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## Asset markets and individual trade policy preferences

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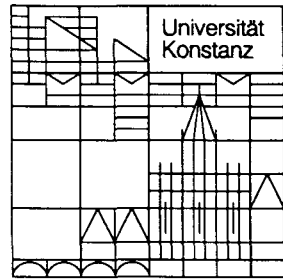
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**Sonderforschungsbereich 178**  
**„Internationalisierung der Wirtschaft“**

Diskussionsbeiträge

Juristische  
Fakultät

Fakultät für Wirtschafts-  
wissenschaften und Statistik

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JoAnne Feeney  
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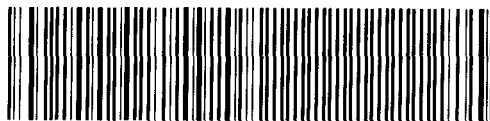
**Asset Markets and Individual Trade-Policy  
Preferences**

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**W 113 (282)**



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## ASSET MARKETS AND INDIVIDUAL TRADE-POLICY PREFERENCES

### Abstract

Protectionist industry interests stem from nondiversified individual income which derives from industry-specific factor ownership. This paper investigates how access to domestic and international asset markets moderates industry-affiliated individuals' preferences for protectionist trade policies. We consider an economy where individuals with industry-specific holdings of human and physical capital confront real-income risk due to uncertainty in the economy's terms of trade. While human capital is nontradeable, noncontingent asset markets permit the exchange of ownership of physical capital. We establish conditions by which domestic asset markets can create a consensus for free trade. These conditions would not in general be expected to be realized. We then proceed to show how the addition of access to international asset markets has a liberalizing influence on individuals' preferred trade policies, and how the internationally tradeable assets of an economy's nontraded-goods sector further liberalizes individuals' policy preferences. The predictions of the model are consistent with the greater proclivity to liberalization of trade policy in market economies with developed domestic asset markets, liberal foreign investment opportunities, and sizeable nontraded-goods sectors. The model is also consistent with observed historical trade policy phenomena.

## Introduction

The theory of international trade stresses the efficiency gains from trade and recommends that governments refrain from protectionist policies.<sup>1</sup> Nevertheless, the preferred trade policy of each member of an economy often fails to be free trade. The differences in preferred policies arise from asymmetries in the sources of the population's income. A consensus in favor of free trade requires that the component sources of each individual's income be proportional to the economy's aggregate resource endowments. Only then do the liberal trade policies which maximize aggregate income also maximize all individual incomes. In the absence of such income symmetry, endogenous-policy mechanisms can give rise to Pareto-inefficient protection. If policies are determined by majority voting under direct democracy, the median voter's income sources may lead him or her to prefer protection to free trade (Wolfgang Mayer, 1984). Under the more commonplace, and more complex, institutions of representative democracy, protection can reflect a principal-agent problem between voters and their elected representatives. While a majority of voters at large can be expected to prefer an absence of import restrictions on every good, elected representatives may choose protectionist policies in response to lobbying by coalitions of beneficiaries of barriers to free trade (Robert Baldwin, 1982).

Since individuals have no interest in such protectionist policies when income-source components are symmetric, asset markets would appear to have a role in the endogenous determination of a country's international trade policy: asset markets increase income symmetry by allowing individuals to diversify income sources. Nonetheless, the role of asset markets has not been studied in the context of the theory of endogenous trade policy. The usual framework for describing

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<sup>1</sup> There are also many proposed qualifications to the efficiency case for free trade, for example the strategic-trade-policy case for government intervention arising out of the imperfectly competitive environment of the "new" international trade theory. We adopt here the classical presumption of the desirability of free trade on efficiency grounds. For a critical evaluation of the "new" trade theory, see Robert Baldwin (1992).

the basis for individuals' preferred trade policies is the specific-factors model of international trade -- formulated and refined by Ronald Jones (1971, 1975), Wolfgang Mayer (1974), Ronald Jones and Roy Ruffin (1977), Peter Neary (1978), and others.<sup>2</sup> In this model policy interests are established under conditions where factor owners are obliged to retain nondiversified industry-specific factor endowments due to an exogenous absence of asset markets. The exogenous restriction against asset diversification ties individual real income to industry rents which in import-competing industries are increased by protectionist policies. Factor owners are thus confronted with incentives to influence trade policy to protect or increase industry rents. These incentives provide the foundation for an extensive literature on industry interests and the political economy of protection (see the surveys by Arye Hillman 1989, Stephen Magee, William Brock, and Leslie Young 1989, and Magee, 1994).

