Trade, Risk, and the Demand for Social Insurance: A Global Perspective

David E. Wildasin†

Martin School of Public Policy

University of Kentucky

Lexington, KY 40506-0027

USA

April, 2007

Abstract: Viewed from a global perspective, trade propagates but does not create risk. Trade reduces price variability for regions facing less-than-perfectly correlated random shocks and may allow risk pooling that reduces the demand for private and public insurance, whereas autarky is characterized by price, income, and utility risk. Trade may also shift the distribution of risk among households, possibly raising or lowering the social cost of risk and the demand for insurance. The analysis of trade and risk in a global framework suggests new perspectives for empirical and policy analysis.

---

†Prepared for presentation at a conference on "The New Political Economy of Globalization" sponsored by the Leverhulme Centre for Research on Globalisation and Economic Policy and the Murphy Institute of Political Economy, New Orleans, 20-21 April, 2007.

1 Introduction

It has become commonplace to view "exposure" to international markets as a source of risk, from which economic agents may seek to protect themselves. Rodrik (1998, p. 998), for instance, writes that "Societies seem to demand (and receive) an expanded government role as the price for accepting larger doses of external risk. In other words, government spending appears to provide social insurance in economies subject to external shocks." To many analysts, the growth of government in the twentieth century is attributable, in significant part, to international trade, although it goes without saying that there are many other potential factors at work that may affect the size of government.

It is obvious that the growth of government is a historical development of great complexity and with many possible determinants.[1] The present paper does not attempt to shed new light on the empirical determinants of the growth of government in the world as a whole or in any part of the world, such as the developed nations of Europe, North America, and Asia. Rather, its more modest goal is simply to consider some of the theoretical implications of trade for risk and the demand for insurance against risk. The discussion focuses on very elementary and stylized economic models, within which the distribution and costs of risks are transparently displayed. In particular, the formal analysis stays entirely within the framework of standard competitive equilibrium analysis, relying on familiar textbook models of pure exchange and of trade in the Heckscher-Ohlin-Samuelson (HOS) tradition. These models, simple though they may be, have the virtue that they can be used to analyze the general equilibrium of an entire economy, such as the world economy, and not simply a small part of that economy such as a single nation in its relation to the "rest of the world." Within this general equilibrium context, trade is in no way a fundamental *cause* of risk. Market-determined prices, including prices on international markets, reflect underlying demand and supply conditions.

[1] Any references to the vast relevant literature will necessarily be extremely incomplete. To cite only two recent studies, each containing many additional references, see Boix (2001) and Lindert (2004). These authors highlight the role of fundamental political institutions (whether democratic or authoritarian, and if democratic, whether or not highly inclusive) as determinants of redistribution.

Fluctuations in economic fundamentals cause equilibrium prices to fluctuate, *transmitting* fundamental shocks, through the general-equilibrium linkages of the economy, to all market participants in the entire system. In principle, these linkages can be broken, for instance through a hypothetical prohibition on trade that would put each nation into a state of autarkic self-reliance. The elimination of trade thus can stop the propagation of shocks through markets. The elimination of trade does not, however, eliminate underlying economic risks.

As a simple illustration, consider the impact of climatic fluctuations on agricultural markets. Each year, rainfall, temperature, and other natural conditions affect food production over the entire planet. Leaving aside possible complications from human impacts on climate, the presence or absence of trade does not affect the probability distribution of these natural occurrences in any one region. Given a particular climatic realization, a region that produces cotton, citrus, rice, and beef may have high production of some commodities and low production of others. Other regions, with different climatic realizations, experience different levels of production. Under autarky, each region's production, consumption, prices, and income fluctuates in accordance with local climate. The absence of trade does not insulate the region from climatic shocks. With trade, it is possible that unusually high production of one commodity can be used for export, with which to acquire another commodity with unusually low production. Shocks in one region are transmitted to the global economy through trade: positive shocks result in higher exports, whereas negative shocks result in higher imports. The net effect may be to pool risks among trading regions. One may conjecture that the demand for insurance against risk is reduced, not increased, by trade.

The following analysis develops this basic idea in two stages. Section 2 examines a very simple pure exchange economy in which regions experience endowment shocks, focusing on the risk attributes of two polar extreme cases: free trade and autarky. Pure increases in endowment risk produce price, income, consumption, and utility risk in autarky, but need not do so under free trade. Expected utility is higher under free trade than autarky, regardless of the degree of risk aversion. Section 3 extends the basic analysis to incorporate production within the standard HOS model of trade. In this model, it is possible to discuss the distribution of income and the effects of trade on potentially heterogeneous agents. Section 3 also generalizes the types of endowment shocks within the model to allow for correlated risks.

Section 4 departs from the textbook pure exchange and HOS models to allow for sector-specific factors of production. In this variant of the analysis, there may be factor price and income risk both under autarky and free trade. However, the *distribution* of income risk may differ in each regime. The shifting of income risk associated with trade may result either in an increase or a decrease in the social cost of risk and thus in an increase or decrease in the demand for insurance.

For the sake of analytical transparency, the analyses of Sections 2–4 are all undertaken under the assumption that markets are perfectly competitive and that there are no private institutional arrangements through which risk may be shared. Section 5 summarizes the main conclusions and discusses their implications for empirical analysis and for the broader discussion of trade, the management of uncertainty through private-sector institutions, and the demand for social insurance.

