Divergent Income Paths: How Economic Growth Outruns Farmers and the Uneducated

Lesley Emerson, October 22, 2019

Abstract

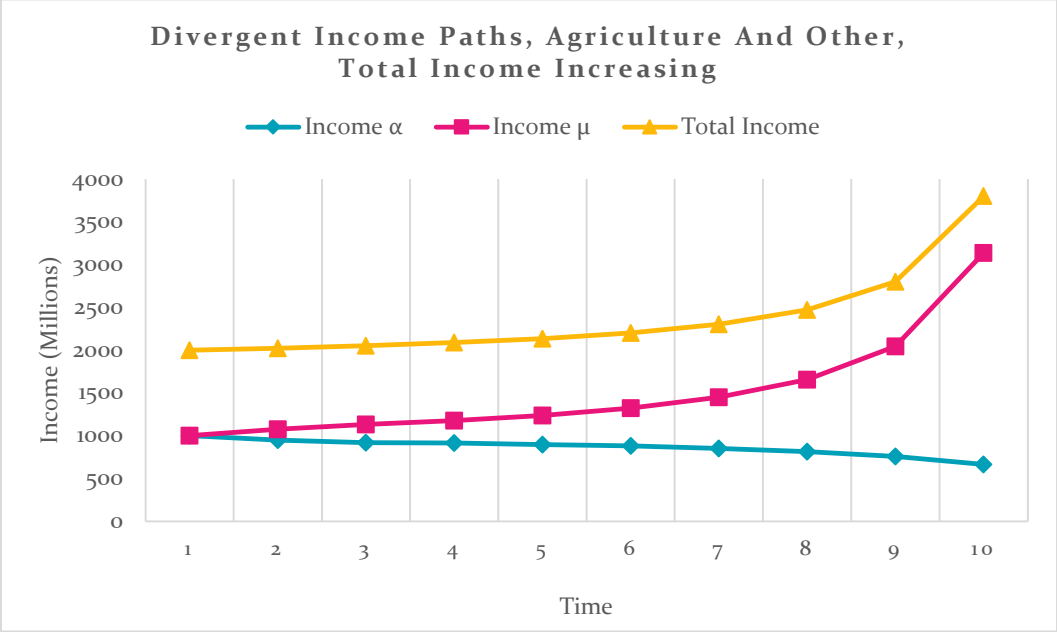
This paper presents an innovative two-path growth model, based on accepted economic principles, of the long-run process of change from an agrarian society to an industrially and technologically-advanced economy. We show how economic growth impoverishes world agriculture, by investigating changes in sectoral incomes - with associated changes in total regional incomes and rates of job-creation, even in economies open to trade - and the relationships of these income-changes to productivity-advance. In a more-formal development, two production functions depend on factor inputs and the overall level of technological knowhow in the economy; embodiment of technological inventiveness in the real world is driven by demand elasticities.

The two-path long-run growth scenario provides a framework within which to understand:

- Urban growth, with economic dynamism and job-creation in urban regions
- Agricultural loss of income share and population; low or declining job-creation; loss of nutritional quality in modern food commodities
- The increasing importance of education as economic growth and development occur
- Skill-biased technological change
- Economic dualism; the advent of the information age; and various types of cost diseases

We infer, from the two-path scenario for the relationship of agriculture to the rest of the economy, a similar two-path scenario for neighborhoods in which low-quality education repels businesses, leads to unemployment, and hence to declining neighborhood income. Our innovative analytical framework is consistent with empirical anomalies that have confounded other theoreticians.

Preview



V.F. The two-path scenario accommodates heterogeneous outputs and factor inputs

The two-path scenario analysis can easily support many goods; we deal with sectoral demand, so that demand for the output of each sector as a whole is elastic or inelastic. There is no need to specify a single good, or output mix, for each sector.

Let us now assume that there are many goods in each sector and that the number of these goods increases over time, as it does in a growing economy. We continue to assume a constant quantity of money circulating, MV = K. Then we can understand how, as the same money chases more goods, the nominal prices of *all* goods can decline. Relative prices cannot all decline.

Thus, we may model the real world just as well by analyzing the relative incomes of two sectors, as by investigating relative prices and factor-incomes in a two-good economy. We are now ready to present the scenario more formally.

VI. The two-path long-run growth scenario; two examples, with tables and diagrams

We offer a first step toward a new approach, and as such, we introduce it by means of examples, in the forms of tables and diagrams. There are two types of diagrams: elasticity diagrams, and income-path diagrams.

The data described by the tables and diagrams, are invented, but not arbitrary. There are some very specific relationships among the two sectors and the money circulating in the economy. The scenario has two consumption-good sectors, α (agriculture) and μ (manufacturing and services, or "the rest of the economy").

VI.A Initial presentation: money circulating does not increase over time

For the initial presentation, the quantity of money in circulation (MV) is constant (=K). The tables represent not only the theoretical, or unseen, relationship between price, quantity, and income for each sector at a point in time, as conventional supply-demand charts may do, but also the consequences for sectoral incomes, over time, of actual price changes. (The underlying assumption, in order that the same data can represent these two different situations, is that demand relationships remain constant over time.[1]) This assumption permits us to keep focus on the main point of the argument, that the distribution of money income within the closed economy is a zero-sum game.

VI.A.i. Demand and price elasticities, α and μ. In the tables and diagrams, we assume one good for each sector. This is, again, to maintain focus on the relationship between sectoral incomes. Each period (1, 2, etc.) represents the same time period in each table (that for α and that for μ). The total income in each period (income to α plus income to μ) adds up to $2000m, the money income in the economy (= MV = K).

1. This can be true if there are only two goods and if their prices change in such a way, as total output increases, that consumers' demand curves for each of them remains the same as it was in previous periods.

Table 2 below represents demand for the output of α, the agricultural sector.

Demand for the Output of α

Period	Quantity (Millions)	Price	Sectoral Income (Millions)	Total Income (or Revenue) (Millions)
1	100	10	1000	2000
2	104	9	936	2000
3	112	8	896	2000
4	125	7	875	2000
5	140	6	840	2000
6	160	5	800	2000
7	185	4	740	2000
8	220	3	660	2000
9	270	2	540	2000
10	350	1	350	2000

Table 2: Relationships among price, quantity, time period, and income for α

The sectoral income of α, the agricultural sector, declines as productivity advances and output increases. For agricultural products, when output increases in a closed economy, prices decline and $E_d < 1$ so that producers' income declines. (In this section, E_d is the price elasticity of demand.)

These invented data have similar properties to those of invented data in Principles of Economics textbooks. They are meant to illustrate a point, and the point here is that, as the price of the agricultural good or sector declines, the quantity demanded increases, but not enough to offset the decline in price, so that total income to the sector declines. ($E_d < 1$; this is a property of inelastic demand.)

The graph of these data is shown in Figure 5. The x axis can represent either quantity demanded at one period of time as the price may theoretically change, or actual quantity demanded as time passes, productivity increases, and the actual price declines. (That is, quantity produced increases over time, so that we take a journey along the demand curve from left to right, with income changing as we move from points A to B to J).