The protectionist policies predicted by the political-economy models have been (and are) observed at different times across countries. Yet we have also witnessed substantial liberalization of international trade within the past framework of the GATT (replaced in 1995 by the WTO), and within customs unions such as the European Union and free-trade agreements such as NAFTA. The liberalization episodes run counter to protection based on common policy interests by individuals earning nondiversified industry rents, and raise questions regarding the sources of change which impart liberalizing tendencies to international trade policy.<sup>3</sup>

In this paper we study the relationship between such liberalizing tendencies and the

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<sup>2</sup> An alternative to the specific-factors model for identifying individuals' policy interests is the Stolper-Samuelson Theorem of the Heckscher-Ohlin model of international trade. In the latter model, the policy protagonists are owners of intersectorally mobile factors of production, and not industry-based coalitions. For a summary of different frameworks for identifying beneficiaries of protection, see Arye Hillman (1989, chapter 1).

<sup>3</sup> The liberalization episodes were accompanied by compensating protection for some industries, with nontariff barriers replacing reduced tariffs (see, for example, Robert Baldwin, 1985). The overall tendency has been toward trade liberalization (see Dan Trefler, 1993, on the magnitude of U.S. liberalization).

development of asset markets.<sup>4</sup> Our theoretical framework employs a reformulated specific-factors model wherein individuals confront real-income risk due to uncertainty regarding the economy's terms of trade. We introduce into this setting the noncontingent asset markets that are present in developed market economies.<sup>5</sup> Noncontingent markets offer only limited opportunities for diversification in part due to the nontradeability of claims to some forms of capital. In particular, moral-hazard and adverse-selection problems that follow from difficulties in observing effort and ability inhibit trades in claims to the returns to human capital. Reflecting these limitations, we model individuals as initially endowed with both human and physical industry-specific capital but restricted in asset trade to physical capital alone. We use the model to establish how asset markets affect self-interested trade policies, and thereby influence the policies that are sought via endogenous-policy processes.

We begin by characterizing the conditions where domestic asset markets permit the portfolio diversification necessary to establish a domestic consensus for a free-trade policy. When these conditions are not fulfilled, however, we show that the further opportunity of access to international asset markets will in general have an additional liberalizing influence on individuals' preferred trade policies. Still, the nontradeability of industry-specific human capital may convey benefits from protectionist policies to some individuals even after trades in both domestic and international asset markets. We then show how the internationally tradeable assets of an economy's nontraded-goods sector further liberalize individuals' policy preferences.

Asset markets of course do not diminish the industry-specificity of factors of production, but

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<sup>4</sup> Our study of the relationship between asset markets and individuals' trade-policy preferences complements the literature concerned with the effects of asset-market completeness on incentives to engage in international trade in goods. See, for example, Alan Stockman (1987) and JoAnne Feeney (1994).

<sup>5</sup> Thus we assume that the transactions costs associated with extensive use of terms-of-trade contingent markets are prohibitively high.



rather reduce the industry-specificity of individual income sources.<sup>6</sup> The more liberal individual policy preferences that result affect both ex-ante and ex-post endogenous trade policies. Ex-ante (before the realization of the economy's terms of trade), the risk-sharing achievable via asset markets reduces individuals' incentives to secure contingent protection as insurance against adverse realizations of the terms of trade.<sup>7</sup> Ex-post (after the realization of the terms of trade), the character of self-interested policy coalitions is transformed by asset markets as individuals' trade-policy preferences become less partisan and more attuned to the objective of maximizing income of the economy at large.<sup>8</sup>

Endogenous trade liberalization, whether interpreted in terms of ex-ante or ex-post policy preferences, is accordingly furthered by development of domestic asset markets and by liberalization of international asset transactions, and, given liberal private foreign investment policies, by a

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<sup>6</sup> The preference for trade liberalization derived from portfolio diversification in domestic and international asset markets contrasts with the endogenous-policy conclusions when industry-specific capital is imperfectly mobile between industries at any point in time (Gene Grossman, 1983) or intersectorally mobile over time (Wolfgang Mayer, 1974). In these latter instances intersectoral mobility of capital (rather than as in our model cross-sectoral diversification of immobile-capital ownership) leads in the limit of complete factor mobility to the Heckscher-Ohlin model and to the income-distribution consequences expressed in the Stolper-Samuelson Theorem: broad cross-industry coalitions of labor and capital emerge with conflicting trade-policy positions that depend on the economy's relative aggregate factor endowments, rather than individuals moderating towards more liberal preferred trade policies.

