1,045
*Lumber, fir	4,728	*Paper index	1,033
*Wool, raw	4,508	*Hogs (receipts)	987
*Copper	4,387	*Meat index	936
*Steel, rails	4,227	*Petroleum (Appalachian)	819
*Autos, passenger	4,090	*Sheep (receipts)	806
*Pig iron (total)	3,784	*Silk, yarn	761
*Milk, condensed	3,245	*Cotton (exports)	708
*Cottonseed oil, crude	2,985	*Butter (receipts)	665
*Worsted yarn	2,970	*Hogs (slaughter)	631
Potatoes	2,857	*Cattle (slaughter)	621
*Linseed oil	2,832	*Cattle (receipts)	583
*Cotton, yarn	2,811	Flour (production)	577
*Gasoline	2,759	*Cement	533
*Lubricants	2,726	*Beef	527
Cottonseed oil, refined	2,714	*Coffee	519
*Petroleum (total)	2,674	*Milk, evaporated	504
*Corn	2,665	*Coal, anthracite	473
Lard	2,634	*Milk, raw	364
*Rubber	2,581	Shoes	351
*Cotton (consumption)	2,274	Eggs	337
*Zinc, raw	2,194	Bread	207
Hides	1,666	Sugar	192
*Lead	1,649	Flour (shipments)	167

Certain commodities appear twice in this record. In each of these cases different physical volume series have been available, for combination with series measuring the prices of the commodity in question. Thus the production of merchant pig iron, for which records are available for nine business cycles between 1904 and 1938, has been paired with a composite pig iron price series to give one of our combinations; the total production of pig iron, for which data cover 16 business cycles between 1879 and 1938, has been paired with the price of pig iron in Eastern Pennsylvania to give another combination. Total petroleum production (covering 6 cycles) is a member of one combination, while Appalachian production (covering 13 cycles) enters into another. The parenthetical references in Table 6 and other tables define the physical volume series entering into these different combinations.

* Cyclical variability significant.

significant movements from others. Fifty-four of the commodities listed in Table 6 have patterns of behavior sufficiently consistent to justify the conclusion that they were generated by truly cyclical forces.[3] The commodities with relatively high joint variability predominate in the 'significant' list, but many articles on this list fall below the median, in amplitude of variability. Raw milk, with a joint variability of only 364, has a significant pattern; for potatoes, with a joint variability of 2,857, the average pattern is not significant. The explanation is that for milk the fluctuations, though small, are relatively consistent in 12 business cycles; for potatoes the record, which covers only 5 business cycles, is one of wide but erratic movements.

This survey of measures of amplitude has given some indication of the nature of the materials available to us in studying the correlated interactions of commodity prices and quantities in business cycles. In Table 7 we have a series of measures indicative of the part price has played in these interactions. Here, again, the range is very wide. For petroleum (this series is for the Appalachian field alone) and potatoes, at one end of the scale, cyclical fluctuations in the price factor accounted for 98 percent of the joint variability of prices and quantities, quantity fluctuations for 2 percent. (The reference, of course, is to variability that is related to cycles in general business. The method of averaging in the reference cycle framework tends to offset fluctuations not consistently associated with business cycles.) Passenger automobiles and iron ore were at the other extreme; price fluctuations contributed only 1 percent, while

[3] In the interpretation of these results it must be remembered that the measure of joint variability for each commodity is derived from the average price-quantity pattern (the counterpart of the pattern for merchant pig iron in Table 2). In a given case this average may represent a highly consistent pattern, repeated with only slight differences from cycle to cycle, or a pattern from which there is wide deviation from cycle to cycle. When this deviation is wide, the average pattern is not significant; when the deviation from cycle to cycle is moderate, and there is a fairly high degree of consistency in the patterns traced by price-quantity movements in successive cycles, significant average patterns emerge.

The criterion of significance is a composite one, involving tests of prices, quantities, and values of individual commodities. These tests are discussed in detail in a monograph scheduled for later publication.

quantity fluctuations accounted for 99 percent, of the combined variability. For 37 of the 64 commodities the price contribution was more than 50 percent of the total. Prices varied more than quantities, in their cyclical movements, for slightly more than half of the sample.

We discuss below distinctive group behavior. Here we note the dominance of agricultural products in that group of the entries in Table 7 for which the price contribution is more than 75 percent of the joint variability. Of the 15 commodities

TABLE 7

64 Commodities in Order of Price Contribution to Joint Cyclical Variability in Reference Framework

	PRICE CONTRIBUTION (percent)		PRICE CONTRIBUTION (percent)
*Petroleum (Appalachian)	98	*Cotton (exports)	55
Potatoes	98	*Leather	55
*Meat index	95	*Milk, evaporated	54
*Hogs (slaughter)	92	*Copper	51
*Sheep (slaughter)	92	*Linseed oil	51
*Corn	91	*Gasoline	49
*Pork	89	*Zinc, raw	49
*Cottonseed oil, crude	88	*Milk, raw	48
Flour (production)	88	*Worsted yarn	48
Cottonseed oil, refined	86	*Coffee	46
Eggs	86	*Steel, scrap	44
*Beef	84	*Coal, anthracite	43
*Butter (production)	83	*Coal, bituminous	38
Lard	81	*Cement	37
*Lubricants	78	*Cattle (receipts)	31
*Cotton, yarn	75	*Coke	28
*Hogs (receipts)	75	*Pig iron (total)	21
*Butter (receipts)	74	*Steel, billets	20
*Silk, raw	73	*Pig iron (merchant)	19
Sugar	73	*Paper index	18
Hides	71	*Tin	18
*Cattle (slaughter)	69	*Zinc, sheet	18
*Cotton (consumption)	69	*Steel, structural	14
*Sheep (receipts)	67	*Steel, rails	8
*Petroleum (total)	66	*Glass	6
*Rubber	66	*Steel, sheet	6
*Silk, yarn	66	*Milk, condensed	5
Bread	65	*Asphalt	3
*Lumber, fir	59	Shoes	3
*Lead	58	*Steel, plates	2
Flour (shipments)	57	*Autos, passenger	1
*Wool, raw	57	*Iron ore	1

* Cyclical variability significant.

in this quarter 13 are of agricultural origin. The other 2, petroleum and lubricants, are minerals, but they resemble agricultural products in one important respect—producers cannot effect prompt changes in supply, on the basis of short-term market prospects. The entries in the bottom quarter, in contrast, are predominantly products of the heavy, metal-working industries. (Paper, condensed milk and shoes are outstanding exceptions.) Production of these articles is controlled on the basis of business prospects; the contribution of quantity fluctuations to joint variability is outstanding.

The aggregate record of related changes in commodity prices and quantities during business cycles is summarized in Table 8, Part 1. For 60 of the 64 commodities prices rose during the phase of general business expansion. (This statement applies, of course, to average patterns of behavior for individual commodities, not to behavior during any particular cycle.) For 47 of these there was a concurrent rise in quantities produced (or traded, or consumed). Quantities of 13 commodities showed no net change, or fell. In addition, quantities rose for 4 commodities for which prices did not rise. We have here a good summary picture of the response of commodity markets to the forces of business expansion. For roughly three-quarters of our list of commodities the push of revival is reflected in both unit prices and number of units produced. The remaining quarter is composed predominantly of goods for which prices rose while output did not. These observations indicate a more general positive response of prices than of quantities to expansion.[4] Yet of the 47 for which both factors advanced, 29 showed sharper rises in quantities than in prices. The net effect, indeed, of expansion, in terms of these average patterns of behavior, was to raise quantities more than prices from their relative standings at the preceding low point in general business. The participation of prices in expansions is more general but advances in quantities are more pronounced in a majority of the individual cases studied.[5]

[4] The response of physical quantities to business cycles takes the form of an inverted pattern for some commodities, e.g., butter receipts, cotton exports.
[5] Examination of records for larger samples of production and price series lends support to the second part of this statement although the lack of comparability