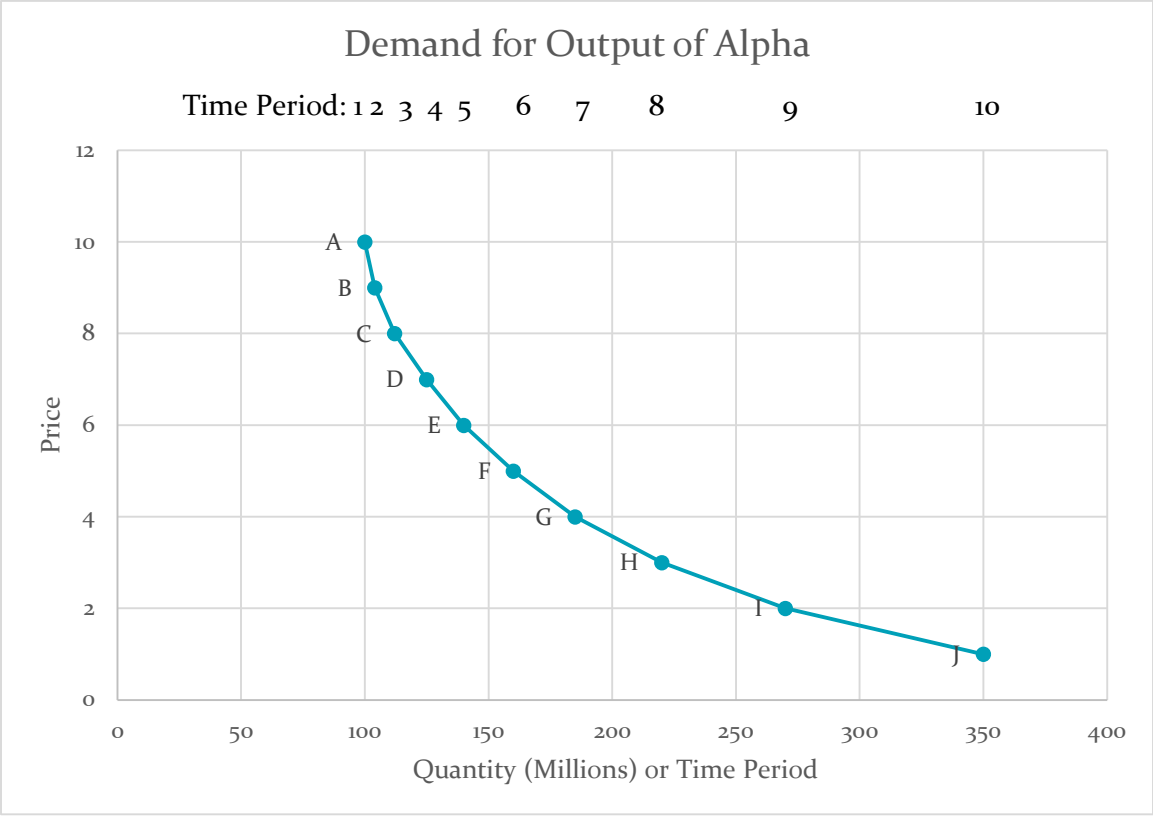


Figure 5: Demand for Output of α, as Price Declines and Time Advances

Time period is represented at the top of the figure. Observe that time periods on the figure are not related to one another by the usual proportional scale. This will give a hint regarding the nature of the eventual, mathematically generated, income paths of the two sectors over time.

At point E where P = 6, Q = 140, farmers' income (sectoral income) is represented by area 0,6,E,140, = 6 x 140 = 840

At point G where P = 4, Q = 185, sectoral income is represented by area 0,4,G,185, = 4 x 185 = 740

Area 0,4,G,185 is smaller than the area 0,6,E,140 and thus we can see on the diagram as well as in the chart, that sectoral income declines when moving from point E to point G.

Turning now to the "rest of the economy," Table 3 represents demand for the output of μ, the manufacturing and services sector, representing the non-agricultural share of the economy.

μ is the manufacturing and services sector. Its income increases as productivity advances and output increases, because, for the non-agricultural sector, when output increases, prices decline and Ed > 1, so that producers' income increases.

Demand for Output of μ

Period	Quantity (Millions)	Price	Sectoral Income (Millions)	Total Income (or Revenue) (Millions)
1	100	10	1000	2000
2	118	9	1064	2000
3	138	8	1104	2000
4	161	7	1125	2000
5	193	6	1160	2000
6	240	5	1200	2000
7	315	4	1260	2000
8	447	3	1340	2000
9	730	2	1460	2000
10	1650	1	1650	2000

Table 3: Relationships among price, quantity, time period, and income for μ

As for α above, these invented data have similar properties to those of invented data in Principles of Economics textbooks. They are meant to illustrate a point, and the point here is that, as the price of the manufactured good, or the overall price level in its sector, declines, the quantity demanded increases, more than enough to offset the decline in price, so that total income to the sector increases. Ed > 1, and this is a property of elastic demand.

The graph of these data is shown in Figure 6. Please note that the x axis can represent either quantity demanded at one period of time as the price may theoretically change, or actual quantity demanded as time passes, productivity increases, and the actual price declines. (That is, quantity produced increases over time, so that we take a journey along the demand curve from left to right, with income changing as we move from points K to L to U.)