<sup>7</sup> In a setting where asset markets are unavailable, Jonathan Eaton and Gene Grossman (1985) show that a government can provide social insurance via a commitment to state-contingent protection, although as shown by Avinash Dixit (1992) such trade intervention becomes Pareto-inefficient when the market failure arises endogenously due to the presence of moral hazard, adverse selection, or informational asymmetries. Despite this Pareto inefficiency, sufficiently risk-averse individuals with nondiversified sector-specific income will prefer (and have reason to lobby for) some contingent protection due to the risk-sharing delivered via the income redistribution of ex-post protectionist policies (Hillman, 1989, chapter 9). State-contingent protection in practice includes anti-dumping and injury-clause protection, import quotas which in the face of terms-of-trade variability place lower bounds on realized domestic prices of import-competing output, and variable import levies set to maintain stable domestic prices. Such contingent policies in turn, in particular antidumping and injury escape-clause, are manipulable by their potential beneficiaries (see James Anderson, 1992, Michael Leidy, 1994).

<sup>8</sup> Support for protectionist candidates is thereby reduced when policies are the outcome of political competition (Arye Hillman and Heinrich Ursprung, 1988), as is willingness to pay an incumbent policy maker for "protection for sale" (Gene Grossman and Elhanan Helpman, 1994).

significant nontraded-goods sector. These conditions characterize liberal developed market economies. We thus provide an explanation for the greater amenability of governments in developed high-income countries to embark on trade liberalization, and the oft-observed inability to sustain liberal trade reforms in countries where asset markets are not developed, international capital-account transactions are restricted, and nontraded-goods sectors are small.

The model also has implications for the circumstances of economies in transition.

Privatization in the form of distribution of vouchers to the population at large permits diversified ownership of industry-specific assets. The symmetry in income sources gives citizens reason to prefer liberal international trade policies. By contrast, where privatization takes the form of distribution of shares to management and workers with restricted transfer rights, or where private agents remain the claimants to nonprivatized enterprises' profits, industry-specific income sources are not diversified. Conditions are then more conducive to the emergence of protectionist international trade policies.

A further application addresses historical trade-policy phenomena. An intensively-studied episode in the history of international trade policy is the mid-19th century repeal of the protectionist English Corn Laws. Our model sets out the formal basis for an explanation of the repeal of the Corn Laws that looks to development of asset markets in 19th-century England and to the portfolio diversification opportunities thereby provided to import-competing English agricultural landed interests. Domestic asset markets permitted landowners in the protected agricultural sector to diversify their income away from agriculture (see the empirical evidence in Cheryl Schonhardt-Bailey, 1991). Such diversification would have brought the composition of individuals' asset portfolios closer to that of the structure of factor endowments of the economy at large. Beyond this, liberal trade preferences were enhanced by foreign investment opportunities and internationally tradeable claims in assets of domestic nontraded-goods industries (such as English railroads). By contrast, in the ante-bellum United States, asset diversification possibilities were more limited (see for example Gavin

Wright, 1978). Agents with claims to import-competing (northern) manufacturing-specific capital had limited opportunities (and desire) to diversify by holding claims to factors (including slaves) specific to (southern) agriculture.<sup>9</sup> Individual portfolios consistent with a broad consensus for free trade could not be established, and liberalization did not take place.

We proceed now with the paper as follows. In Section 1 we set out our specific-factors model which incorporates real-income risk due to terms of trade uncertainty and asset markets that permit trade in physical but not human capital. Section 2 describes how the presence of domestic and international asset markets affects individuals' preferred trade policies. Section 3 introduces a nontraded-goods sector. The final section contains observations regarding additional limitations on asset diversification, and thereby liberalization of individuals' policy preferences, beyond those due to nontradeability of human capital.

### **1. A Specific-Factors Model with Asset Markets**

We consider a competitive economy in which two final goods are produced and consumed. In the standard two-sector version of the specific-factors model competitive firms produce such goods using inputs of competitively and inelastically supplied sector-specific capital and intersectorally mobile labor. Ownership of these factors of production by private agents is given exogenously and once given is thereafter immutable. In our modification of the specific-factors model we make three changes: (i) we incorporate explicitly the presence of uncertainty in returns to sector-specific factors of production, (ii) we introduce asset markets wherein agents may trade ownership claims to sector-specific capital, and (iii) we distinguish sector-specific capital whose ownership is tradeable from that which is not tradeable.

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<sup>9</sup> The value of a portfolio that includes claims to slaves would have been diminished by the difficulty of monitoring the treatment of one's slaves when working conditions were subject to the discretion of distant plantation managers.