TABLE 8

Related Movements of Prices and Quantities
in Reference Expansion and Contraction

PART 1

	No. of Commodities

A: REFERENCE EXPANSION (STAGES I-V)

	No. of Commodities	
1) Classification by price movements		
Commodities for which prices show net rise	60	
and quantities rise more than price		29
and quantities rise less than price		18
and quantities show no net change		2
and quantities fall		11
Commodities for which prices show no net change and quantities rise	2	
Commodities for which prices show net fall and quantities rise	2	
Total	64	
2) Classification by quantity movements		
Commodities for which quantities show net rise	51	
and prices rise more than quantity		18
and prices rise less than quantity		29
and prices show no net change		2
and prices fall		2
Commodities for which quantities show no net change and prices rise	2	
Commodities for which quantities show net fall and prices rise	11	
Total	64	

B: REFERENCE CONTRACTION (STAGES V-IX)

	No. of Commodities	
1) Classification by price movements		
Commodities for which prices show net fall	63	
and quantities fall more than price		23
and quantities fall less than price		19
and quantities rise		21
Commodities for which prices show net rise and quantities fall	1	
Total	64	
2) Classification by quantity movements		
Commodities for which quantities show net fall	43	
and prices fall more than quantity		19
and prices fall less than quantity		23
and prices rise		1
Commodities for which quantities show net rise and prices fall	21	
Total	64	

TABLE 8 *(cont.)*

PART 2

A: REFERENCE EXPANSION (STAGES I-V)

COMMODITIES FOR WHICH PRICES SHOW NET RISE

Quantities Rise		Quantities Show no Net Change (2)	Quantities Fall (11)
More than price (29)	Less than price (18)		
*Cattle (receipts)	*Beef	*Hogs (slaughter)	Bread
*Cement	*Butter (production)	Sugar	*Butter (receipts)
*Coal, anthracite	*Cattle (slaughter)		*Cotton (exports)
*Coal, bituminous	*Corn		*Cottonseed oil, cru
*Coffee	*Cotton (consumption)		Cottonseed oil, ref
*Coke	*Cotton, yarn		Flour (production)
*Copper	Eggs		Lard
Flour (shipments)	Hides		*Lumber, fir
*Gasoline	*Hogs (receipts)		*Milk, condensed
*Leather	*Lead		*Pork
*Linseed oil	*Lubricants		*Sheep (slaughter)
*Milk, evaporated	*Meat index		
*Paper index	*Milk, raw		
*Pig iron (merchant)	*Petroleum (Appalachian)		
*Pig iron (total)	*Petroleum (total)		
*Rubber	Potatoes		
Shoes	*Sheep (receipts)		
*Silk, yarn	*Silk, raw		
*Steel, billets			
*Steel, plates			
*Steel, rails			
*Steel, scrap.			
*Steel, sheet			
*Steel, structural			

COMMODITIES FOR WHICH PRICES SHO

*Tin		No Net Change, Quantities Rise (2)	Net Fall, Quantities Rise (2)
*Wool, raw		*Autos, passenger	*Asphalt
*Worsted yarn		*Iron ore	*Glass
*Zinc, raw			
*Zinc, sheet			

*Cyclical variability significant.

This story may be read, by individual commodities, in Table 8, Part 2. The goods for which quantities fall, or advance less than prices, are primarily of agricultural origin. Lumber, lead,

of the production and price series lessens the immediate relevance of this general body of evidence. The median advance of 241 production series between reference cycle stages I and V was 20.3 (in reference cycle relatives); the median advance of 132 price series was 8.0 (war cycles were excluded in summarizing the price records). The price movements were much more compact and uniform than the production movements, a condition evidenced by an interquartile range of 5.8 for the price series, at stage V, and a corresponding interquartile range of 17.0 for the production series.

TABLE 8, PART 2 *(concl.)*

B: REFERENCE CONTRACTION (STAGES V-IX)				COMMODITIES FOR WHICH PRICES SHOW NET RISE
COMMODITIES FOR WHICH PRICES SHOW NET FALL				
Quantities Fall		Quantities		Quantities
More than price	Less than price	Rise		Fall
(23)	(19)	(21)		(1)
*Autos, passenger	*Asphalt	Bread		*Coal, anthracite
*Cement	*Beef	*Butter (production)		
*Coal, bituminous	*Cattle (receipts)	*Butter (receipts)		
*Coke	*Cattle (slaughter)	*Coffee		
Flour (shipments)	*Copper	*Cotton (exports)		
*Glass	*Corn	*Cottonseed oil, crude		
*Iron ore	*Cotton (consumption)	Cottonseed oil, refined		
*Leather	*Cotton, yarn	Eggs		
*Linseed oil	Hides	Flour (production)		
*Milk, condensed	*Lead	*Gasoline		
*Paper index	*Lubricants	*Hogs (receipts)		
*Pig iron (merchant)	*Lumber, fir	*Hogs (slaughter)		
*Pig iron (total)	*Petroleum (Appalachian)	Lard		
Shoes	*Petroleum (total)	*Meat index		
*Steel, billets	*Rubber	*Milk, evaporated		
*Steel, plates	*Silk, raw	*Milk, raw		
*Steel, rails	*Silk, yarn	*Pork		
*Steel, scrap	*Wool, raw	Potatoes		
*Steel, sheet	*Zinc, raw	*Sheep (receipts)		
*Steel, structural		*Sheep (slaughter)		
*Tin		Sugar		
* Worsted yarn				
*Zinc, sheet				

*Cyclical variability significant.

petroleum (2 series), and lubricants are the only exceptions among 31 commodities. For the industrial sector of the economy, typically, both prices and quantities respond to the push of general business recovery, but the advances in quantities are far sharper. This significant fact is obscured, in the general record, by the presence of many agricultural and a few petroleum products for which output is not responsive to cyclical forces.

Prices participate even more widely during general business contractions. Of the 64 commodities 63 were characterized, on the average, by declining prices. For only 43 did quantities fall. For approximately one-third of the goods here studied, that is, business contractions at large brought no absolute declines in physical output (or exchange). This pronounced contracyclical

tendency during business contractions, in a large minority of quantity series, has no counterpart in the price series. Prices do not buck the cyclical tide, on either expansion or contraction, to nearly the same extent as quantities. The degree of price change in particular industries may be slight, but the movement is usually with the tide.

Here, also, the record is illuminated by the details for individual commodities (Table 8, Part 2). The contrast between the industrial and agricultural sectors of the economy is again sharp. Of the 40 commodities for which contraction brings gains in quantities, or declines less marked than those of prices, 31 are of agricultural origin.[6] Industrial products predominate among the goods for which quantities decline more sharply than prices.

The relations of quantity and price movements in business cycles are defined by the coefficients e and f (measuring elasticity and flexibility). For the present purpose it is convenient to present the results for individual commodities in order of their 'full cycle' elasticities (Table 9). The full cycle measures are supplemented by elasticity coefficients for the phases of expansion and contraction.

In interpreting the measures in Table 9 chief interest attaches to the coefficients for the phases of expansion and contraction. These are unequivocal in their meaning. The averaging process involved in deriving the full cycle measures introduces an element of ambiguity when the signs of the measures for expansion and contraction differ.

Of the 64 commodities 49 are marked by positive relations between price and quantity changes during the expansion phases of business cycles, 15 by inverse movements. In the main, that is, the general forces of business expansion that may be thought of as impinging from without on the markets for individual commodities override the tendencies toward inverse relations between quantities and prices that are characteristic of demand schedules and reenforce the positive relations gen-

[6] The reader should note that the present sample is rather heavily weighted with agricultural products. Their relative importance is greater in the sample than in the economy at large.