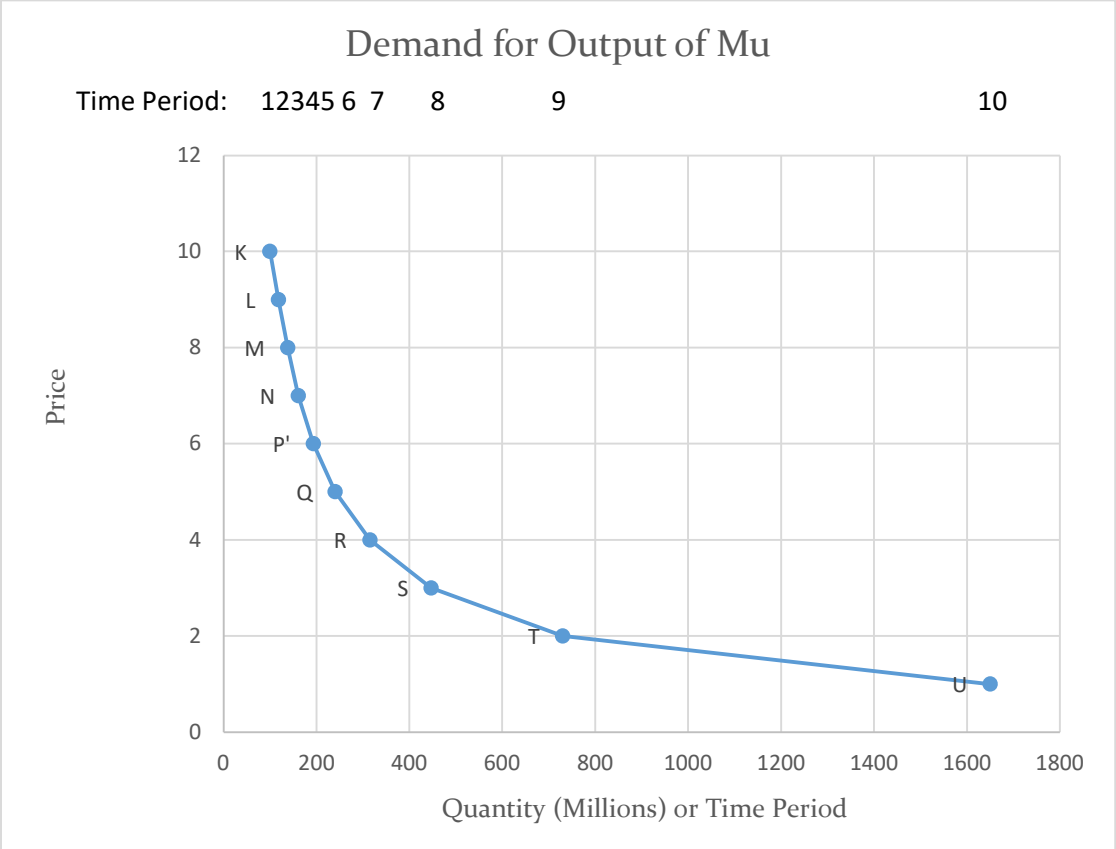


Figure 6: Demand for Output of μ, as Price Declines and Time Advances

At point P' where P = 6, Q = 193, manufacturers' income (sectoral income) is represented by area 0,6,P',193 = 6 x 193 = 1160

At point R where P = 4, Q = 315, sectoral income is represented by area 0,4,R,315 = 4 x 315 = 1260

Area 0,4,P',315 is larger than area 0,6,R,193 and thus we can see on the diagram as well as on the chart, that sectoral income increases when moving from point P' to point R.

As with the time periods for α, the relationship of one time period to another on the graph, is non-linear.

Given the two paths for sectoral income-change over time, developed in these tables and diagrams, we can plot them both on a graph that shows the relationships between income and time period, for each sector and for total income (=MV).

The two-path long-run growth scenario that we have developed, has been derived from supply-demand diagrams, and price elasticities of demand, that look very much like the ones generally accepted by economists. If there is any analytical innovation here, it is to have linked the two demand diagrams by means of a constant quantity of money circulating, that is, a constant money income which they both must share.

VI.B. Diverging income path diagram, total income unchanged:

Agricultural income declines over time, while manufacturing income increases, even as total income remains constant.

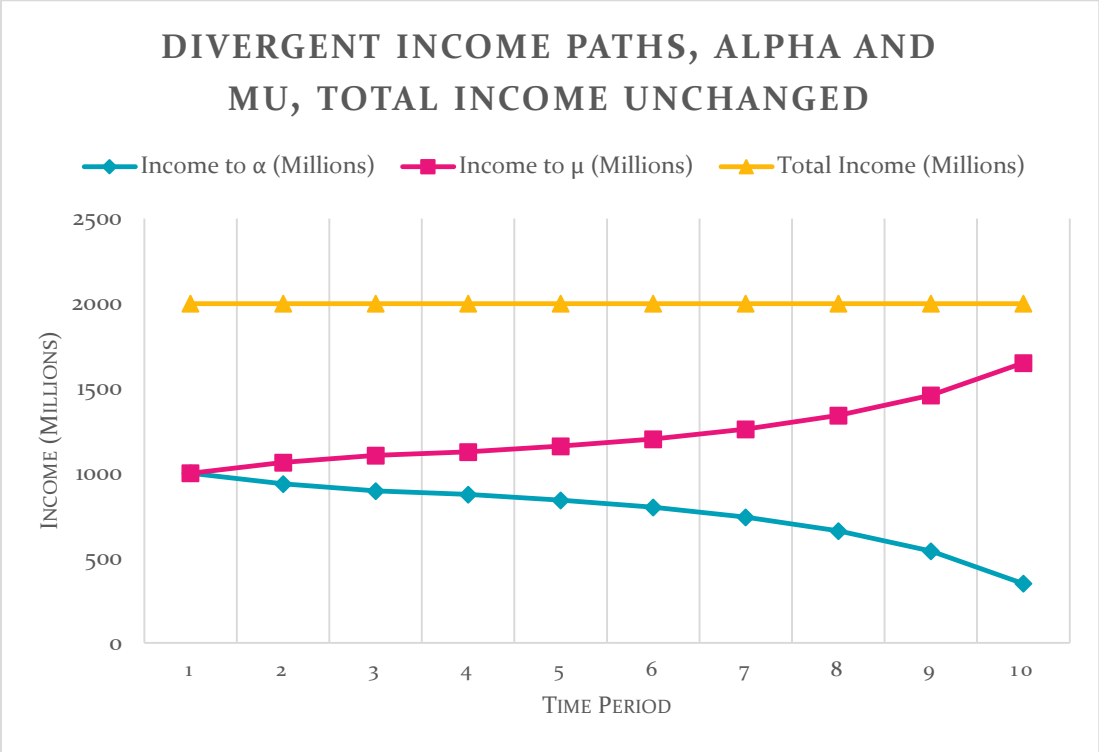


Figure 7: Divergent Sectoral Income Paths, Total Income (i.e., Economy-Wide Income or Revenue) Unchanged

We have derived diverging income paths, similar to what occurs in the real world, from recognized economic principles; sectoral differences in income can persist and grow larger. The underlying argument is based in both real-world data and accepted economic ideas about demand, elasticities, and money.

VI.C. Divergent income paths with an increase in the quantity of money in circulation

In the above discussion, the money in circulation (MV) remains constant. This artificially constrains the economy to appear not to grow, in the sense of higher nominal income in later periods. (In the model so far, instead of allowing the money supply to grow, we have by implication, placed a lower value (lower price) on each unit of the higher output that exists in later periods.)

Let us change our point of view and reason that wealth and higher incomes are created in the economy as goods and services accrue and their numbers increase. The money supply can increase and often does in the real world. The subscripts 1 and 2 represent the first time period, and the second time period, respectively. The money in circulation has increased from period 1 to period 2.

Our equations become:

(1) $P_{1\alpha}Q_{1\alpha} + P_{1\mu}Q_{1\mu} = (MV)_1$

(2) $P_{2\alpha}Q_{2\alpha} + P_{2\mu}Q_{2\mu} = (MV)_2$

Rearranging:

(3) $(MV)_2 - (MV)_1 = P_{2\alpha}Q_{2\alpha} - P_{1\alpha}Q_{1\alpha} + P_{2\mu}Q_{2\mu} - P_{1\mu}Q_{1\mu}$

Again, $P_{1\alpha}Q_{1\alpha} > P_{2\alpha}Q_{2\alpha}$ and $P_{2\mu}Q_{2\mu} > P_{1\mu}Q_{1\mu.}$, because of the assumed properties of the demand elasticities. The increase in money circulating (that is, $(MV)_2 - (MV)_1$) equals the nominal income-loss in α plus the nominal income-gain in μ.

The nominal gain in μ is greater than the increase in money circulating, because it includes an amount to offset the nominal loss in α. Money is transferred from α to μ even when the money in circulation increases. There is not, in this model, a nominal gain in α when there is a nominal gain in μ. (A rising economic tide apparently does not lift all economic boats. Trickle down apparently does not occur, for the particular case of agriculture.)