The economy faces exogenous and stochastic terms of trade that are due to unpredictable fluctuations in production of the two goods in the rest of the world. Agents are risk-averse with identical preferences, and maximize expected utility subject to constraints that depend upon the completeness of markets. Initially, we consider the implications for trade-policy preferences of access to domestic asset markets alone, and subsequently international asset markets. Potential trade policies are limited to those with solely internal redistributive effects.<sup>10</sup> We focus on the two types of agents who are initially endowed with sector-specific human and physical capital. Supplies of both types of capital have been accumulated in the past and have sector-specific uses which prevent mobility across sectors. While future investment and depreciation would permit changes in the ratios in which these factors exist, at any point in time capital is not readily transferable between industries, and current supplies of specific capital form the basis of trade-policy preferences of the private sector. For purposes of simplicity and clarity, our model thus omits the accumulation process and focuses on the importance of the existing relative supplies of sector-specific human and physical capital.<sup>11</sup> <sup>ea</sup>

To capture the incompleteness of markets discussed in the introduction, we model claims to income from physical capital as tradeable, but not so claims to income from human capital. The returns to human capital are generally not tradeable when, for example, human capital is the residual claimant and its return is not observable, or difficulties arise in distinguishing between the contributions of effort and random technology to an observable return. The analysis in this paper depends on the existence of such a market failure, but not critically on its source. We examine the effects of nontradeability of human capital on industry-specificity of individual income and the consequent trade-policy preferences of these constrained individuals; we do not suggest that policy can

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<sup>10</sup> Alan Stockman and Harris Dellas (1986), by contrast, examine the impact of international financial markets on the consequences of the imposition of the 'optimal tariff' and show, paradoxically, that individuals in the country whose government imposed the tariff lose due to the ex-ante risk-sharing arrangements.

<sup>11</sup> This points to a relation between endogenous capital accumulation and endogenous trade-policy formation.

correct the market failure. In the exposition of the production technology that follows, therefore, we refrain from adding complexities to the model that would endogenize the nontradeability of human capital.

### A. Technologies and factor returns

Final consumption goods, X and Y, are produced using combinations of inputs of an industry-specific intermediate good,  $M_j$  ( $j=X, Y$ ), and mobile labor,  $L_j$ . Intermediate goods are produced using combinations of industry-specific human capital,  $H_j$ , and physical capital,  $K_j$ . In addition to labor, there are two types of agents in the economy who are distinguished by initial sector-specific endowments of physical and human capital. The type-X agents, on the one hand, are initially endowed with equal amounts of  $K_X$  and  $H_X$ , while the type-Y agents, on the other, receive  $K_Y$  and  $H_Y$ . Asset markets permit transfer of ownership of physical capital, while human capital must be retained. Intermediate- and final-goods production takes place under competitive, constant-returns-to-scale conditions. Productivity is, however, uncertain due to exogenous disturbances to the country's terms of trade. The two types of specific capital are employed in the fixed proportions in which they exist in (fixed) supply, and earn the value of ex-post marginal products as specified in ex-ante contracts that allocate sector-specific rents.<sup>12</sup> In state-of-the-world  $s$  for  $s = \{1, 2, \dots, S\}$ , the economy's outputs for the realized terms of trade are given by

$$(1) \quad X(s) = X[M_X, L_X(s)], \quad M_X = F(K_X, H_X) = H_X f(k_X), \quad k_X \equiv \frac{K_X}{H_X}$$

$$Y(s) = Y[M_Y, L_Y(s)], \quad M_Y = G(K_Y, H_Y) = H_Y g(k_Y), \quad k_Y \equiv \frac{K_Y}{H_Y}$$

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<sup>12</sup> The constant-returns-to-scale technology generates production functions which are concave in each factor. Although the supplies of sector-specific human and physical capital are fixed, the returns earned by each thus reflect the shadow value of a marginal change in the factor's supply.

where for mobile factors,

$$L_X(s) + L_Y(s) = \bar{L}$$

and for sector-specific factors,

$$K_X = \bar{K}_X, K_Y = \bar{K}_Y, H_X = \bar{H}_X, H_Y = \bar{H}_Y .$$

A bar over a variable indicates the endowment level and  $L_j(s)$  reflects the state-dependency of labor which is allocated ex post. The returns to sector-specific intermediate inputs and, thereby, to the sector-specific physical and human capital used to produce these inputs, depend on the realized relative price of output, and on the state-contingent allocation of labor.

The nominal returns to industry-specific human and physical capital are consequently given by

$$(2) \quad \begin{aligned} r_{KX}(s) &= P_X(s) X_1[F(K_X, H_X), L_X(s)] F_1(K_X, H_X) = r_{MX}(s) f'(k_X) \\ r_{KY}(s) &= P_Y(s) Y_1[G(K_Y, H_Y), L_Y(s)] G_1(K_Y, H_Y) = r_{MY}(s) g'(k_Y) \\ r_{HX}(s) &= P_X(s) X_1[F(K_X, H_X), L_X(s)] F_2(K_X, H_X) = r_{MX}(s) [f(k_X) - k_X f'(k_X)] \\ r_{HY}(s) &= P_Y(s) Y_1[G(K_Y, H_Y), L_Y(s)] G_2(K_Y, H_Y) = r_{MY}(s) [g(k_Y) - k_Y g'(k_Y)] \end{aligned}$$

where numerical subscripts and primes denote marginal products. With a 'hat' over a variable denoting percentage change, the competitive allocation of mobile labor implies the magnification effects for real incomes,

$$(3) \quad \hat{r}_{HY} = \hat{r}_{KY} > \hat{P}_Y > \hat{w} > \hat{P}_X > \hat{r}_{HX} = \hat{r}_{KX} .$$