2 Random Endowments in a Pure Exchange Economy with Representative Agents

To begin with, it is obvious that there can be no completely general presumption that trade either increases or reduces economic risks. This is easily confirmed by postulating a two-region economy in which one region faces absolutely no "internal" risks while the other region does face such risks. In the first region, endowments, technology, preferences, and any other fundamental economic data are never subject to change, while any or all of these may fluctuate randomly in the other region. Under autarky, the equilibrium outcome is deterministic in the first region, while the allocation of resources, equilibrium prices, and utility will depend on the realized values of relevant random variables in the other region. Under free trade, the equilibrium outcome in both regions will depend on the realizations of the random variables in the "stochastic" region. Trade can result in risk for a region that otherwise experiences no shocks at all. Under autarky, there would be no demand for any type of insurance in the first region, but risk-averse agents would value such insurance in the second region. Under free trade, there could be a demand for insurance in both regions. If this demand is somehow translated into "growth of government," trade would result in a larger government in the first region. As explained below, however, it might reduce the demand for insurance, and thus the size of government, in the second region. The overall effect on the size of the government in the world as a whole would appear to be ambiguous.

A more interesting approach to the issue of risk and trade, however, begins with the recognition that no economies are immune to risk. Indeed, in order to focus on the essential issues, it is convenient to assume that all regions are *ex ante* identical, and that they differ only *ex post* as a result of the realizations of random shocks. Abstracting initially from production, let us assume an economy with N regions, $j = 1, ..., N$, with each region j inhabited by a single representative household with a well-behaved utility function $u(c^j)$ defined over a consumption vector c^j of $n + 1$ commodities, $i = 0, 1, ..., n$.[2] Commodity 0 serves as a numéraire, with price fixed at 1, whether regions engage in trade or are autarkic. The endowment of each region is random. Let e^j denote the realized (*ex post*) endowment vector $e^j = (e^j_0, e^j_1, ..., e^j_n)$ for region j. Endowment risks are assumed in this section to be independently and identically distributed among regions. (Section 3 considers correlated shocks.)

Let p^{jA} denote the competitive equilibrium price vector under autarky in region j. These prices are given by the the vector of marginal rates of substitution between each commodity and the numéraire, evaluated at the realized consumption vector, i.e., denoting partial derivatives of u with subscripts, $p^{jA}_i = u_i(c^j)/u_0(c^j) \quad \forall i, j$. Under autarky, the household in each region must consume its realized endowment, that is, $c^j = e^j$. Consumption, and hence autarky

[2]In order to obviate minor technical problems, assume that $u(c^j)$ is monotonically increasing, strictly quasi-concave, smooth, and satisfies the Inada conditions. The partial derivatives of u are denoted by subscripts.

equilibrium prices, are therefore random, except in the special case where the probability distribution of endowments degenerates to the certainty case. The autarky value of the endowment in region j, $p^{jA}e^j$, is also random, as is the equilibrium level of utility, $u(e^j)$. Households face risk in prices, incomes, consumption, and welfare. If they are risk averse, they would be willing to pay in order to avoid this risk, that is, there would a demand for insurance.

The absence of trade does not eliminate risk in this model. Does trade cause risk to increase or decrease? To define a useful point of reference for further discussion, let $\bar{e}$ denote the expected value of e^j. (This is the same for all j under the assumption that regions are *ex ante* identical.) As a special case, the probability distribution for endowments could degenerate, such that endowments are nonstochastic and $e^j = \bar{e} \quad \forall j$. In this special case, there is no longer any risk under autarky. Moreover, the autarky equilibrium coincides with the equilibrium under free trade: with identical preferences and endowments, there are no gains from trade and no trade takes place in equilibrium. Let $\bar{p}$ denote the equilibrium price vector in this equilibrium, which we may call the *deterministic no-trade equilibrium.* In this equilibrium, the realized consumption vector is just $\bar{e}$ in every region, and the realized utility is $u(\bar{e})$, irrespective of whether trade is permitted or prohibited. The equilibrium income in each region is $\bar{w} \equiv \bar{p}\bar{e}$.

Now consider a randomization of endowments around $\bar{e}$ such that such that $E(e^j) = \bar{e}$ and assume that there is a large number of regions so that the law of large numbers holds.[3] In other words, consider a mean-preserving increase in endowment risk.

Because the realized endowments of individual regions are now not generally equal to the mean endowment, they face consumption, price, income, and utility risk under autarky, as previously described. In addition, the autarky equilibrium no longer coincides with the free-trade equilibrium. Under free trade, region j's consumption vector c^j may differ and generally does differ from its endowment vector e^j. A free-trade equilibrium is defined by a vector

[3]To be more precise, the statements that follow characterize economies in which the number of regions is sufficiently large that discrepancies between realized and expected aggregate endowments, and their associated equilibria, are as small as desired.

of world equilibrium prices p^T and a set of consumption vectors c^j such that c^j maximizes $u(c)$ subject to $p^T c = p^T e^j$ and such that $\sum_j c^j = \sum_j e^j$.