As wealth and income increase, we also need to investigate the role of the income elasticity of demand in our model.

VI.C.i. Demand and income elasticities[1], α and μ

E_I in the discussion below, is the income elasticity of demand.[1] $E_I = \%\Delta Q/\%\Delta I$

We assume that the income elasticity of demand for agricultural products is less than one, and for products of the rest of the economy, is greater than one. Empirical data and reasoning in support of these assumptions were presented above.

Given these properties of income elasticities, it follows that consumers will spend more of any increase in income on the rest of the economy than on agricultural goods. The reasoning is as follows:

If a consumer receives $100 in extra income, she has to allocate it between α and μ.

If $E_{I\mu} > E_{I\alpha}$, then $\%\Delta Q_\mu/\%\Delta I_\mu > \%\Delta Q_\alpha/\%\Delta I_\alpha$

It follows that $\%\Delta Q_\mu/\%\Delta Q_\alpha > \%\Delta I_\mu/\%\Delta I_\alpha$

1. The income elasticity of demand (E_I) is defined as:

(% change in quantity demanded (Q))/(% change in income (I))

Necessity goods have an income elasticity of demand between zero and one: expenditure on these goods increases with income, but not as fast as income does, so the proportion of expenditure on these goods falls as income rises. This observation for food is known as *Engel's law*.

Since the change in the consumer's income for consideration in the spending decision on μ, equals the change in consumers' income for consideration in the spending decision on α, which both equal the change in the consumer's income, $100, that is:

$$\%\Delta I_{\mu} = \%\Delta I_{\alpha} = \%\Delta I = \$100, \text{ so that } \%\Delta I_{\mu}/\%\Delta I_{\alpha} = 1$$

it follows that $\%\Delta Q_{\mu}/\%\Delta Q_{\alpha} > 1$ and $\%\Delta Q_{\mu} > \%\Delta Q_{\alpha}$

That is, the percent change in the quantity of μ purchased is greater than the percent change in the quantity of α purchased.

VI.C.ii. Why it follows that increases in income will be spent more on "the rest of the economy" than on agricultural goods

In order for the above to imply that consumers will spend more of any increase in income on "the rest of the economy," we must further assume that the percent of agricultural products in the consumer's original budget is less than 50%. The reason this assumption is necessary is outlined below:

If μ takes more than 50% of the original budget, and $\%\Delta Q_{\mu} > \%\Delta Q_{\alpha}$, it follows that the increase in μ must be greater than the increase in α, both because the original quantity was greater, and because the percent increase is greater.

If α takes more than 50% of the original budget, and $\%\Delta Q_{\mu} > \%\Delta Q_{\alpha}$, then the increase in α may be greater or less than the increase in μ, because the original quantity of α is greater than the original quantity of μ, but the percent increase is greater for μ.

Thus, after the point in economic development at which non-agricultural products and services consume more than half of consumers' budgets[1], income will tend to accumulate in non-agricultural regions rather than in agricultural regions. The result, for an economy that is past such a point, is a similar divergent income growth path situation to that presented above for price elasticities.

VI.D. Data tables for α and μ, MV increasing

Table 4 represents the case where the economy has reached and passed such a point, and where the money in circulation (MV) increases. We say that MV and the economy's nominal income are conceptually one and the same, and will use them interchangeably. Once again, the data are invented, but with a very specific purpose.

The table is related to the two previous tables. As more money exists in the economy, the prices in each period are a little higher relative to the other tables (because more money is spread out over the same goods – quantity in each time period has not changed, from Tables 2 and 3 to Table 4, but MV has increased). The quantities in Table 4 and in the other tables are the same. The total money income starts out at $2000m, as before, but it increases over time.

1. Could this be the condition for take-off?

Table 4: Demand for Outputs of Both Sectors, MV increasing

	Alpha			Mu			
Period	**Quantity (Millions)**	**Price**	**Income (Millions)**	**Quantity (Millions)**	**Price**	**Income (Millions)**	**Total Income (Millions)**
1	100	10	1000	100	10	1000	2000
2	104	9.1	946.4	118	9.1	1073.8	2020.2
3	112	8.2	918.4	138	8.2	1131.6	2050
4	125	7.3	912.5	161	7.3	1175.3	2087.8
5	140	6.4	896	193	6.4	1235.2	2131.2
6	160	5.5	880	240	5.5	1320	2200
7	185	4.6	851	315	4.6	1449	2300
8	220	3.7	814	447	3.7	1653.9	2467.9
9	270	2.8	756	730	2.8	2044	2800
10	350	1.9	665	1650	1.9	3135	3800

Table 4: the relationships among time period, quantity demanded, price, and incomes, MV increasing

In the table, income to α declines as the price of α declines, while income to μ increases as the price of μ declines. Income to α and income to μ add up to the total money income in each period. Although total income changes from period to period, the link between the two sectors still exists, because each sector must share the total income for that particular time period with the other sector.

We will move directly from the table to the income-path diagram. Price and income elasticities for each sector move income in the same direction (down for α and up for μ), and so we do not concern ourselves with the technical analysis of the precise effect of either.

Figure 8 represents the graph of the sectoral income paths over time, with MV increasing.

VI.E. Diverging income path diagram, total income increasing:

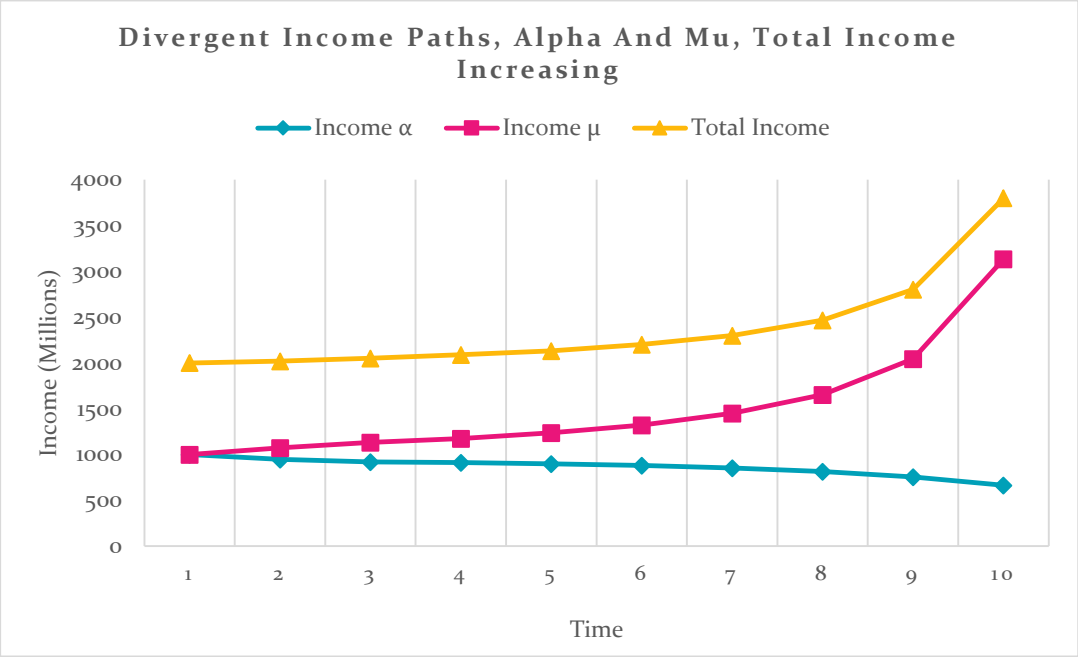


Figure 8: Divergent income paths, total income (i.e., economy-wide income or revenue) increasing

The income paths over time, of α and μ, diverge more in this graph than in the one where total income remains constant. This is a property of the numbers created for the example. This may or may not represent the situation as it might occur in the real world, although our equation (5), above, suggests that the more the money in circulation increases, the more rapidly the income (or sectoral revenue) paths diverge.