Asset markets facilitate trade only in physical capital,  $K_X$  and  $K_Y$ . Denote the dividend to a claim to  $K_j$  by  $\delta_{Kj}$  (to  $H_j$  by  $\delta_{Hj}$ ), and, with the total number of claims of each type of specific capital normalized to unity, the dividend equals the total return to  $K_j$ ,  $r_{Kj}(s) \bar{K}_j$  (or to  $H_j$ ,  $r_{Hj}(s) \bar{H}_j$ ). Uncertainty in the terms of trade imparts the following characteristics to dividends paid on specific

capital:

$$\begin{aligned}
 (4) \quad \text{Cov}(\delta_{KX}, \delta_{HX}) &= f'(k_X)K_X F_2(\cdot) \sigma_{MX}^2 \quad \text{and} \quad \text{Corr}(\delta_{KX}, \delta_{HX}) = 1 \\
 \text{Cov}(\delta_{KY}, \delta_{HY}) &= g'(k_Y)K_Y G_2(\cdot) \sigma_{MY}^2 \quad \text{and} \quad \text{Corr}(\delta_{KY}, \delta_{HY}) = 1 \\
 \text{Cov}(\delta_{KX}, \delta_{KY}) &= f'(k_X)K_X g'(k_Y)E\{[r_{MX} - \bar{r}_{MX}][r_{MY} - \bar{r}_{MY}]\} \\
 \text{Corr}(\delta_{KX}, \delta_{KY}) &= \frac{E\{[r_{MX} - \bar{r}_{MX}][r_{MY} - \bar{r}_{MY}]\}}{\sigma_{MX} \sigma_{MY}} \\
 &= \text{Corr}(\delta_{HX}, \delta_{HY}) = \text{Corr}(\delta_{HX}, \delta_{KY}) = \text{Corr}(\delta_{HY}, \delta_{KX}) \\
 &= \text{Corr}(r_{MX}, r_{MY}) < 0
 \end{aligned}$$

where  $\sigma_{ij}$  denotes the standard deviation of the return to factor  $i$  specific to sector  $j$ ,  $\sigma_{ij}^2$  the variance, and bars denote expected values. These correlations follow from factor returns given in (2).

We identify trade-policy preferences in the context of a free-trade equilibrium with no initial protection nor any other type of "industry assistance." Hence there is no capitalization of protectionist or other intervention-derived rents into asset values.<sup>13</sup>

### *B. Individual Optimization with Domestic Asset Markets*

In the first stage of a two-stage decision problem, before the terms of trade are known, agents engage in asset trade to acquire a portfolio of claims to physical capital. After the terms of trade are revealed, mobile labor is competitively allocated between sectors, firms undertake production, and owners of factors receive payments. Subsequently, agents in the second-stage decision use this income to obtain the desired bundle of consumption goods through international trade. The representative type- $j$  agent thus chooses consumption to

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<sup>13</sup> Nor therefore are we concerned with the distribution of tariff revenues (see Ngo Van Long and Neil Vousden, 1991).

$$(5) \quad \max u(x^j, y^j)$$

$$\text{subject to } NI^j(s) = P_x(s)x^j + P_y(s)y^j \quad .$$

Utility,  $u(x^j, y^j)$ , is increasing in both arguments, strictly concave, homothetic, and twice-continuously differentiable.<sup>14</sup> Corresponding indirect utility is  $V[\bar{I}^j(s), p_y(s)]$  where  $\bar{I}^j(s)$  is agent  $j$ 's real income in state  $s$ . Nominal income in state  $s$  for agent  $j$ ,  $NI^j(s)$ , depends on the realized world relative price  $p_y(s) \equiv P_y(s)/P_x(s)$ . Nominal income is transformed to real income by deflating by a linearly homogeneous, strictly increasing, quasiconcave price index,  $D(P_x(s), P_y(s))$ , defined as  $D=1$  for the minimal cost of achieving a normalized level of utility. In equilibrium, marginal rates of substitution in consumption for all individuals are equal to the realized world relative price in state  $s$ ,

$$(6) \quad \frac{u_2(x^j, y^j)}{u_1(x^j, y^j)} = p_y(s) \quad .$$

In the first-stage decision problem, each agent has an endowed total capital-asset wealth,  $\Theta^j$ , which can be transformed to a portfolio of holdings of claims to X- and Y-sector-specific physical capital to maximize expected utility. Normalizing to unity the total number of claims available on each type of capital, and denoting by  $\alpha_i^j$  holdings of asset  $i$  by agent  $j$  (where  $i = x, y, H$  indicates claims to physical capital,  $K_x$  and  $K_y$ , and human capital), the type- $j$  agent maximizes expected utility by choosing portfolio allocations to solve