To compare the free trade and autarky equilibria, consider first the special case where the probability distribution of endowments satisfies $\bar{p}e^j = \bar{p}\bar{e} \quad \forall j$, that is, although endowments vary randomly, the *value* of endowments, evaluated at the deterministic no-trade equilibrium prices, are equal to the value of the mean endowment for all regions. Let us call such a probability distribution *income preserving.*

Proposition 1: Assume that endowments are randomly distributed according to a wealth-preserving probability distribution. The equilibrium vector of prices under free trade is equal to the equilibrium prices in the deterministic no-trade equilibrium. For each region, the free-trade equilibrium consumption vector, income, and utility are equal to their values in the deterministic no-trade equilibrium. Under autarky, equilibrium prices, consumption vectors, incomes, and utilities vary randomly. Expected utility is lower under autarky than under free trade.

The proof of this proposition is obvious from the construction. The fact that expected utility is lower under autarky than free trade is of limited interest for present purposes, since, even leaving risk considerations aside, there are gains from trade. More importantly for present purposes, is the fact that realized utility under free trade is not subject to risk. A region's realized endowment will differ from the mean endowment but it can use trade to offset its endowment shock. See Figure 1.

The assumption of wealth-preserving endowment shocks is of course a special one. In general, endowment shocks will raise the value of endowments for some regions (evaluated at deterministic no-trade equilibrium prices) and lower their values for other regions. In this more general case, incomes, consumption, and utilities are random, both under autarky and under free trade. It is noteworthy, however, that equilibrium prices under free trade may be stable.

Proposition 2: Assume that consumer preferences are homothetic. The equilibrium vector of prices under free trade is equal to the equilibrium prices in the deterministic no-trade equilibrium. Equilibrium prices under autarky vary randomly.

To prove this proposition, note that homotheticity implies that consumption is proportional to the value of endowment for each region. By the law of large numbers, although the income of any one region varies randomly, the value of the aggregate endowment at deterministic no-trade equilibrium prices, and hence the aggregate demand for each commodity at deterministic no-trade equilibrium prices, is equal to the aggregate endowment of each commodity. Thus, the deterministic no-trade equilibrium prices are the free-trade equilibrium prices.

Of course, if preferences are not homothetic, equilibrium prices under free trade may depend on the distribution of income among regions and thus may vary randomly under free trade. For instance, if the demand for commodity n is highly income-elastic, an endowment realization that reduces the value of endowments (at deterministic no-trade equilibrium prices) very slightly for most regions while raising the value of income dramatically for one region would result in an increase in aggregate demand for commodity n and thus (with well-behaved demand functions) an increase in its equilibrium price. This once again illustrates the fact that completely general propositions about risk and trade are not possible. The implication of Proposition 2 is simply that trade reduces price risk, relative to autarky, in the absence of demand variations arising solely from inequality in the distribution of realized incomes.

Before turning to the analysis of an economy with production, it is worth emphasizing that the preceding analysis does not depend in any way on political boundaries. There is no reason to identify "regions" with "nations"; regions may be small areas within nations or possibly groupings of nations. The issue of trade and risk arises among regions at all geographical scales. As a thought experiment, one can even contemplate the special case in which regions literally correspond to individual households. A household living in complete isolation does not escape risk; rather, it may forego opportunities to shed risk through economic exchange. At least within the framework of the simple model presented above, the same is true for cities, states or provinces, regions within them, and nations.

3 Extensions: Production, Terms of Trade Shocks

This section extends the preceding analysis in two ways. First, it incorporates production and factor pricing into the model. Second, it incorporates shocks of global magnitude that affect the terms of trade.

3.1 Production

The introduction of production allows for a much richer economic structure but does not necessarily change any fundamental conclusions from the preceding analysis. Following the Heckscher-Ohlin-Samuelson tradition, and preserving most of the notational conventions already established, assume that regions possess identical linear homogeneous production functions $f(e^j)$ defined over regional endowment vectors e^j, now understood as endowments of productive inputs (factors of production). The endowment vector for each region may be owned by a representative household. Alternatively, households in each region may have identical homothetic preferences and possibly unequal ownership shares in the regional endowment. In the latter case, each region contains heterogeneous households and a non-degenerate income distribution, thus allowing for the possibility that trade may affect the distribution of income. In either case, the regional demand vector c^j will depend on the prices of goods and on the value of the regional endowment. As in Section 2, assume that preferences are identical among regions. Since goods and factors are distinct commodities, let goods prices be denoted by the vector p and factor prices by the vector π.

The relationship between the prices of goods and factors in models of this type has been thoroughly discussed in the literature of international trade. For the purposes of the present section, let us focus on the simplest cases, in which the numbers goods and factors of production are equal. In this case, there is a one-to-one mapping between the equilibrium prices of goods and factors, both under autarky and under free trade. As is well known, this implies that factor prices in each region must be equalized under free trade.

Suppose, then, that factor endowments are potentially random. As a special benchmark case, regions may have identical nonstochastic endowments such that $e^j = \bar{e} \quad \forall j$. In this case, as in the pure exchange economy of Section 2, the equilibrium under free trade coincides with the autarky equilibrium. There is no price, income, consumption, or utility risk either under autarky or under free trade. Let $\bar{p}$ denote the vector of equilibrium goods prices in this deterministic no-trade equilibrium, and let $\bar{\pi}$ denote the vector of equilibrium factor prices.