In the present analysis, we abstract from transportation costs and other costs of inter-regional commerce, and assume that input markets are reasonably competitive, economy-wide. Then, over time, the agricultural sector as a whole must buy fewer, or lower-quality, inputs, relative to the last period, than the manufacturing sector. (This period's income buys next period's inputs.)

To use a numerical example from Table 4 above, when the economy moves from period 1 to period 2, α's income declines from $1000m to $946.4m, while μ's income increases from $1000m to $1073.8m. Clearly the non-agricultural sector has more money to spend on inputs in the third period than in the second, whereas the agricultural sector has less. (The second period's income buys the third period's inputs.)

VII. Why we selected a closed-economy model

Why would we apply a closed model to an economic environment in which countries are increasingly open to international trade? There are three reasons:

IX. Discussion

We have developed a two-path growth scenario where an agricultural sector takes an ever-smaller share of GDP (represented by MV in our equations) as productivity increases and output expands, while the rest of the economy, represented here by a manufacturing and service sector, gains GDP share.

There is nothing in this model to suggest that the economy will self-correct out of the situation where agriculture loses income share and becomes increasingly marginalized. Johnson (1991, 87) makes the same point.

IX.A. Why price signals do not draw resources into agriculture

Some may argue that, in a market economy, when we move away from equilibrium in the agricultural sector, in the following situations:

1) Demand for food increases, for example if the population increases, or
2) Food becomes scarce

that the price will be bid up. Firms will enter the industry, and producers will produce more of the desirable good, so that any shortage will go away.

Our responses to these arguments are as follows.

In case 1) yes, demand for food may go up, but in our analysis, it is unlikely that the price goes up. The reason is that productivity increase, leading to price decline, outpaces the impact on the price of increasing demand. The situation is illustrated in Figures 13 and 14 below. Anderson (1987) suggests that this reason is often given for agricultural disadvantage, although the puzzle to address is why it can occur in an open economy.

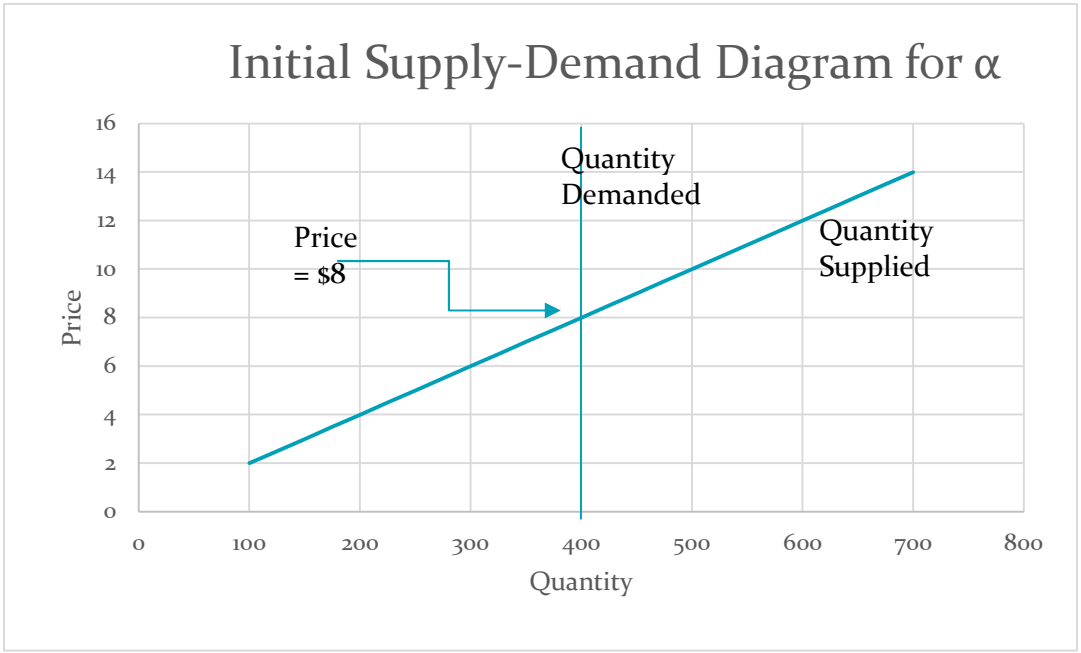


Figure 11: an example of a supply-demand diagram with inelastic demand

In figure 11, the equilibrium price is $8. If population remains constant, there is no reason for demand for agricultural products, especially food, to increase. People eat as much as they need, but not more.

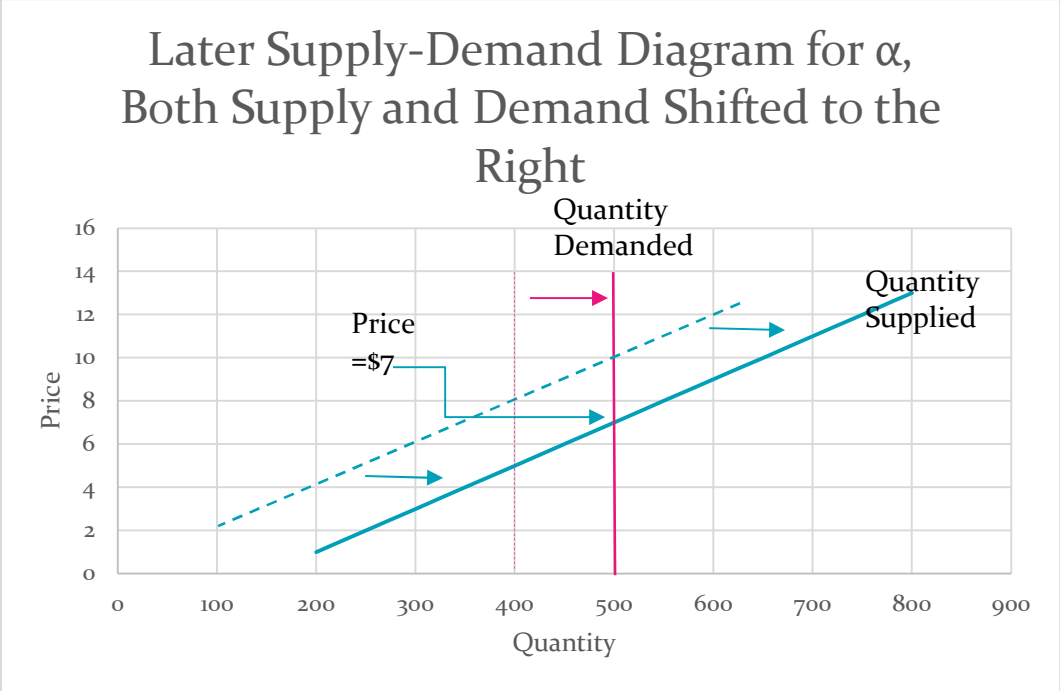


Figure 12: Supply-Demand Diagram when both the demand and supply curves shift to the right