TABLE 9

64 Commodities in Order of Elasticity of Quantities and, Inversely, in Order of Flexibility of Prices in Business Cycles

A: COMMODITIES FOR WHICH FULL CYCLE ELASTICITY IS POSITIVE

	PHASE MEASURES, ELASTICITY		FULL CYCLE MEASURES	
	Expansion	Contraction	Elasticity	Flexibility
*Iron ore	+344.44	+28.60	+186.52a	+0.01
Shoes	+6.09	+7.62	+6.86	+0.15
*Steel, plates	+5.46	+7.74	+6.60	+0.15
Flour (shipments)	+5.80	+6.80	+6.30	+0.16
*Steel, sheet	+5.39	+3.81	+4.60	+0.22
*Steel, rails	+3.78	+2.49	+3.14	+0.32
*Paper index	+4.50	+1.75	+3.12	+0.32
*Steel, structural	+2.41	+3.42	+2.92	+0.34
*Cement	+1.39	+3.39	+2.39	+0.42
*Gasoline	+4.90	—0.25	+2.32	+0.43
*Steel, billets	+2.09	+2.27	+2.18	+0.46
*Pig iron (merchant)	+1.79	+2.55	+2.17	+0.46
*Rubber	+4.11	+0.15	+2.13	+0.47
*Zinc, sheet	+1.92	+2.24	+2.08	+0.48
*Coal, bituminous	+1.43	+2.64	+2.04	+0.49
*Pig iron (total)	+2.20	+1.87	+2.04	+0.49
*Milk, condensed	—0.44	+4.24	+1.90	+0.53
*Tin	+2.23	+1.57	+1.90	+0.53
*Glass	—7.00	+10.49	+1.74	+0.57
*Coke	+1.34	+1.92	+1.63	+0.61
*Linseed oil	+1.92	+1.20	+1.56	+0.64
*Leather	+1.75	+1.07	+1.41	+0.71
*Worsted yarn	+1.43	+1.05	+1.24	+0.81
*Steel, scrap	+1.27	+1.08	+1.18	+0.85
*Wool, raw	+1.44	+0.87	+1.16	+0.86
*Cattle (receipts)	+1.57	+0.58	+1.08	+0.93
*Silk, yarn	+1.58	+0.56	+1.07	+0.93
*Copper	+1.22	+0.83	+1.02	+0.98
*Zinc, raw	+1.02	+0.87	+0.94	+1.06
*Lead	+0.91	+0.80	+0.86	+1.16
*Cotton (consumption)	+0.88	+0.80	+0.84	+1.19
*Cattle (slaughter)	+0.77	+0.81	+0.79	+1.27
*Beef	+0.85	+0.40	+0.62	+1.61
*Cotton, yarn	+0.62	+0.62	+0.62	+1.61
Hides	+0.59	+0.58	+0.58	+1.72
*Lubricants	+0.78	+0.31	+0.54	+1.85
*Milk, evaporated	+1.19	—0.28	+0.46	+2.17
*Coffee	+2.11	—1.25	+0.43	+2.33
*Silk, raw	+0.72	+0.09	+0.40	+2.50
*Petroleum (total)	+0.63	+0.08	+0.36	+2.78
*Lumber, fir	—0.05	+0.65	+0.30	+3.33
*Corn	+0.17	+0.04	+0.10	+10.00
*Petroleum (Appalachian)	+0.04	+0.16	+0.10	+10.00
*Meat index	+0.13	—0.08	+0.02	+50.00

TABLE 9 (concl.)

B: COMMODITIES FOR WHICH FULL CYCLE ELASTICITY IS NEGATIVE

| | PHASE MEASURES, ELASTICITY | | FULL CYCLE MEASURES | |
	Expansion	Contraction	Elasticity	Flexibility
Potatoes	+0.10	—0.13	—0.02	—50.00
*Sheep (receipts)	+0.27	—0.45	—0.09	—11.11
*Milk, raw	+0.62	—0.81	—0.10	—10.00
*Hogs (slaughter)	+0.01	—0.23	—0.11	—9.09
*Butter (production)	+0.16	—0.39	—0.12	—8.33
Eggs	+0.08	—0.33	—0.12	—8.33
*Hogs (receipts)	+0.28	—0.57	—0.14	—7.14
Flour (production)	—0.14	—0.17	—0.16	—6.25
*Cottonseed oil, crude	—0.21	—0.21	—0.21	—4.76
Cottonseed oil, refined	—0.15	—0.28	—0.22	—4.55
*Pork	—0.18	—0.28	—0.23	—4.35
*Sheep (slaughter)	—0.13	—0.33	—0.23	—4.35
*Coal, anthracite	+2.15	—2.65	—0.25	—4.00
Sugar	—0.01	—0.84	—0.42	—2.38
Lard	—1.27	—0.24	—0.76	—1.32
*Butter (receipts)	—0.76	—0.81	—0.78	—1.28
*Cotton (exports)	—0.89	—0.90	—0.90	—1.11
Bread	—0.21	—2.94	—1.58	—0.63
*Asphalt	—34.75	+0.44	—17.16	—0.06
*Autos, passenger	—132.27	+22.00	—55.14[a]	—0.02

For convenience of classification these coefficients are given to two decimal places. This does not imply accuracy to the second decimal place.

* Cyclical variability significant.

[a] When the measure of price change during expansion or contraction, is close to zero the coefficient of elasticity may be very large. It will, moreover, be subject to considerable variation in magnitude, and to alteration in sign, with slight shifts in the price measure. In such cases the sign of the coefficient may not be particularly revealing, without reference to the underlying measurements. Thus iron ore and automobiles, which stand at opposite ends of Table 9, were much alike in their cyclical movements, with wide, positively conforming quantity changes and slight price changes. In phases of expansion, however, the net movement of iron ore prices, as averaged for all cycles, was positive (+0.2 in reference cycle relatives) while the net movement of automobile prices was negative (—0.5). This minor difference in net price changes leads to the difference in the signs of the two coefficients of elasticity. Of the commodities listed only flour, in addition to automobiles and iron ore, was marked by a net price change, in expansion or contraction, of less than 1.

Coefficients of price flexibility would be similarly affected by slight shifts in the net movements of the quantity factor, when the quantity measure is close to zero. Eggs, hogs (slaughter), and sugar were characterized by net changes in physical volume of less than 1, in periods of expansion or contraction.

Under the same conditions (i.e., when either the price or quantity measure is about zero) full cycle measures of elasticity and flexibility are subject to similar variations with slight shifts in the basic measures. To this variability is added a technical difficulty in obtaining an unequivocal average when the phase coefficients differ in sign. Full cycle coefficients of elasticity and flexibility derived by averaging phase coefficients of opposite sign are not open to interpretation in customary terms.

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erally prevailing on the supply side. Among the commodities having positive price and quantity relations the range of the coefficients of elasticity is from +344.44 for iron ore to +0.01 for hogs. The negative coefficients range from —132.27 for passenger automobiles to —0.01 for sugar. Durables, chiefly metal products, predominate among the goods that are elastic in their quantity movements, but shoes, flour, paper, and gasoline are high on this list. Quantity inelasticity and high price flexibility (positive or inverse) are found among farm products and foods, though raw silk, petroleum, lumber, and lead appear also in this part of the list.

The elasticity measurements for the phase of contraction range, on the positive side, from +28.60 for iron ore to +0.04 for corn, on the negative side, from —2.94 for bread to —0.08 for meat. Forty-two of the 64 commodities show positive relations between price and quantity changes, 22 negative relations. In contraction, as in expansion, forces related to business cycles are generally stronger than the more specific forces making for inverse relations between prices and quantities. We note, too, that the commodities marked by high elasticity of quantities in expansion usually show above-average elasticity in contraction, while inelasticity in expansion is paired with inelasticity in contraction. Asphalt, gasoline, and rubber, all of which are highly elastic in expansion and inelastic in contraction, are notable exceptions. The proportion of commodities for which quantities are elastic (and price inflexible) is somewhat higher in expansion than in contraction (34 out of 64 in expansion, 26 out of 64 in contraction). For the sample of commodities here studied, a majority is marked by volume elasticity in expansion, by price flexibility in contraction. Quantities are freer to rise than are prices; prices are freer to fall than are quantities. Finally, we observe that in contraction, as in expansion, an extraordinary range of variation among these coefficients reflects wide diversity in the relative responsiveness of commodity prices and quantities to the forces of business cycles and to pressures originating in particular markets.