As in Section 2, let us consider the implications of randomizations of the endowment vectors, independently and identically distributed around the mean value of $\bar{e}$. An *income preserving* probability distribution over regional endowments is one such that $\bar{\pi} e^j = \bar{\pi} \bar{e} \quad \forall j$. As in the earlier exchange economy analysis, an income-preserving and mean-preserving increase in endowment risk does not disturb equilibrium prices, consumption, or utilities under free trade, although all of these vary randomly under autarky. If endowment shocks are mean-preserving but not income-preserving, then the added assumption of homothetic preferences is sufficient to insure that equilibrium prices under free trade are independent of realized endowments, whereas equilibrium prices do vary randomly under autarky. Hence:

Proposition 3: Propositions 1 and 2 continue to hold in a Heckscher-Ohlin-Samuelson economy when the numbers of goods and factors of production are equal.

Thus, as in the model of Section 2, trade allows for the transmission of risks among regional economies with production. Trade itself need not create any price risk and, indeed, it can eliminate price risks that would otherwise be unavoidable under autarky. To take a concrete example, consider the standard "2x2" case where there are two goods and two factors of production, labor and capital. Suppose that labor is owned by one group of households and that capital is owned by a different group. Either labor or capital endowments may be subject to risk.[4] Under autarky, the equilibrium prices of

[4] One way to think of risk in this setting is to imagine that there are "technological" risks that may alter the effective endowment of labor, capital, or both. Thus, letting $\bar{l}$ and $\bar{k}$ denote the mean endowments of each, suppose that the production function in each region j takes the form $f(\alpha_k^j \bar{k}, \alpha_l^j \bar{l})$, where α_k^j and α_l^j are the region-specific realizations of iid random variables

labor and capital, and thus the incomes of "workers" and "capitalists," depend on the endowment realizations for each. One might postulate particular attitudes toward risk on the part of workers and capitalists – both may be risk averse, for example, or workers may be risk averse while capitalists are risk-neutral. For any factor owners who are not risk-neutral, factor price risk, and the associated income risk, is costly, and these factor owners would value insurance against such income risk. Under free trade, the prices of goods in each regional economy are linked to global markets and factor prices are thus equalized across regions. Free trade pools the risks associated with endowment shocks, factor prices are stabilized, and income risks vanish. In the presence of trade, the demand for insurance against income risk also vanishes.

3.2 Terms of Trade Risk

A feature of the models discussed so far is that there is no risk in free-trade equilibria. This is deliberately achieved by construction so that risks under free trade and autarky can easily be compared and so that the risk-pooling effects of trade are clearly revealed. However, because equilibrium prices under free trade exhibit no risk, these models cannot be used directly to discuss "terms of trade risk," that is, the implications of fluctuations in world prices.

It is possible, however, to extend the analysis – whether in the pure exchange or production versions – to incorporate shocks that do affect world prices. To see this, note that the free-trade equilibrium prices $\bar{p}$ derived above are conditioned on a given global mean endowment $\bar{e}$, whether this is interpreted as an endowment of goods or an endowment of factors. The only risks that have entered the model so far are randomizations of regional endowments that do not affect the global mean endowment. Suppose instead that there are S "states of the world," $s = 1, ..., S$, in each of which there is a different global mean endowment $\bar{e}^s$. Consider as a reference point the situation where each region has identical endowments, equal to the global mean endowment, in each state of the world, that is,

with mean 1. The realizations of these random variables determine the effective supplies of each factor of production.

$e^{js} = \bar{e}^s \quad \forall j, s$ where e^{js} is the endowment of region j in state of the world s, corresponding to the case where regional risks are perfectly correlated. Assuming identical preferences, there is a no-trade equilibrium vector of prices p^s associated with each state of the world. Because these prices vary with the global endowment realization, the no-trade equilibria exhibit price risk, that is, equilibrium prices are stochastic, both under autarky and under free trade.

It is now possible to randomize the endowments of each region, in each state of the world, around the global mean endowments $\bar{e}^s$, and to compare the autarky and free-trade equilibria under these randomized endowments. Assuming that individual regional endowments differ from global mean endowments as a result of iid shocks, Propositions 1-3 continue to hold for each realization of the global endowment. Global endowment shocks create price, income, consumption, and utility risks, and these are unavoidable both under free trade and under autarky. In both regimes, risk-averse agents would seek insurance against such risks. Regional endowment shocks can still, however, be pooled through trade, whereas they become an added source of risk under autarky.

4 Trade and the Distribution of Income Risk

The discussion so far has emphasized that trade may reduce price variability, not only for traded goods themselves but for factors of production as well. Trade does not create risks, but rather transmits risks to trading partners. If these risks are not completely correlated, the effect of trade is to pool risk. Autarky, which cannot prevent risk, does prevent such risk pooling.

Of course these conclusions are derived within specific models and are not perfectly general. This section considers comparison of autarky and free trade in a model with sector-specificity. As in the preceding discussion, trade is not a cause or source of risk. By comparison with autarky, trade brings prices into equality and thus eliminates price risk. However, trade also shifts the incidence or *distribution* of risk, including especially income risk. Because the cost of risk bearing may be higher for some agents than others, the shifting of risk due to trade may raise or lower the demand for insurance.