At a later date, in Figure 12, population has increased, and so the quantity demanded of agricultural products has changed from 400 units to 500 units, so that at every price the quantity demanded is now 500 units. However, productivity has not remained at the previous level. Productivity increase has reduced the per-unit marginal cost to producers so that the supply curve has shifted to the right. Input prices may be higher, as described in the reasoning above, but those inputs are more productive; or the input mix might have changed. The quantity that would be offered at each price has increased. The new equilibrium price is $7, lower than the initial equilibrium price.

The diagrams do not show the full dynamics of the economy, and some analysts may think that there is no necessary reason for the supply curve to shift to the right so much that the price cannot rise. Appendix I shows that, in our scenario, income moves from agriculture to the rest of the economy, even when population increases.

In case 2) (Food becomes scarce) we respond as follows:

Whatever caused the scarcity will not easily be solved, because under normal circumstances the economy provides enough food for the population. For example, if climate change reduces farm productivity worldwide, it will be difficult to bring back former levels of productivity even with entry of firms into agriculture, because productive agricultural land is already limited.

Then, food remains scarce, and the price will be bid up until food becomes rationed according to those who can afford it. The new market equilibrium solution will involve severe distress, such as malnutrition or even starvation, for the disadvantaged. We doubt that this market solution would be politically acceptable.

We have shown in the two-path growth scenario that the impact of technological knowledge on production causes the agricultural price to fall over time. (That is, an average sectoral price, in the real world.) Increases in the money supply, difficulties of international comparisons, and changes in types of outputs and consumption baskets, may make it difficult to observe an unambiguous decline in average agricultural prices in the real world. We believe that, if the right data are collected, this will be found.

For example, Figure 13 below suggests a major change in the fortunes of wheat farmers in England, around 1800. Also, changing sectoral incomes or revenues can be associated with increasing sectoral poverty, absent obvious price changes.

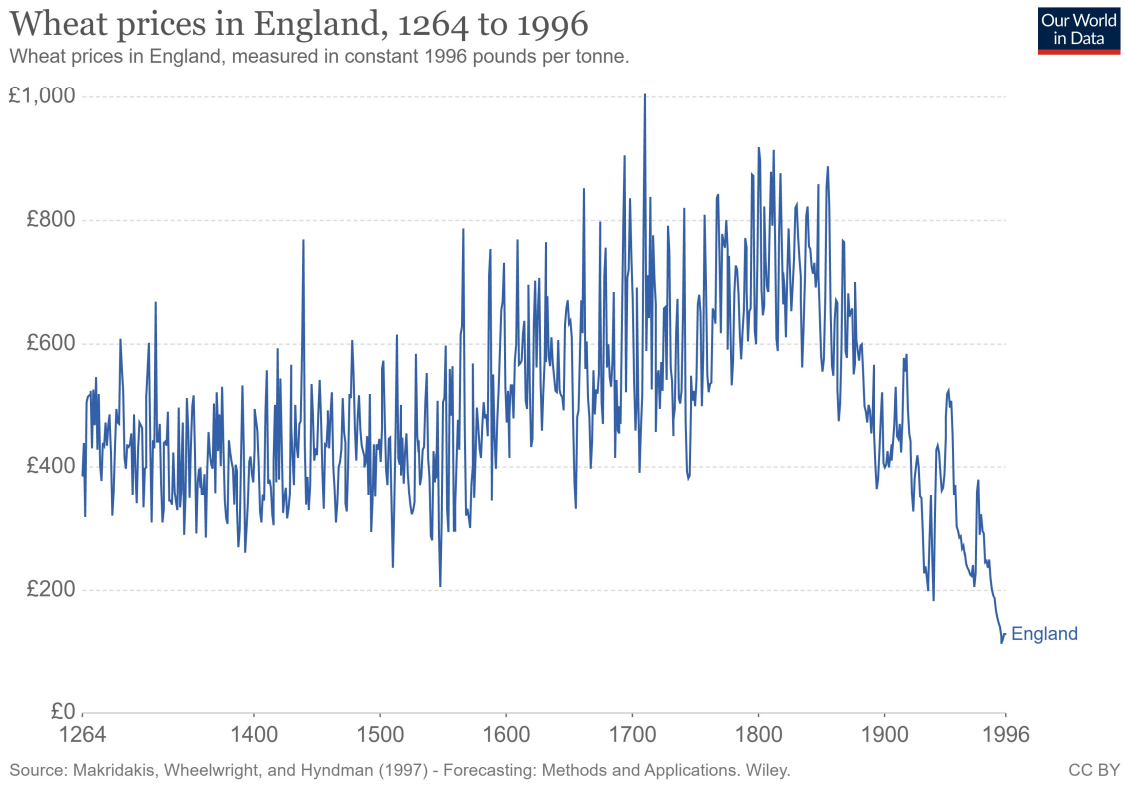


Figure 13: Wheat prices in England, 1264 to 1996. Source: Our World in Data: Food Prices. Roser and Hitchie (2020).

Wheat prices in England experienced a long-run trend decline starting around 1850. The Industrial Revolution took place in England from 1760 to 1840. Repeal of the Corn Laws in England took place in 1846, opening grain markets in England to the free market, or, as was argued at the time, to the capitalist ideal (www.Britannica.com, 2020). Figure 13 is suggestive of the change in power

better than equilibrium models at predicting the changes in wealth and power as we convert from an industrial to an information age.

Summary of Section X – A Historical Perspective. Productivity advance in agriculture leads to many adverse consequences for farmers, listed in section IX.B above. Productivity advance in the rest of the economy, especially in manufacturing and "cutting-edge" technologies, generates increasing incomes for those businesses and the regions in which they locate. Because of the technical nature of manufacturing and cutting-edge businesses, their high incomes create a demand for skilled workers (including internet gurus with little formal higher education).

Economic dualism manifests itself, not just in relative agricultural poverty, but also in the poverty of those with little education. These two types of economic disadvantage are related, especially in countries whose populations live primarily in agricultural regions, because farm workers may have little schooling.

A market system with productivity advance perpetuates this type of dualism, because advancing sectors leave declining sectors behind more rapidly than equilibration can occur. In creating the two-path growth scenario, we investigated a non-equilibrium (continuing for the long-run) intersectoral transfer of labor. The scenario that we developed shows how a non-equilibrium situation can arise and persist for many years.