Composite Records

From these individual records we pass to the general picture of the related movements of commodity prices and quantities during business cycles. A graphic presentation of the composite pattern is given in Chart 3,[7] based upon the average standing of the 64 commodities here studied at each of nine stages of business cycles. The coordinates and derived descriptive measurements appear in Table 10.[8] These measures and those in

TABLE 10

Movements of Prices and Quantities in Business Cycles
All Commodities

A: AVERAGE STANDING AT REFERENCE CYCLE STAGES

	I	II	III	IV	V	VI	VII	VIII	IX
Price	94	99	104	110	112	110	99	91	90
Quantity	90	98	101	108	112	107	99	94	94

B: JOINT VARIABILITY IN REFERENCE CYCLES

	JOINT VARIABILITY	PERCENTAGE CONTRIBUTION TO JOINT VARIABILITY							
		Full Cycle		Expansion			Contraction		
		p	q	p	q	p+q	p	q	p+q
Av. reference cycle pattern	1,005	57	43	20	24	44	37	19	56

the tables that follow, it must be emphasized, relate to the average behavior of many commodities in many business cycles. Just as there are differences from commodity to commodity, so are there differences from cycle to cycle. In the process of aggregating and averaging we deliberately subordinate these differences and search for general and persisting patterns of behavior. But such an over-all average, it is clear, cannot accord perfectly with the pattern for any particular commodity or with aggregate movements in any particular business cycle.
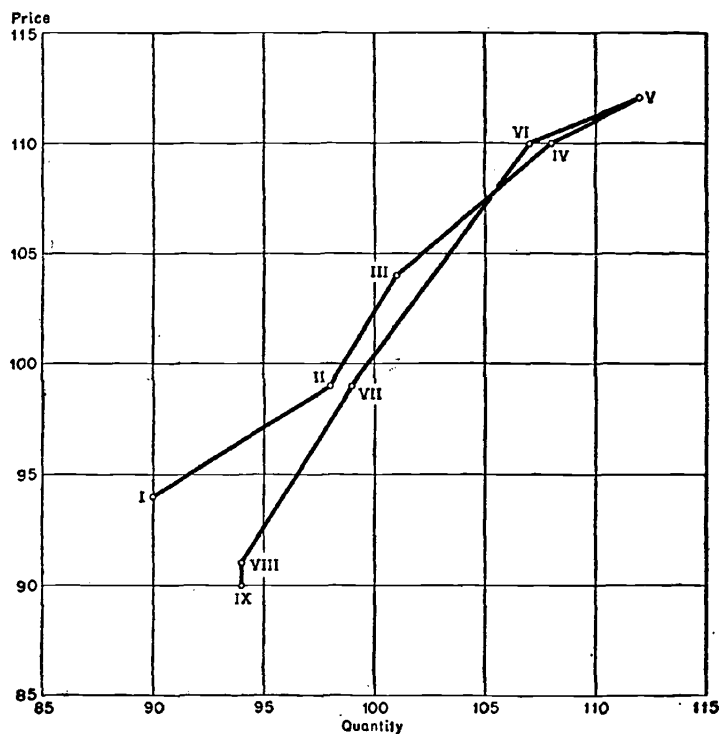
[7] Two methods of portraying such movements were noted in the preceding chapter. One involves the superimposing of price and quantity graphs, with an x-scale on which cyclical stages are marked off. We employ here a coordinate system, with reference cycle relatives for prices plotted on the y-scale, those for quantities plotted on the x-scale. While studying Chart 3, the reader may wish to examine the superimposed price and quantity graphs shown in Chart 5.

[8] In computing the coordinates that define the average pattern of price-quantity behavior, measures for individual commodities were equally weighted. No account was taken of differences in the number of cycles covered by the records for the various commodities.

Chart 3 reveals a pattern of price-quantity behavior generally characteristic of conforming series. Unit prices and quantities both increase between stages I and V of reference cycles, fall between stages V and IX. Neither movement is broken by shifts that reverse the general tide of expansion and contraction, but

CHART 3

Pattern of Related Price-Quantity Movements in Business Cycles, All Commodities

Averages by Cycle Stages

the decline in quantities is ended at stage VIII. Prices continue to decline at a low rate to stage IX.

The range of movement along the two scales of Chart 3 is the same, but the contributions of the price and quantity components to their combined variability is not the same. The averages defining the standing of the physical volume series at suc-

cessive cyclical stages are more closely concentrated about their mean than are the price averages. Of the combined variability of prices and quantities 57 percent is attributable to price fluctuations, 43 percent to quantity movements.[9] Prices fluctuate more widely than quantities, in the sense that their wider deviations from the cyclical averages persist over more stages of the cycle than do the more extreme deviations of quantities.[10] This is true, indeed, of the contraction phase alone, but the full cycle measures reflect this condition.

The contributions of the two phases of business cycles to the combined variability of prices and quantities are also unequal. Contraction accounts for 56 percent of the total, with prices heavily preponderant, while expansion accounts for 44 percent, with the quantity component slightly greater than that of price. Since the point of reference in the measurement of deviations is the cycle average, this means that divergence from the kind of business 'normalcy' represented by the average standings of prices and quantities in business cycles is greater during contractions than during expansions. The chief factor in the divergence, as here defined and measured, is the persistence of depressed commodity prices in the later stages of business contraction.

We see these movements of prices and quantities in a some-

[9] Prices are subject to relatively greater fluctuations during war cycles than during peacetime cycles. The exclusion of records for war cycles for all commodities yields the following figures, which are to be compared with those given in Table 10, Part B. When war cycles are omitted, the joint variability of prices and quantities is reduced by about one-eighth. The percentage contributions of prices and quantities are changed to 44 and 56, respectively, as compared with 57 and 43 when all cycles are included. In the peacetime record, therefore, changes in physical quantities are responsible for the larger proportion of the combined variability of prices and quantities. The exclusion of war cycles serves also to accentuate the role of the quantity factor in expansions, to reduce the importance of the price factor in contractions.

	JOINT VARIABILITY	PERCENTAGE CONTRIBUTION TO JOINT VARIABILITY							
		Full Cycle		Expansion			Contraction		
		p	q	p	q	p+q	p	q	p+q
Av. reference cycle pattern	878	44	56	17	31	48	27	25	52

[10] The use of squared deviations in deriving the aggregate measure of 'joint variability' gives extra weight to the sustained divergence of average prices from the reference cycle average.

what different light when we define the rates of change of the two factors by interstage periods (Table 11). A sharp initial rise occurs in quantities—indeed, the rate for this factor is at its maximum for the cycle between stages I and II. Thereafter, during expansion, the rate of increase in quantities is lower. It drops substantially between stages II and III, then recovers somewhat to stage V. During three of the four interstage periods of expansion quantities increase more rapidly than prices, the only exception being interstage period II-III. The initial drop in quantities, after stage V, is sharp, again well above the rate of decline in prices. Between stages VI and VII, however, the price decline is accelerated. In three of the four interstage periods of contraction the rate of price decline exceeds the rate of quantity decline. Maximum rates of price change for the whole

TABLE 11

Average Monthly Interstage Changes in Prices and
Quantities in Business Cycles, All Commodities

INTERSTAGE PERIOD	PRICE	QUANTITY
I-II	+1.1	+1.7
II-III	+0.6	+0.4
III-IV	+0.7	+0.9
IV-V	+0.6	+0.9
V-VI	—0.7	—1.6
VI-VII	—1.6	—1.1
VII-VIII	—1.3	—0.9
VIII-IX	—0.3	+0.1

The rates are derived from the average standings of prices and quantities of 64 commodities at reference stages (Table 10). The differences between the standings (computed to one decimal place) at successive stages are divided by the average number of months in the period in question, over the time span of the present observations. Thus the average duration of interstage period I-II is 4.6 months. (This is derived by dividing 2,394.5 months, the actual aggregate of the months covered by records for the 64 commodities for the period between stages I and II, by 520, the number of items in this aggregate.) Dividing the difference between 94.3 and 99.2 the average standings of prices at stages I and II by 4.6, we have +1.1 the average change in unit price, per month, for the 64 commodities. Measures are in terms of reference cycle relatives. The other entries in Table 11 were similarly derived. See Arthur F. Burns and Wesley C. Mitchell, *Measuring Business Cycles*, Ch. 5, for a fuller explanation of the measure of interstage change.