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<sup>14</sup> Output levels are indicated by uppercase letters, and consumption by lowercase.



$$(7) \quad \text{Max } E \left\{ V[I^j(s), p_y(s)] \right\}$$

$$\text{s.t. } \theta^j - q_{KX} \alpha_x^j - q_{KY} \alpha_y^j - q_{Hj} \alpha_H^j \geq 0$$

$$\alpha_x^j \geq 0, \alpha_y^j \geq 0, \alpha_H^j = 1$$

$$\text{where } NI^j(s) = r_{Hj}(s) H_j + \alpha_x^j r_{KX}(s) \bar{K}_x + \alpha_y^j r_{KY}(s) \bar{K}_y$$

$$\text{and where } I^j(s) = \frac{NI^j(s)}{D[P_x(s), P_y(s)]}$$

Since agents are obliged to maintain ownership of initial human capital endowments,  $\alpha_H^j = 1$ .<sup>15</sup> The domestic asset prices are  $q_{KX}$ ,  $q_{KY}$ ,  $q_{Hj}$ . Conditions for optimal portfolio choice follow as:

$$(8) \quad E \left\{ V_j[I^j(s), p_y(s)] \delta_{KX}(s) \right\} - \lambda^j q_{KX} + \gamma_x^j = 0$$

$$E \left\{ V_j[I^j(s), p_y(s)] \delta_{KY}(s) \right\} - \lambda^j q_{KY} + \gamma_y^j = 0$$

$$\theta^j - q_{KX} \alpha_x^j - q_{KY} \alpha_y^j - q_{Hj} \geq 0$$

$$0 \leq \alpha_x^j \leq 1, \quad 0 \leq \alpha_y^j \leq 1, \quad \alpha_H^j = 1$$

$$\lambda^j \geq 0, \quad \gamma_x^j \geq 0, \quad \gamma_y^j \geq 0$$

$$\gamma_x^j \alpha_x^j = 0, \quad \gamma_y^j \alpha_y^j = 0, \quad \text{and}$$

$$\lambda^j \left\{ \theta^j - q_{KX} \alpha_x^j - q_{KY} \alpha_y^j - q_{Hj} \alpha_H^j \right\} = 0 \quad \text{Complementary Slackness Conditions}$$

where  $\lambda^j$  and  $\gamma^j$  denote the Kuhn-Tucker multipliers. The portfolios that satisfy these conditions will be shown to depend in part on the risk characteristics of returns and on relative human and physical capital returns. Before turning to a discussion of the possible outcomes, we introduce the decision

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<sup>15</sup> We also rule out short sales of industry-specific physical capital since this would otherwise create a liability on the return paid to the agent's human capital. Consequently, when trade in claims to human capital does not arise in an economy, it must also be the case that short sales of physical capital are prohibited.

problem when international capital markets are available.

### C. International Portfolio Diversification

Uncertainty in the terms of trade reflects stochastic foreign technology which creates unforeseen fluctuations in foreign factor productivities and results in volatility in (rest-of-the) world output levels. Foreign production takes place with the same expected technology as domestic production, and is described for state-contingent outputs by:

$$(9) \quad X^w(s) = \phi_x(s) X[M_X^w, L_X^w(s)] \quad \text{and} \quad M_X^w = F(K_X^w, H_X^w) = H_X^w f(k_X^w), \quad k_X^w \equiv \frac{K_X^w}{H_X^w}$$

$$Y^w(s) = \phi_y(s) Y[M_Y^w, L_Y^w(s)] \quad \text{and} \quad M_Y^w = G(K_Y^w, H_Y^w) = H_Y^w g(k_Y^w), \quad k_Y^w \equiv \frac{K_Y^w}{H_Y^w}$$

$$\text{where } L_X^w(s) + L_Y^w(s) = L^w$$

$$\text{and } K_X^w = \bar{K}_X^w, \quad K_Y^w = \bar{K}_Y^w, \quad H_X^w = \bar{H}_X^w, \quad H_Y^w = \bar{H}_Y^w \quad .$$