The fact that the two-path growth scenario includes money (often left out of microeconomic models), encouraged appraisal of the roles of money and prices in the market system. We have offered an innovative way to develop an understanding of long run economic trends. This approach was created in order to address a long run phenomenon (long-run, ongoing rural to urban migration) that other models of migration did not capture.

XI. Conclusion

We presented an innovative two-path growth scenario, based on accepted principles, to explain the long-run process of change from an agrarian society to an industrially and technologically-advanced society. We investigated sectoral incomes rather than factor incomes; and explored changing total regional incomes, rather than individual (per-capita) incomes. Numerical examples suggest a relationship between monetary growth and increasing sectoral income, or wealth, inequality.

In a mathematical development of the model, two production functions depend on inputs and the overall level of technological knowledge in the national economy or the world. We explored the consequences of increases in productivity over time, closely related to advances in technological knowledge, for two sectors facing different demand conditions.

The two-path scenario provides a framework within which to understand:

- Urban growth, economic dynamism, and job-creation
- Agricultural loss of income share, population, and jobs

- The increasing importance of education as economic growth and development occur
- Skill-biased technological change
- Economic dualism and poverty traps
- The advent of the information age

A way out of agriculture, and poor regions in general, is migration, or moving away. This can increase regional poverty for the region of departure. Relatively little technical education is also a factor in keeping disadvantaged workers, or rural migrants, in the "underclass," or, in a developing country, in the "informal sector." Revitalization of poor regions involves keeping income and productive energy within the region, and attracting income in, from outside regions.

We are currently undergoing an economic transition into an information age. The two-path scenario, modeling loss of jobs in agricultural regions could be something we can adapt, to confront the possibility of technological unemployment and continued economic dualism, on a larger scale, even in wealthy countries.

And, finally, economic forces are powerful. They may overwhelm even the most determined of intentions. The information age may alter the economic landscape in ways we cannot predict or control.

Appendix I: Growth of Population in the Two-Path Growth Model

For every new person born, demand for both types of goods (α and μ) increases. The additional money expended for the livelihood of the new person will go relatively more on manufactures than on food, as described above. Income is transferred from α to μ as shown in the discussion above.

Some new persons born will eventually become productive workers, and will contribute to expanding output in one or the other sector. As output increases, income is transferred from agriculture to manufacturing as described in the discussions above.

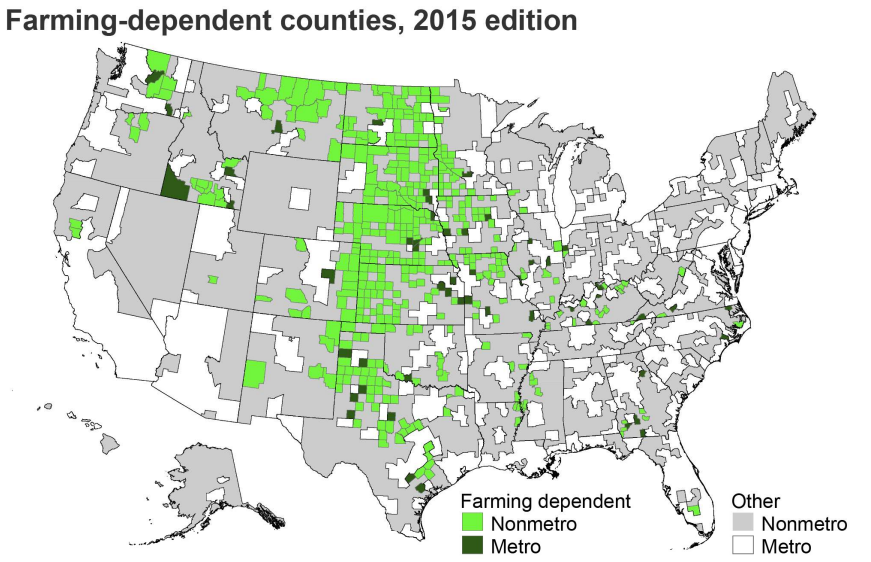
The case of population increase does not alter the conclusion that economic growth with productivity advance transfers income from α to μ.

(We are talking about countries or a world, with enough people rich enough to be willing and able to spend more than 50% of GDP on manufactures and services, so that income is transferred from agriculture to the rest of the economy as described in the model.)

Appendix II: Additional Empirical Data

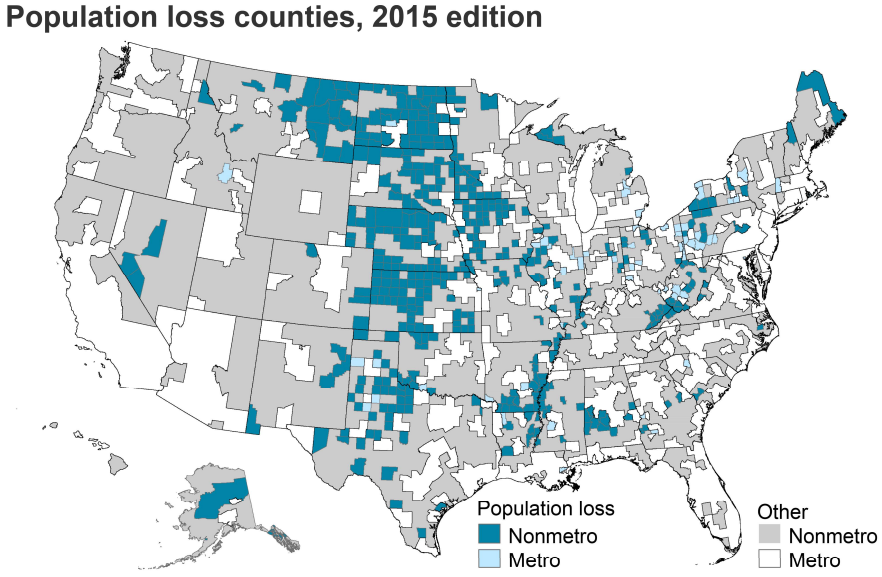
Appendix II, Section A: Maps of farm-dependent counties and population-loss counties in the U.S.

Figure 14 shows counties in the US that USDA classifies as farming-dependent, the meaning of which is explained on the figure.



Farming-dependent counties are those where 25 percent or more of the county's average annual labor and proprietors' earnings were derived from farming, or 16 percent or more of jobs were in farming, as measured by 2010-12 Bureau of Economic Analysis, Local Area Personal Income and Employment data.
Note that county boundaries are drawn for the farming-dependent counties only.
Source: USDA, Economic Research Service using data from Bureau of Economic Analysis.

Figure 14: US Farming-dependent counties, 2012



Population loss counties are those where the number of county residents declined between the 1990 and 2000 censuses and also between the 2000 and 2010 censuses.
Note that county boundaries are drawn only for the population loss counties.
Source: USDA, Economic Research Service using data from U.S. Census Bureau.

Figure 15: US population loss counties, 1990-2010

Figure 15 shows population loss counties, the meaning of which is explained on the figure. Population loss can occur when deaths exceed births within the county, or when out-migration from the county exceeds in-migration to the county, and is usually a combination of both effects. Note the close correspondence between population loss counties and farming-dependent counties. Assuming that population loss is associated with job losses, these data suggest that loss of jobs continues in agriculture, while other rural regions may not experience job losses to the same extent.