The use of stage averages carried to one decimal place in deriving the entries in Tables 11 and 12 accounts for certain minor differences between these tables and Table 10. (The slight rise in quantity between stages VIII and IX is not apparent in the rounded figures of Table 10.)

cycle, indeed, occur between stages VI and VIII. In the terminal period of contraction both prices and quantities are nearly immobile—a situation unlike that prevailing in the final stage of expansion, when both factors push upward. The reversal of direction at stage V is sharper and more pronounced for the quantity factor than is the turn of the tide when contraction gives way to expansion. Expansion gets under way with relatively sharp acceleration, it is true, but this follows a stage of semi-stagnation.[11]

From the average pattern of reference cycle behavior for all 64 commodities (Chart 5 and Table 10), we have derived measures of the elasticity of physical quantities and the flexibility of unit prices for interstage periods, for expansion and contraction, and for the full cycle (Table 12). The record for the full cycle shows that quantities and unit prices move in general in the same direction, under the pressure of cyclical forces, and differ but slightly in their average rates of change. By convention, we should classify the quantity movements as elastic (positively), the price movements as inflexible (positively), since the coefficient e is greater than unity while f is less than unity. But the difference is too small to be significant.

If we go behind the approximate equality of the price and quantity measures for the full cycle we find notable differences in behavior from phase to phase and from stage to stage of reference cycles. The phase coefficients tell an illuminating story of related quantity and price changes in business cycles. During

[11] The comments of this and the following paragraphs apply to the sample of 64 commodities for which price and quantity series are here compared. More comprehensive (but less comparable) price and physical volume index numbers show some differences of behavior. In particular, general index numbers of industrial production show acceleration of decline from interstage period V-VI to VI-VII. This is notably true of durable manufactured goods and of mining production. The general index of consumer goods production shows a maximum rate of decline in period V-VI, however. The acceleration of price decline shown by the present evidence is apparent also in the behavior of general price index numbers. (Cf. the rates of price change given in Ch. 5, note 9.)

The index of industrial production of the Federal Reserve Board, covering only five recent cycles, reveals no difference in the sharpness of reversal of movement at the peaks and troughs of business cycles; the more comprehensive Babson index of volume of business activity, covering eight business cycles, indicates semi-stagnation between stages VIII and IX and a much sharper reversal at peaks than at troughs.

TABLE 12

Measures of Elasticity of Quantities and Flexibility of Prices in Business Cycles, All Commodities

| | STAGE MEASURES | | | | | | | |
| | Interstage Period | | | | | | | |
	I-II	II-III	III-IV	IV-V	V-VI	VI-VII	VII-VIII	VIII-IX
Elasticity	+1.59	+0.69	+1.34	+1.47	+2.34	+0.71	+0.69	—0.32
Flexibility	+0.63	+1.45	+0.75	+0.68	+0.43	+1.41	+1.45	—3.12

| | PHASE MEASURES | | FULL CYCLE MEASURE |
	Expansion	Contraction	Av. of expansion and contraction
Elasticity	+1.25	+0.81	+1.01 a
Flexibility	+0.80	+1.23	+0.99 a

a For formal consistency between measures of elasticity and flexibility for the full cycle, as derived by averaging elasticity measures and their reciprocals for the separate phases of expansion and contraction, the geometric mean of arithmetic and harmonic means of the separate measures should be employed. The full cycle measures for all commodities are of this type. Full cycle measures for individual commodities and commodity groups given in other tables are derived by averaging (arithmetically) coefficients of elasticity for expansion and contraction. Flexibility coefficients for the full cycle are reciprocals of the coefficients of elasticity.

periods of general business expansion physical volume increases 1.25 percent for every 1 percent rise in price. During contractions commodity prices decline 1.23 percent, on the average, for every 1 percent fall in physical volume. We shall find wide differences among commodity groups in the correlated behavior of quantity and price, but for the aggregate of commodities here studied quantity is elastic, positively, in response to the stimulations of expansion and unit prices are flexible, positively, under the pressures of contraction.[12]

We trace these relations more closely in the measures for interstage periods. Quantities are elastic, relatively, in three of the four interstage periods of expansion (in period II-III alone

12 The exclusion of war cycles, which are marked by relatively wide price movements, yields the following measures for all commodities. The elasticity of quantities is increased, the flexibility of prices substantially decreased, when war cycles are left out. Prices are more flexible in expansion than in contraction, but the coefficient f remains below unity, even in contraction, under peacetime conditions.

| | PHASE MEASURES | | FULL CYCLE |
	Expansion	Contraction	MEASURE
Elasticity of quantities	+1.54	+1.02	+1.25
Flexibility of prices	+0.65	+0.98	+0.80

are prices more responsive than quantities to cyclical pressures), inelastic in three of the four interstage periods of contraction (in period V-VI alone are quantities more responsive than prices to cyclical pressures). All the interstage measures are positive (indicating direct relations between price and quantity changes) except that for the terminal period of contraction (VIII-IX). At this final stage prices are declining and quantities increasing, but the increase in quantity is relatively less rapid than the decline in price, and the coefficient *e* is below unity.

The coefficients for the eight interstage periods show a distinct and suggestive pattern of change. After the decline in the elasticity of quantities after stage II, there is a progressive increase in the stage elasticity of physical quantities (and a corresponding progressive decline in the flexibility of unit prices) between periods II-III and V-VI of reference cycles. We may think of these two factors as representing alternative means by which markets respond to and adapt themselves to the pressures of rising demand during business expansion, of declining demand during contraction. After the reversal of the second period, accommodations are effected in increasing degree through physical output. Prices become decreasingly flexible, relative to quantities. There is a sharp contrast indeed between the situation prevailing between stages II and III, when prices advance 1.45 percent for every 1 percent rise in quantity, and that in the final period of reference expansion (IV-V) when prices advance only 0.68 percent for every 1 percent rise in quantity. These growing strictures on prices, relative to the forces affecting output and sales, are a notable feature of the present evidence bearing on the later stages of business expansion.

In the first period of contraction (V-VI) quantities drop sharply, while prices decline but slightly. Thereafter the record is the exact opposite of that for expansion. There is a pronounced and progressive decline in the elasticity of quantities (and a progressive increase in the flexibility of unit prices). Quantity falls at a declining rate, relative to prices; prices decline at accelerating rates, relative to quantities. Between stages V and VI prices decline 0.43 percent for every 1 percent fall in

quantities; between stages VII and VIII average unit prices fall 1.45 percent for every 1 percent fall in quantities. As general contraction spreads, and pervades the economy, resistances to continuing reductions in physical quantity are stronger, rela- tively, than the resistances to continuing price declines. Price is distinctly the more responsive factor, in all except the first period of business contraction.