Starting with the HOS model of the preceding section, let us specialize the model by postulating that just two goods, 0, and 1, are produced using only two factors of production, now called "labor" and "capital." Suppose that good 0 is produced using a linear production technology with labor as the sole input. Good 1 is produced using a constant returns to scale technology in capital and labor; capital is thus a sector-specific factor of production. Assume that labor endowments are identical and nonstochastic in all regions but that capital endowments are independently and identically distributed among regions, with $\bar{k}$ denoting the mean capital endowment. Labor endowments are owned by "workers" in each region. Each region's capital endowment is owned by a different group of households called "capital owners." All households in all regions have quasi-linear preferences represented by the utility function $u(c_0, c_1) = U^m(c_0 + \phi(c_1))$ where $\phi' > 0 > \phi''$ where m indexes the household type, either worker (l) or capital owner (k). The functions $U^m(\cdot)$, assumed to be monotonically increasing, reflect attitudes toward risk: if U^m is linear, then households of type m are risk-neutral; if it is concave or convex, they are risk-averse or risk-preferring.

Taking good 0 as numéraire, the price of good 0 is 1, both under autarky and under free trade. Because of the linear production technology in sector 0, the wage of labor is also 1 under both trade regimes.

The price of good 1 in region j, p_1^j, is determined entirely within the regional economy under autarky, whereas it is determined in global markets under free trade.

Let $\bar{p}_1$ denote the free-trade equilibrium price of good 1 in global markets; it is independent of the realization of k^j in any one region. Because production occurs under constant returns to scale, the unit cost of good 1 must be equal to its price, and hence the free-trade equilibrium return to capital in region j must satisfy the condition $\bar{p}_1 = C(1, r^j)$ where the unit cost function C depends on the wage rate, fixed at 1, and on the return to capital in region j, r^j. It follows that the return to capital under free trade is fixed at a the same value $\bar{r}$ for all regions, independently of regional endowment realizations.

Under autarky, the regional return to capital and the price of good 1 do depend on the capital endowment realization. Letting l_1^j denote the employment of labor in sector 1 in region j, competitive factor pricing implies that

$$r^j = p_1^j f_k(l_1^j, k^j) \tag{1}$$

$$1 = p_1^j f_l(l_1^j, k^j). \tag{2}$$

In the absence of trade, consumption of good 1 is equal to production of good 1, $f(l_1^j, k^j)$, in every region. Using the fact that the equilibrium price of good 1 must be equal to the marginal rate of substitution between that good and good 0, i.e., $p_1^j = \phi'(c_1^j)$, the autarky price of good 1 in region j is given by

$$p_1^j = \phi'(f[l_1^j, k^j]). \tag{3}$$

Substituting for p_1 into (1) and (2) yields a system of two equations that simultaneously determine the autarky equilibrium values of the two unknowns r^{jA} and l_1^{jA}, conditional on the realization of the regional capital endowment.

This completes the description of the basic model, showing how equilibrium allocations and prices are determined both under autarky and under free trade.

With the wage rate fixed at 1 and with labor endowments given, wage income, expressed in units of numéraire, are nonstochastic. Under free trade, the price of good 1 is also nonstochastic. Hence the real incomes and utilities of workers are free of risk under free trade. The incomes of capital owners are stochastic; under free trade, capital income in region j is given by $\bar{r}k^j$ and depends on the endowment realization. The utilities of capital owners are thus also stochastic.

Under autarky, the incomes of workers, expressed in units of numéraire, are again nonstochastic. However, the price of good 1 depends on the local capital endowment realization. Hence the real incomes and utilities of workers vary randomly under autarky.

The incomes of capital owners generally depend on capital endowment realizations under autarky. However, they may vary either positively or negatively with the endowment realization and, as a special case, may even be independent of the realized endowment. To see this, it is convenient, for ease of exposition, to specialize the model by supposing that the capital endowment may take on only one of two values, k^0 and k^1, with equal probability. Assume that $k^0 < k^1$ for concreteness. When the capital endowment realization is low, output in sector 1 is reduced, relative to the high capital endowment realization, and the price of good 1 is thus increased. The concavity of the production function implies that the marginal product of capital is increased. For both reasons, the equilibrium return to capital is higher in the low-endowment than in the high-endowment state. The value of r^{jA} is higher, in the low-endowment state, to a degree that depends both on the degree of substitutability between labor and capital in production and on the elasticity of demand for good 1. In the limiting case where labor and capital are perfect substitutes in production, the value of r^{jA} is independent of the capital endowment because (relative) factor prices cannot change. In the limiting case where labor and capital are perfect complements, output of good 1 is proportional to the capital endowment. With a unit-elastic demand for good 1, the price of good 1 varies in proportion with output and the return to capital must then vary more than in proportion to its endowment.[5] More generally, the lower the elasticity of demand, the greater the sensitivity of the equilibrium price p_1, and the equilibrium return to capital, to the capital endowment realization.