And, since the recession of 2008-9, rural employment has recovered less well than urban employment: "Urban-rural gap in employment growth persists Although urban (metro) and rural (nonmetro) unemployment rates have declined at a similar pace since their peak in 2010, and both are now below their pre-recession levels, growth in employment has been slower in rural areas. Urban employment has grown steadily at about 1.6 percent per year since the fourth quarter of 2009 and had risen 8.2 percent above its pre-recession level by the second quarter of 2018. Rural employment has grown at about 0.5 percent per year, with periods of stagnation (2012-13 and 2016). Estimated rural employment in the second quarter of 2018 was still 1.8 percent below its pre-recession level. Rural America includes 14 percent of the Nation's population but has accounted for only 4 percent of employment growth since 2013." From: USDA, Rural America at a Glance, 2018 Edition.

Appendix II, Section B: Employment and compensation by occupation and region

Some occupations are relatively more highly paid than others, although there is a range of levels of compensation in each occupation. (US BLS, 2018). And, Groshen (1991) summarizes a study by Slichter (1950), thus: "a strong link between industry [earnings] differentials and industrial concentration (or profit rates) is found in all studies that search for it [6 studies], except [1 study]."

The above data suggest that workers earn more in industries where there is more money per worker. We argue in the paper that there are some industries in which this is more likely to be true, such as industries with elastic demand, than in other types of industries.

Adam Smith (in Heilbroner, 1986, 212) lists five reasons which he has observed to cause earnings to differ among occupations:

- The agreeableness or disagreeableness of the occupation
- The ease or cost of learning the occupation
- The constancy or inconstancy of employment in that occupation
- The degree of trust residing in the holder of the job
- The probability or improbability of success in the occupation

We might add, related to the fifth reason, the properties of the demand for outputs of the occupation. And we might note that reason one (disagreeableness of the occupation) seems not to earn much of a higher income, today.

Appendix II, Section C: Data on Relative Prices

Even when agricultural prices increase, they increase less than other prices; that means that they decline, relatively. See figures 16 and 17 below.

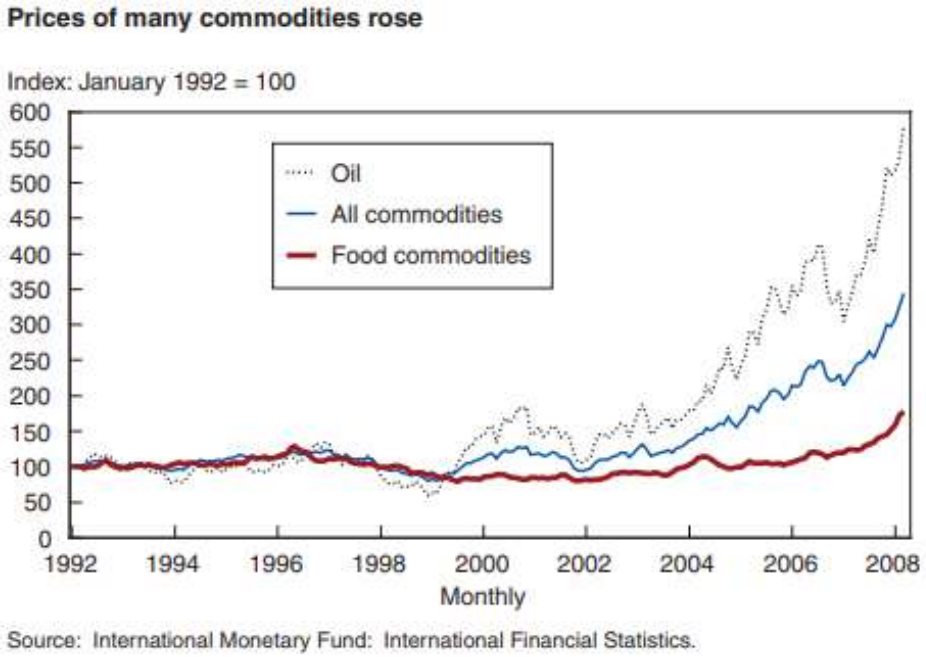


Figure 16, from USDA ERS: International Commodity Prices, 1992 to 2008. Reproduced from Trostle et al. (2011). US Department of Agriculture, Economic Research Service.

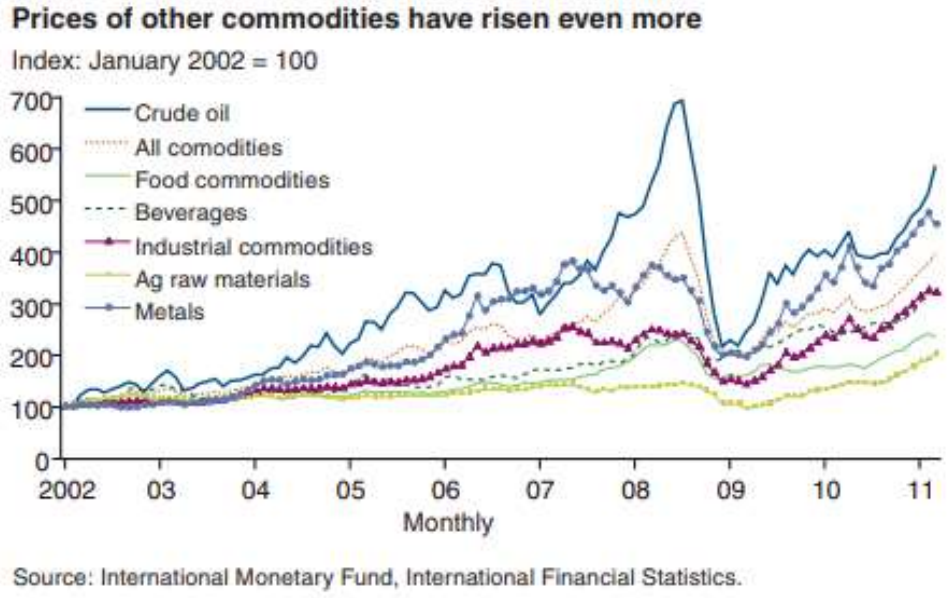


Figure 17, from USDA ERS: International Commodity Prices, 2001 to 2011. Reproduced from Trostle (2008). US Department of Agriculture, Economic Research Service.

Appendix III: quantity adjustments and the path of change

We suggest that the market-clearing price (measured at a moment in time) may be related to the overall pattern (flow over time) of economic change, somewhat in the way that the level (height) of water in a stream is related to the number of gallons flowing underneath the surface.

As described in the paper, the rate of migration is a flow variable. It is more likely to have a discoverable and direct relationship to the rate of creation of jobs, another flow variable, than to the wage rate. Of course, availabilities of jobs, workers, and the wage rate, interact, and it may be appropriate to emphasize one or another of these at different times.

With this (flow) perspective, we can organize our understanding of the long-run path of an economy by observing the numbers and types of new products being made and used, new skills being taught and used, and by the ebb and flow of sectoral, industry, regional, or neighborhood incomes (revenues; wealth), as an alternative to analyzing the impacts of relative price changes at the margin.

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