Commodity Groups

In getting the average pattern of price-quantity behavior dur- ing business cycles we have thrown records for a wide variety of commodities into a single composite. The picture that emerges reflects the tides of cyclical change with rather high consistency. Certain suggestive differences between prices and quantities in their cyclical behavior have been discussed in pre- ceding pages. We shall get more insight into these differences if we examine the market behavior of the various kinds of goods that make up our composite. Price-quantity patterns for six- teen major classes of goods are shown graphically in Chart 4.[18] (Each group pattern is derived by averaging the stage measure- ments defining the patterns of the individual commodities be- longing to that group. Examples of individual commodity

[18] These groups are described in Appendix Table 2. The reader should note that certain of the groups are mutually exclusive (raw materials and manufactured goods; American farm products and products other than American farm prod- ucts; crop and animal products, metals, and nonmetallic minerals; durable goods and nondurable goods). Other categories are not mutually exclusive. (Gasoline is both a producer good and a consumer good; so are coke, passenger automo- biles, lubricants, and many other goods. Pig iron, passenger automobiles, lumber and other goods are both human consumption goods and goods intended for use in capital equipment or as building materials.) The commodity classes thus include overlapping and exclusive categories. Moreover, the categories cut across one another in diverse ways. Butter is a manufactured good, an Amer- ican farm product, an animal product, a consumer good, a human consump- tion good, a nondurable good, and a food product.

The captions of the groups are largely self-explanatory. A consumer good is one that is in shape for final consumption; a producer good is one that is intended for instrumental use (in capital equipment) or one that requires further fabrication if it is intended for human consumption. A human con- sumption good is one that is intended for ultimate human consumption, either in its present shape or after further fabrication. Producer goods destined for human consumption are those that will become consumer goods after further fabrication. All categories except raw and manufactured goods cut across the raw-processed division. Thus American farm products include manufactured as well as primary products.

CHART 4

Patterns of Related Price–Quantity Movements in Business Cycles
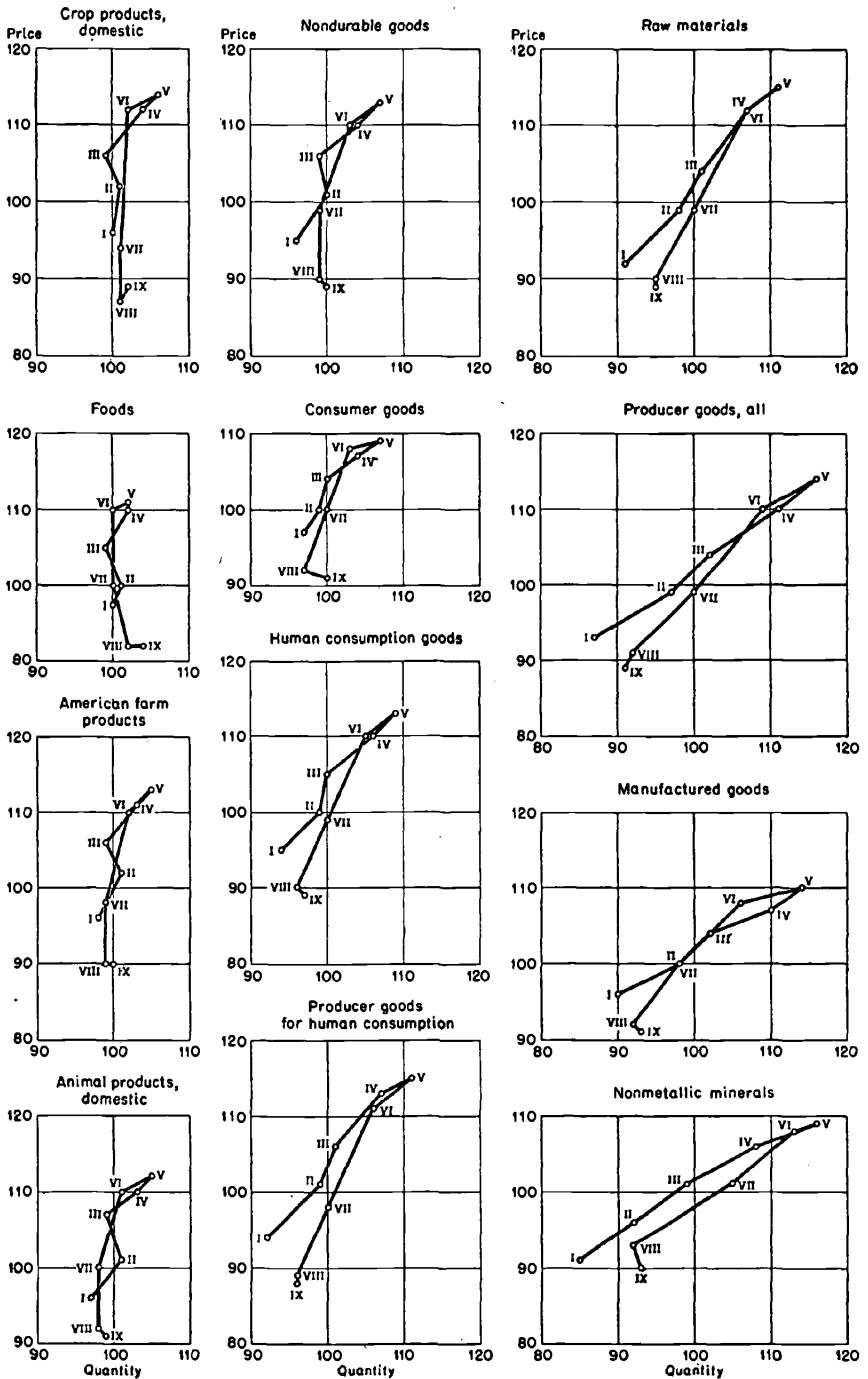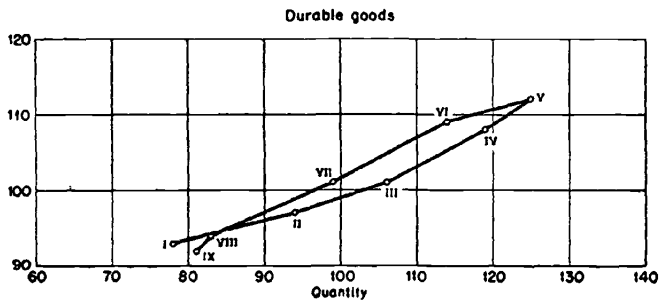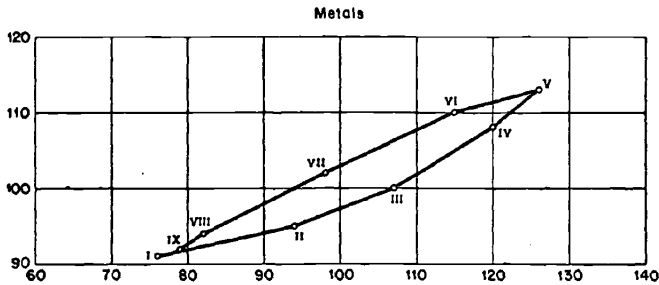## Sixteen Major Commodity Groups — Averages by Cycle Stages

CHART 4 (continued)

Patterns of Related Price-Quantity Movements in Business Cycles
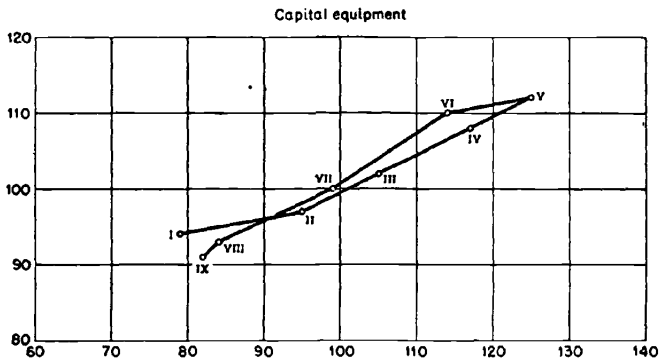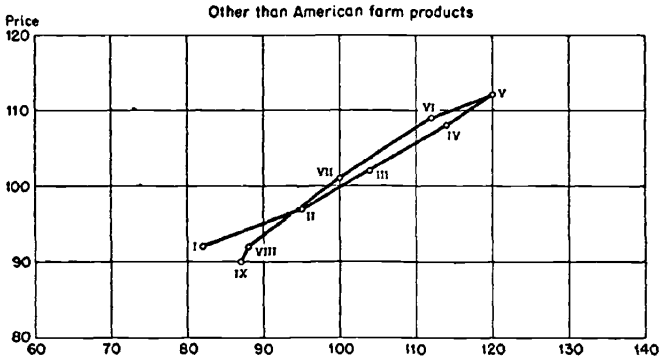# Sixteen Major Commodity Groups — Averages by Cycle Stages

Other than American farm products

Capital equipment

Metals

Durable goods

patterns are shown in Chart 2.) The coordinates here plotted are given in Appendix Table 3, and derived measurements are presented in Table 13.