The foreign productivity shocks  $\phi_j(s)$  are strictly positive, drawn from the same distribution, imperfectly correlated, and have an expected value of unity. The ex-post returns to foreign physical and human capital depend on the magnitude of the technology shock, the response of world prices to technology shocks, and the equilibrium ex-post allocation of labor across industries, and are given by

$$(10) \quad r_{KX}^w(s) = P_X(s) \phi_x(s) X_1[F(K_X^w, H_X^w), L_X^w(s)] F_1(K_X^w, H_X^w) = r_{MX}^w(s) f'(k_X^w)$$

$$r_{KY}^w(s) = P_Y(s) \phi_y(s) Y_1[G(K_Y^w, H_Y^w), L_Y^w(s)] G_1(K_Y^w, H_Y^w) = r_{MY}^w(s) g'(k_Y^w)$$

$$r_{HX}^w(s) = P_X(s) \phi_x(s) X_1[F(K_X^w, H_X^w), L_X^w(s)] F_2(K_X^w, H_X^w) = r_{MX}^w(s) [f(k_X^w) - k_X^w f'(k_X^w)]$$

$$r_{HY}^w(s) = P_Y(s) \phi_y(s) Y_1[G(K_Y^w, H_Y^w), L_Y^w(s)] G_2(K_Y^w, H_Y^w) = r_{MY}^w(s) [g(k_Y^w) - k_Y^w g'(k_Y^w)]$$

Since domestic and foreign expected factor productivities are the same, domestic and foreign expected factor returns are also equal. We also assume that the technology guarantees that domestic and foreign variances of returns are equal.<sup>16</sup> When access is provided to world capital markets, domestic agents have opportunities to purchase claims to foreign sector-specific physical capital at given world asset prices, and the decision problem of the representative type- $j$  agent becomes:

$$(11) \quad \max E \left\{ V[I^j(s), p_y(s)] \right\}$$

$$\text{s.t. } (1 - \beta_H^j) - \beta_X^j - \beta_Y^j - \beta_{XW}^j - \beta_{YW}^j \geq 0$$

$$\beta_i^j \geq 0 \text{ for } i = H, X, Y, XW, YW$$

$$\text{where } NI^j(s) = H_j r_{Hj}(s) + \theta^j [\beta_X^j R_{KX}(s) + \beta_Y^j R_{KY}(s) + \beta_{XW}^j R_{KX}^*(s) + \beta_{YW}^j R_{KY}^*(s)] .$$

Here  $\beta_i^j$  denotes the share of agent  $j$ 's wealth in asset  $i$ :  $H$  denotes human capital, and the remaining shares refer to ownership of physical capital with the  $W$  indicating shares in world physical capital in the world  $X$  or  $Y$  industries. Since agents are restricted to trading only physical capital wealth,  $\beta_H^j = \{r_{Hj}H^j\}/NI^j$ .  $R_{Kj}$  and  $R_{Kj}^*$  denote the gross rate of return on domestic and world physical capital specific to sector  $j$ .<sup>17</sup> Total wealth of agent  $j$ ,  $\theta^j$ , is given by the value at world asset prices of the agent's initial physical capital holdings and the shadow value of the agent's sector-specific human capital endowment. An optimal portfolio diversified between domestic and foreign assets is characterized by the conditions:

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<sup>16</sup> With equal expected factor returns, differing variances of factor returns at home and abroad would create independent incentives for individuals to engage in international asset trade as one country would sell insurance against this higher aggregate risk to the other. We here eliminate such incentives.

<sup>17</sup> The gross rates of return on physical capital are positively related to the realized marginal productivities and are scaled by world equilibrium capital-asset prices. Thus, the covariance properties of these gross returns with domestic human capital match those of  $r_{Kj}^*$  with domestic human capital.

$$\begin{aligned}
(12) \quad & E \left\{ V_i[I^j(s), p_y(s)] \theta^j R_{KX}(s) \right\} - \lambda^j + \gamma_X^j = 0 \\
& E \left\{ V_i[I^j(s), p_y(s)] \theta^j R_{KY}(s) \right\} - \lambda^j + \gamma_Y^j = 0 \\
& E \left\{ V_i[I^j(s), p_y(s)] \theta^j R_{KX}^w(s) \right\} - \lambda^j + \gamma_{XW}^j = 0 \\
& E \left\{ V_i[I^j(s), p_y(s)] \theta^j R_{KY}^w(s) \right\} - \lambda^j + \gamma_{YW}^j = 0 \\
& (1 - \beta_H^j) - \beta_X^j - \beta_Y^j - \beta_{XW}^j - \beta_{YW}^j \geq 0 \\
& 0 \leq \beta_i^j \leq 1 \quad \forall i \neq H \quad \text{and} \quad \beta_H^j = \frac{r_{Hj} H^j}{N I^j} \\
& \lambda^j \geq 0, \quad \gamma_i^j \geq 0 \quad \forall i \neq H \\
& \gamma_i^j \beta_i^j = 0 \quad \forall i \neq H \quad \text{and} \\
& \lambda^j \left\{ (1 - \beta_H^j) - \beta_X^j - \beta_Y^j - \beta_{XW}^j - \beta_{YW}^j \right\} = 0 \quad \text{C.S. Conditions}
\end{aligned}$$

These conditions describe a potentially greater level of expected utility than when individuals have access to domestic asset markets only. This additional benefit depends on the scope offered by international asset markets for transforming initial physical capital wealth in a manner that offsets the human-capital risk exposure which remains after trade in domestic asset markets.