As one reference case, r^j may vary in inverse proportion to k^j, in which case capital income under autarky, $r^j k^j$, expressed in units of numéraire, is independent of the endowment realization. In this case, capital and labor income are both nonstochastic. Because of the variability of p_1, the real incomes and utilities of capital owners depend on the endowment realization in the benchmark case due to consumption price risk. The consumption price risk of capital owners could be perfectly offset, however, if capital income is suffi-

[5]When the elasticity of demand is equal to one, if k^0 is $x\%$ less than k^1, p_1 is $x\%$ higher in the low-endowment state. The unit cost of good 1 is correspondingly higher. If capital and labor are used in equal proportions, the return to capital is higher by $2x\%$ in the low-endowment state.

ciently higher when the capital endowment realization is low, and conversely when it is high. Thus,

Proposition 4: (a) Under autarky, the incomes of workers, expressed in units of numéraire, are nonstochastic. The price of good 1, and hence the real incomes and utilities of workers, vary stochastically with the realization of the capital endowment. Under free trade, the incomes of workers, expressed in units of numéraire, as nonstochastic, as are the price of good 1, and the real incomes and utilities of workers.

(b) Under autarky, the incomes of capital owners, expressed in units of numéraire, as well as their real incomes and utilities, may be nonstochastic or may vary directly or inversely with the realization of the capital endowment. Under free trade, the return to capital is nonstochastic, but the incomes of capital owners, expressed in units of numéraire, as well as their real incomes and utilities, vary directly with capital endowment realizations.

Although this result is derived within the context of a specialized model, it demonstrates that trade may result in a change in the *distribution* of risk, even in an economy where trade *eliminates* price variability. Indeed, when the price of the traded good is stabilized by trade, and with it, the return on capital, the riskiness of capital income *rises.* Trade shifts income risk from workers to capital owners, while eliminating consumption price risk for both.[6]

How does trade affect the demand for insurance in this model? The answer to this question depends on the attitudes toward risk of workers and capital owners. If the former are risk averse and the latter are risk neutral, then trade reduces the social cost of risk and the demand for insurance (at for insurance against income risk).

Of course, the terms "labor" and "capital" are merely suggestive. If these labels are reversed, so that labor is the specific factor, the analysis implies that labor income risk is increased by trade, while capital income risk is eliminated. If workers are risk averse and

[6]See Wildasin (1995) for a related analysis of factor mobility, which can reduce factor price variability for mobile factors in the same way that trade reduces price variability for traded goods. Factor mobility ("trade in factors") can also shift the distribution of risk, in particular by increasing price variability for immobile factors of production.

capital owners are risk neutral, trade increases rather reduces the social cost of risk and the demand for insurance.

5 Conclusion: Empirical and Policy Implications

The preceding discussion has emphasized that fluctuations in the terms of trade are not fundamental *sources* of risk. Rather, they are *symptoms* of risk, reflecting underlying shocks to market fundamentals such as endowments or technologies.[7] As a matter of public policy, it may be possible to restrict or even to prohibit trade, but doing so does not remove the fundamental sources of economic uncertainty. Rather, trade policies affect the extent to which shocks can be transmitted among regions and thus the extent to which these shocks may be pooled and their costs possibly reduced. There seems to be no *a priori* basis on which to suppose that the demand for social insurance is generally higher in a world with free trade. Indeed, the models developed in Sections 2 and 3 above suggest the opposite. If the "demand for insurance" gives rise to a growth of government, trade may well reduce the size of government.[8]

From an empirical viewpoint, the stylized models of Sections 2 and 3 do nevertheless suggest a reason why the volume of trade may be positively associated with a demand for insurance. In those models, trade arises because of the variability of economic fundamentals, represented as endowments of goods or factors but more generally to be interpreted to include technological or other demand and supply determinants. When the underlying variability is low, trade is also low. In these models, regions with high fundamental variability would also be regions with high volumes of trade. These models are constructed so that trade pools risks perfectly, but such pooling might well be imperfect, in practice – for example, due to impediments to trade.[9] Regions with high fundamental risks might indeed

[7] Market participants – monopolies, warring nations – may intentionally or unintentionally disrupt markets and cause global price fluctuations. Whether such shocks are to be considered "fundamental" risks is open to debate. These risks are in any case not caused or exacerbated by trade *per se*.

[8] Indeed, Garen and Trask (2005) find empirical evidence that suggests that government interventions are generally larger in relatively *closed* economies.

[9] Aside from policy impediments, fundamental transactions costs (transportation, com-

have high volumes of trade, mitigating some but not necessarily all of the risks that they face. If trade does not provide perfect insurance, the demand for social insurance may be relatively high in regions that are observed to have high trade volumes, not because trade accentuates risk, but because trade mitigates risks only imperfectly.

The rather "classical" models of Sections 2 and 3 illustrate, in a particularly transparent fashion, how trade may pool risks. As the specific factor model of Section 4 makes apparent, however, there is an important distinction between price risk and income risk. Income is the product of a (factor) price and an (effective) endowment. When equilibrium (factor) prices are negatively correlated with endowments, price risk may offset endowment risk and thus reduce income risk. Trade may reduce price risk, which may reduce real income and utility risk for some agents, but it may also increase income risk for others. That is, trade may shift the *distribution* of risk, for instance between the recipients of capital and wage income. *A priori*, trade may increase or reduce risk for either.