The patterns in Chart 4 differ in many respects. One obvious difference has to do with the amplitude of the fluctuations traced in the several diagrams. Measures of the combined variability of prices and quantities are set forth in Table 14 where the groups are arrayed in the order of the absolute magnitude of the joint movements. Among the groups most sensitive to business cycles are metals, durable goods, and capital equipment—familiar products of the heavy industries that are traditionally princes or paupers. At the other extreme are consumer

TABLE 13

Measures Descriptive of Joint Cyclical Behavior
of Prices and Quantities, All Commodities and Groups

| | JOINT VARIABILITY | PERCENTAGE CONTRIBUTION TO JOINT VARIABILITY | | | | | | | | |
| | | Full cycle | | Expansion | | | Contraction | | |
		p	q	p	q	p+q	p	q	p+q
All commodities	1,005	57	43	20	24	44	37	19	56
Raw materials	1,155	69	31	27	17	44	42	14	56
Manufactured goods	940	41	59	12	33	45	29	26	55
American farm products	665	93	7	29	4	33	64	3	67
Other than American farm products	1,949	27	73	11	39	50	16	34	50
Crop products, domestic	887	96	4	29	3	32	67	1	68
Animal products, domestic	570	90	10	31	6	37	59	4	63
Metals	3,273	17	83	8	43	51	9	40	49
Nonmetallic minerals	1,345	32	68	13	36	49	19	32	51
Producer goods, all	1,440	46	54	17	29	46	29	25	54
Producer goods for human consumption	1,130	74	26	25	15	40	49	11	60
Consumer goods	445	80	20	21	11	32	59	9	68
Capital equipment	2,664	18	82	7	41	48	11	41	52
Human consumption goods	805	78	22	26	11	37	52	11	63
Foods	470	96	4	30	1	31	66	3	69
Durable goods	2,833	16	84	7	43	50	9	41	50
Nondurable goods	724	88	12	30	8	38	58	4	62

goods, foods, farm products, and nondurable goods. (Each group overlaps various other groups, of course.) The range of difference is wide; the joint variability of metals is more than seven times that of consumer goods.[14]

The entries in Table 14 indicate the magnitude of the cyclical fluctuations to which markets for various types of goods are exposed during cycles in general business. These fluctua-

TABLE 14

Commodity Groups in Order of Joint Cyclical Variability of Prices and Quantities

	JOINT VARIABILITY
Metals	3,273
Durable goods	2,833
Capital equipment	2,664
Other than American farm products	1,949
Producer goods, all	1,440
Nonmetallic minerals	1,345
Raw materials	1,155
Producer goods for human consumption	1,130
All commodities	*1,005*
Manufactured goods	940
Crop products, domestic	887
Human consumption goods	805
Nondurable goods	724
American farm products	665
Animal products, domestic	570
Foods	470
Consumer goods	445

tions are composites of changing physical quantities and varying unit prices. Changes in either factor bring stimulation in their advances and uncertainty, approaching demoralization, in their rapid declines. The relative intensity of the combined effects of these two factors and the degree of alternating stimulation and depression to which producers of various classes of goods are exposed are suggested by the measures of joint varia-

[14] It will be recalled that the measure of joint variability is the sum of the squared deviations of individual observations from the point of averages. The process of squaring accentuates the differences. If we use, as an alternative measure of variation, the amplitude of the cyclical swings in monetary values, the range of difference is narrower, extending from a low of 34 for foods to a high of 138 for metals (these are reference cycle amplitudes). The two measures differ, of course, in derivation and meaning.

bility. But each of these is the sum of price and quantity components, and the groups differ widely in the relative importance of the two components. The graphs in Chart 4 and the entries in Table 15 illuminate the roles played by prices and quantities in these combined movements.

TABLE 15

Commodity Groups in Order of Price Contribution
to Joint Cyclical Variability of Prices and Quantities

	PRICE CONTRIBUTION (percent)
Crop products, domestic	96
Foods	96
American farm products	93
Animal products, domestic	90
Nondurable goods	88
Consumer goods	80
Human consumption goods	78
Producer goods for human consumption	74
Raw materials	69
All commodities	57
Producer goods, all	46
Manufactured goods	41
Nonmetallic minerals	32
Other than American farm products	27
Capital equipment	18
Metals	17
Durable goods	16

The patterns in Chart 4 are arranged in the order of the relative contributions of prices to the combined price-quantity variability. Movements on the vertical axis, it will be recalled, define price changes from stage to stage of reference cycles; movements on the horizontal axis define quantity changes. Thus the inclination of each group pattern serves as an index of the roles played by the two factors in the market adjustments during business cycles. At the top are products of domestic crops.[15] Price movements account for 96 percent of the combined cyclical variability of prices and quantities of crop products. Between stages III and VI alone do quantities appear to vary in any consistent way with the cyclical movements of general business.

[15] Our quantity series define consumption, meltings, grindings, exports, shipments, and the production of various derived products measurable on a monthly basis, not the annual output of cotton, corn, and other crops.

For foods, animal products, farm products in general, and non-durable goods price movements are also predominantly responsible for the observed joint variability. All these categories overlap, of course, with agricultural products bulking large in each. It is characteristic of these goods that basic output is not readily controllable by producers during the periods covered by business cycles or that cost conditions are such that curtailment of output on short order is not expedient. Producers' commitments in respect of output are made well before the time of final production, and natural forces rather than human decisions are the chief factors operating thereafter. These conditions are clearly reflected in the price-quantity patterns for these types of goods, which are ranged almost vertically. Prices reflect the pressures of cyclical advances and absorb the shocks of cyclical declines. Quantities vary only slightly from stage to stage of business cycles. (There are, of course, fluctuations of considerable amplitude in most series measuring the output of agricultural products, but they do not agree regularly in timing with cycles in business at large. Hence the reference cycle patterns, which we are studying here, show but a small part of the amplitudes of the cycles specific to the various individual series.)

Goods intended for human consumption, such goods in final form for consumption, and the broad class of raw materials are also in the upper section of the chart (and of Table 15) with prices playing the chief role in cyclical adjustments. In markets close to the initial stage of extraction and to the final stage of consumption prices vary more than quantities during business cycles. The operative conditions are far from the same in these two types of market. The previously noted characteristics of supply place their impress on the primary markets; relative stability of consumption, particularly of nondurable goods, is a major circumstance influencing markets for consumption goods. But the net result is somewhat the same—relative constancy of quantities as business cycles run their course, relatively high variability of prices as demand waxes and wanes during the expansions and contractions of general business.

Markets intervening between initial production and final

consumption are heavily represented among the classes of goods listed in the lower half of Table 15 and depicted in the third and fourth columns of Chart 4. For producer goods (goods not yet in shape for final use in consumption and goods intended for instrumental use rather than direct consumption) price movements contribute only 46 percent to the joint variability of prices and quantities; quantity fluctuations contribute 54 percent. The price percentage is lower (41) for manufactured goods. It is much lower for metals and other minerals, for non-farm products, and for capital equipment. It is lowest of all for the general class of durable goods, 16 percent; the quantity contribution is 84 percent of the combined variability. The figure for durable goods in Chart 4 is closest to the horizontal, in its inclination. The quantity factor responds sensitively and immediately to the forces of general expansion and contraction; prices move uniformly and symmetrically, but the price movements are relatively modest.

For one important purpose we must go behind measures of relative price and quantity contributions, and study the absolute magnitudes of the two components (Table 16). The order of listing is slightly different from that in Table 15, but chief interest attaches to the widely different ranges of the two sets of absolute figures. For prices, the range extends from 37 percent below the all commodity average (consumer goods) to 49 percent above (crop products). On the quantity scale the measures of cyclical variability range from 96 percent below the all commodity average (foods) to 528 percent above (metals). The measures of average variability for prices and quantities are not far apart—the price average is slightly greater—but in their internal dispersion the two are poles apart. The meaning, of course, is that unit prices of commodities are far more homogeneous in the magnitude of their response to cyclical forces than are physical quantities. There are ties among prices that have no counterpart among physical series.

For all commodities the absolute variability of quantities is greater in the expansion phase of business cycles than in contraction (see Table 13 and Chart 3). A secular growth factor, together with a typical stoppage of cyclical decline after stage

TABLE 16

Commodity Groups in Order of Absolute Magnitudes of Price and Quantity Contributions to Joint Cyclical Variability

	QUANTITY VARIABILITY		PRICE VARIABILITY
Metals	2,731	Crop products, domestic	851
Durable goods	2,389	Producer goods for human	
Capital equipment	2,182	consumption	833
Other than American farm		Raw materials	801
products	1,418	Producer goods, all	656
Nonmetallic minerals	917	Nondurable goods	636
Producer goods, all	784	Human consumption goods	628
Manufactured goods	557	American farm products	622
All commodities	*435*	*All commodities*	*570*
Raw materials	354	Metals	542
Producer goods for human		Other than American farm	
consumption	297	products	531
Human consumption goods	177	Animal products, domestic	515
Consumer goods	88	Capital equipment	482
Nondurable goods	88	Foods	451
Animal products, domestic	55	Durable goods	444
American farm products	43	Nonmetallic minerals	428
Crop products, domestic	36	Manufactured goods	383
Foods	19	Consumer goods	357

VIII, contributes to this condition. This same condition, greater absolute variability of physical quantities during phases of reference expansion, is found among the various commodity groups, except goods for human consumption and the smaller group of foods.[16] The reverse is true, without a single exception, of prices. Mutable prices are an outstanding feature of business contractions. The divergence of prices from the cyclical average was distinctly more marked during contractions than during expansions, in the period covered by these records. [17] (Secular forces make some contribution to this result, in the present sample.)

[16] The difference between the figures for expansion and contraction is small for consumption goods and capital equipment. The present statement is based upon measures carried to a first decimal place.

[17] This evidence, which suggests that the quantity factor is a dominant lifter during business expansions, and that the price factor is a major depressant during business contractions, should be supplemented by more comprehensive observations. The severe contractions of 1920-21 and of 1929-33 are fairly heavily weighted in this sample, but the same relations prevail, for many commodities, in other reference cycles. We should note that for both quantities and prices the effects of secular factors are intertwined with those of cyclical forces.

From the average patterns of price-quantity behavior in reference cycles, measures of the elasticity of quantities and of the flexibility of unit prices have been derived for major commodity groups (Table 17). All the group measures for the full

TABLE 17

Commodity Groups in Order of Elasticity of Quantities and, Inversely, in Order of Flexibility of Prices in Business Cycles

| | PHASE MEASURES, ELASTICITY | | FULL CYCLE MEASURES | |
	Expansion	Contraction	Elasticity	Flexibility
Durable goods	+2.49	+2.18	+2.34	+0.43
Capital equipment	+2.59	+2.01	+2.30	+0.43
Metals	+2.29	+2.24	+2.26	+0.44
Other than American farm products	+1.92	+1.46	+1.69	+0.59
Nonmetallic minerals	+1.71	+1.15	+1.43	+0.70
Manufactured goods	+1.73	+1.08	+1.40	+0.71
Producer goods, all	+1.41	+0.98	+1.20	+0.83
All commodities	*+1.25*	*+0.81*	*+1.01*[a]	*+0.99*
Raw materials	+0.89	+0.61	+0.75	+1.33
Producer goods for human consumption	+0.93	+0.55	+0.74	+1.35
Human consumption goods	+0.85	+0.49	+0.67	+1.49
Consumer goods	+0.84	+0.38	+0.61	+1.64
Nondurable goods	+0.63	+0.28	+0.46	+2.17
Animal products, domestic	+0.51	+0.29	+0.40	+2.50
American farm products	+0.42	+0.22	+0.32	+3.12
Crop products, domestic	+0.34	+0.16	+0.25	+4.00
Foods	+0.14	—0.11	+0.02	+50.00

[a] See note to Table 12.

cycle are positive, an indication that within the framework of reference cycles forces related to business cycles are more powerful in determining price and quantity movements than are the narrower market influences that work toward inverse relations. The ranges are extensive, however—from 0.02 to 2.34 for e (from 50 to 0.43 for f). Perhaps no observations so far reviewed provide more impressive evidence concerning the diversity of market behavior patterns in business cycles. Quantities are most elastic (and prices least flexible) for durable goods, goods intended for use in capital equipment and building, minerals, manufactured goods, and producer goods—a showing quite in accord with expectation, and with evidence previously reviewed. For these goods, physical quantities change from 1.20 percent

(producer goods) to 2.34 percent (durable goods) for every 1 percent change in price during business cycles. However, 9 of the 16 major commodity groups are marked by flexible prices (i.e., the coefficient f exceeds unity). Foods, farm products, nondurables generally, consumption goods, and raw materials are all of this type. For these goods prices change from 1.33 percent (raw materials) to 50 percent (foods) for every 1 percent change in quantities.

The elasticity measures for expansion and contraction are positive for all groups, except foods, for which quantities show a small net increase during business contractions, while prices drop. Among all other groups, as we pass from expansion to contraction, we find the decline in (positive) elasticity of quantities and the increase in (positive) flexibility of prices remarked in the all commodities pattern. It is generally characteristic of commodity markets that the responsiveness of quantities, viewed in relation to prices, is greater during general business expansion than during contraction; for prices relative responsiveness is greater during contraction.[18]

In Table 17 we have not set up the commodity groups in combinations corresponding to the original classifications, but the reader may find it interesting to do so. Sharp differences of behavior would be brought out thereby. With respect to prices in full cycles, raw materials are flexible (i.e., f is greater than 1), manufactured goods inflexible; farm products are flexible, nonfarm products inflexible; consumer goods are flexible, producer goods inflexible; goods for human consumption are flexible, capital goods inflexible; nondurable goods are flexible, durable goods highly inflexible. The observed differences accord with generally familiar evidence, but these measures give desirable precision to the record.

[18] The restricted meaning of measures of elasticity and flexibility derived from reference cycle relatives is to be emphasized. Price or quantity fluctuations that are not synchronized with cycles in general business will be dampened or eliminated when the reference cycle frame is imposed; the coefficients e and f will be correspondingly affected. To supplement the reference cycle record the fluctuations of physical quantities must be studied within a frame provided by specific cycles in the prices of individual commodities, and the fluctuations of commodity prices must be studied within a frame provided by specific cycles in the corresponding physical quantity series. Coefficients based on these additional studies will appear in a later report.