The distribution of risk, particularly income risk, is of critical importance when attempting to determine whether trade increases the demand for insurance. If trade shifts risk to agents for whom the cost of risk-bearing is modest, it reduces the demand for insurance, whereas the opposite is true if it shifts risk to agents that find risk very costly to bear. If trade does increase the demand for insurance, it does not necessarily follow that this demand will or should be met through *social* (public-sector) insurance arrangements, since market institutions may be able to meet this demand. For instance, capital income risk is comparatively easily pooled through financial markets. Wage income risk is more difficult to insure. For this reason, institutions may arise which (imperfectly) shift risks from workers to capital owners. As an example, labor-market contracting through collective bargaining arrangements, reputational mechanisms, or other institutions may limit wage variability and reduce wage income risk, shifting it instead to non-wage income. Financial and labor market institutions may together help to reduce the social

munication, etc.) impede trade. Within the context of the pure exchange and production economies of Sections 2 and 3, let t be a vector of per-unit cost of trading each of n commodities. Under free trade (i.e., in the absence of policy restrictions), equilibrium import (cif) and export (fob) prices will diverge by t, and thus trade cannot eliminate all price risk. If t is large, price risks are also large.

cost of risk.[10] Trade may interact in complex ways with labor and capital market institutions.[11]

Thus, in the end, whether trade results in increased demand for *social insurance* depends, in part, on whether it increases or reduces income risks. It also depends on whether it shifts risks to households for whom risk is costly and not easily pooled or shifted through private sector institutions. It is far from apparent that trade is associated with greater economic risk or with a greater demand for social insurance. To address this issue empirically, it is important to recognize that economies face risk whether or not they engage in trade. From a global perspective, trade is simply a linkage between economies that experience random fluctuations in any case. The underlying sources of risk, the market institutions through which they are propagated, and the fundamental costs of risk all combine to determine the demand for insurance. Trade itself may help to insure against risk.

A number of analysts have developed theoretical analyses that explain how protectionist trade policies can, in principle, provide insurance against risks arising from terms of trade variability. Alternatively, protectionist policies may be viewed as redistributive interventions, to be explained in terms of the power of different factions to impose or defeat policies that redistribute income in their favor or at their expense.[12] To some degree, whether a policy is characterized as "insurance" or "redistribution" is a matter of the time horizon over which the policy is evaluated (see, e.g., Varian (1980)). In any case, protectionist policies affect trade not only for the countries that adopt them, but for their (potential) trad-

[10]See, e.g., Agell (1999, 2000, 2004) for further discussion and references to relevant literature. Schoeb and Wildasin (2007) discuss labor market integration and its implications for risk sharing between workers and capital owners, analyzing the simultaneous adjustment of labor market institutions in a system of partially-integrated economies.

[11]Svaleryd and Vlachos (2002) examine the empirical relationship between the development of financial markets and trade, and Feeney and Hillman (2004) present a theoretical analysis of the linkage between the adoption of protectionist policies and the existence of private risk-sharing institutions. Gaston and Nelson (2004) analyze the interactions between wage setting institutions and trade. Wage risk may also affect the incentive to invest in specialized human capital (Wildasin (2004) and the degree of specialization in production (Picard and Wildasin (2006)), effects that also may interact with and affect the incentives for trade. These and other complexities go beyond the scope of the present analysis.

[12]For example, Rogowski (1989) and Hiscox (2002) explore the development of political parties in relation to protectionist or free trade policies favoring particular economic sectors or classes.

ing partners. Any one region's ability to pool risks through trade depends partly on the willingness of other countries to engage in trade with it, and the demand for insurance in that region may be increased by restrictions on trade in other countries resulting from protectionist interventions. Thus, high demands for social insurance in one set of regions can potentially increase political pressures for the extension of social insurance elsewhere, conceivably supporting a "protectionist equilibrium" in which all regions create policy impediments to trade. In this case, protectionist policies in any one region attributable not to global trade risk but to global trade interventions. Explaining the *simultaneous* determination of protectionist and social insurance policies in a *system* of regions is an important task for future research.

References

Agell, J., (1999), “On the benefits from rigid labour markets: norms, markets failures, and social insurance,” *Economic Journal 109*, 143-164.

Agell, J., (2000), “On the determinants of labor market institutions: rent-sharing vs. social insurance,” *German Economic Review 3*, 107-135.

Agell, J., (2004), “Efficiency and Equality in the Labour Market,” *CESifo Economic Studies 50*, 255-278.

Boix, C. (2001), “Democracy, Development, and the Public Sector,” *American Journal of Political Science 45*, 1-17.

Cassing, J.H., A. L. Hillman, and N.V. Long (1986), “Risk Aversion, Terms of Trade Uncertainty and Social-Consensus Trade Policy,” *Oxford Economic Papers 38*, 234-242.

Feeney, J. and A. Hillman (2004), “Trade liberalization through asset markets,” *Journal of International Economics, 64*, 151-167.

Garen, J. and K. Trask (2005), “Do more open economies have bigger governments? Another look,” *Journal of Development Economics, 77*, 533-551.

Gaston, N. and D. Nelson (2004), “Structural Change and the Labor-market Effects of Globalization,” *Review of International Economics 12*, 769-792.

Hiscox, M.J. (2002), *International Trade and Political Conflict: Commerce, Coalitions, and Mobility.* (Princeton: Princeton University Press).

Katzenstein, P. (1985), *Small States in World Markets* (Ithaca: Cornell University Press).

Lindert, P. H. (2004), *Growing Public: Social Spending and Economic Growth Since the Eighteenth Century* (Cambridge: Cambridge University Press).

Picard, P. and D. E. Wildasin (2006), "Labor Market Pooling, Outsourcing and Contracts in Chamberlinian Cities," University of Manchester School of Economics Discussion Paper No. 0520 and CORE Discussion Paper No. 2006/60.

Rodrik, D. (1998), "Why Do More Open Economies Have Bigger Governments?" *Journal of Political Economy 106*, 997-1032.

Rogowski, R. (1989), *Commerce and Coalitions: How Trade Affects Domestic Political Alignments.* (Princeton: Princeton University Press).

Schoeb, R. and D. E. Wildasin (2007), "Economic Integration and Labor Market Institutions: Worker Mobility, Earnings Risk, and Contract Structure," *Regional Science and Urban Economics 37*, 141-164.

Svaleryd, H. and J. Vlachos (2002), "Markets for Risk and Openness to Trade: How Are They Related?" *Journal of International Economics 57*, 369-395.

Varian, H. (1980), "Redistribution as Social Insurance," *Journal of Public Economics 14*, 49-68.

Wildasin, D. E. (1995), "Factor Mobility, Risk, and Redistribution in the Welfare State," *Scandinavian Journal of Economics 97*, 527-546.

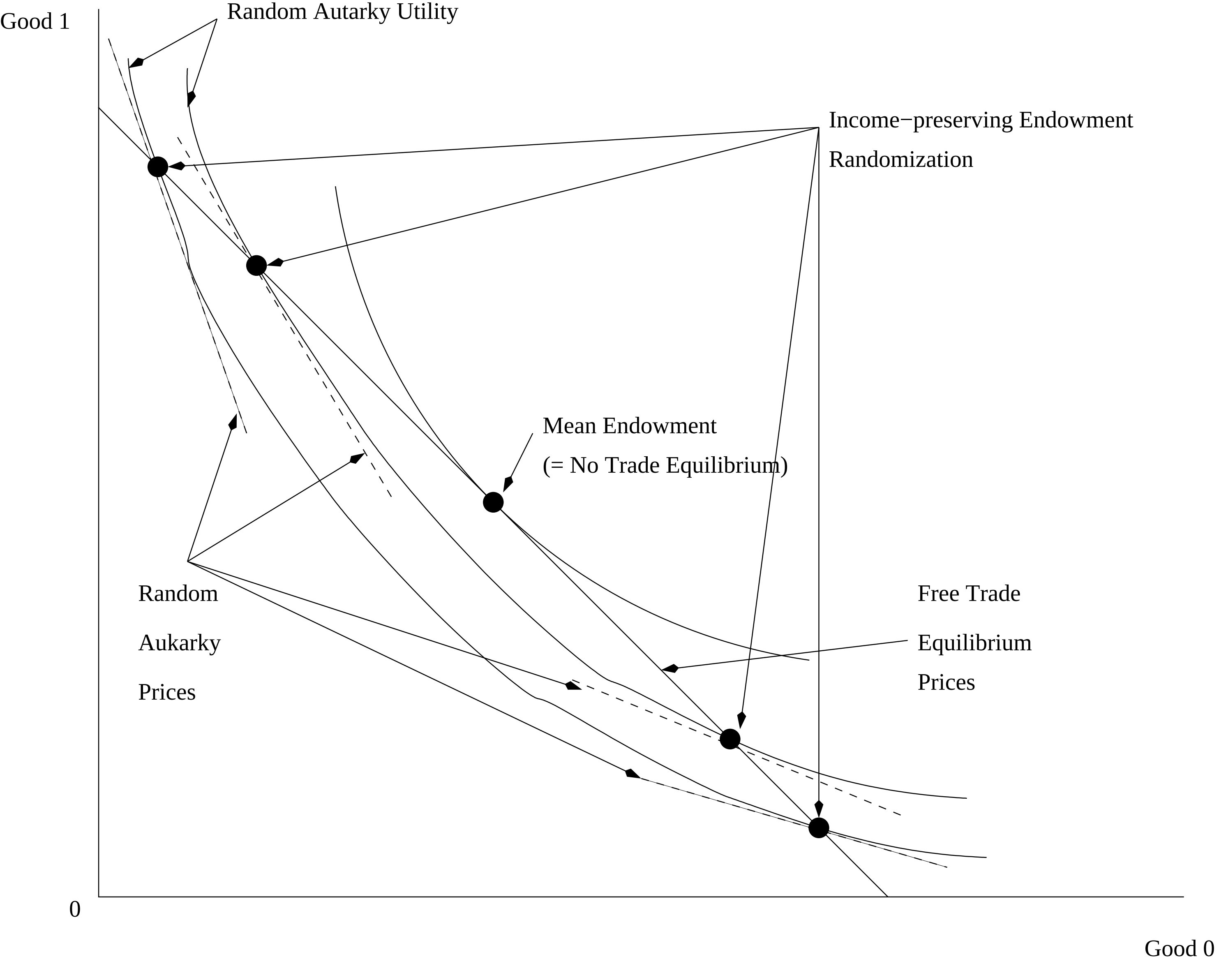
Good 1
Random Autarky Utility
Income−preserving Endowment
Randomization
Mean Endowment
(= No Trade Equilibrium)
Random
Aukarky
Prices
Free Trade
Equilibrium
Prices
0
Good 0

FIGURE 1