#### D. A Two-State Symmetric Representation

For purposes of exposition, we proceed by reducing the dimension of possible realizable terms of trade from  $S$  to two equally-likely, symmetric realizations  $p_y(s)$ ,  $s=1,2$ . The correlations between terms-of-trade realizations and world and domestic physical-capital returns in such a two-state case, and the properties of the covariances across returns, generalize completely to arbitrary  $S$  states with imperfectly correlated shocks. The symmetric two-state case eliminates aggregate risk for the

economy, and allows a focus on the domestic distributional consequences alone of different realizations of the terms of trade. The two-state case for the domestic economy is portrayed in *Figure 1*. The identical, linearly homogeneous utilities permit aggregation, and, as shown, the two realizations of relative world prices symmetrically yield the same ex-post aggregate welfare or real income  $U^1$ . The ex-post realizations of the direction of trade establish ex-post beneficiaries of protectionist policies by designating the identity of the import-competing sector. In autarky, aggregate income is  $U^0$ , where the relative domestic price  $p_y^0$  is the mean of  $p_y(1)$  and  $p_y(2)$ . Because of the gains from trade, aggregate real income (or welfare) is greater with relative price variability than with relative price stability at the mean of the variable prices. At the same time, individual agents with undiversified holdings of sector-specific capital confront real-income risk because of the uncertainty regarding the terms of trade, although expected income is assumed the same for all agents.<sup>18</sup>

The productivity shocks in the rest of the world that create such terms-of-trade fluctuations are assumed to take on one of two possible values,  $\phi_j(H)$  or  $\phi_j(L)$ , where H and L denote ‘high’ and ‘low’ respectively. World production possibilities across the two states are illustrated in *Figure 2*. The effects on world output and physical-capital returns, the terms of trade, and home-country returns to nontradeable human capital are summarized below:

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<sup>18</sup> Thus, we adopt symmetry conditions that guarantee that the expected values of X and Y human and physical capital are equal.

	<u>Shocks</u>	<u>Output</u>	<u>World Capital</u>	<u>Price</u>	<u>Home HK</u>
<u>State 1:</u>	$\phi_X(H), \phi_Y(L)$	$X(H), Y(L)$	$r_{KX}^*(H), r_{KY}^*(L)$	$p_Y(H)$	$r_{HX}(L), r_{HY}(H)$
<u>State 2:</u>	$\phi_X(L), \phi_Y(H)$	$X(L), Y(H)$	$r_{KX}^*(L), r_{KY}^*(H)$	$p_Y(L)$	$r_{HX}(H), r_{HY}(L)$

*Table 1*

For the home country, the real return to sector-X human capital is low in state 1 and high in state 2, with converse outcomes for sector-Y human capital. Within each industry, returns to foreign *physical* capital covary negatively with domestic *human* capital.<sup>19</sup>

## 2. Asset Markets and Preferred Trade Policies

We consider now the relation between asset markets and individuals' preferred trade policies. In response to income uncertainty, agents seek a risk offset by holding sector-specific physical capital whose returns covary negatively with returns to the agent's human capital. The degree to which portfolio diversification allows agents to reduce income uncertainty depends on (i) the proportion of wealth that derives from human capital (the more human capital agents have relative to physical capital, the more limited are potential diversification opportunities), (ii) the supply of domestic physical capital that differs from the sector-specificity of the agent's human capital (since diversification requires that there be opposite-sector tradeable capital available to acquire), and (iii) by the completeness of asset markets.<sup>20</sup>

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<sup>19</sup> We assume that the world elasticity of substitution in demand is sufficiently large so that returns to world capital are positively correlated with the shock rather than the endogenous relative price change. The sign of this correlation (and thus the magnitude of this elasticity) is not critical, provided that relative price movements do not precisely neutralize the shock to leave returns constant across states, since any nonzero correlation presents an opportunity to offset domestic human-capital risk.

<sup>20</sup> The importance of the relative volatility of dividends paid has been omitted by construction. In general, the extent to which risk-averse individuals desire to diversify asset holdings would be reduced by a lower expected rate of return and by a higher variance of returns to opposite-sector physical capital.

### A. Low-Human Capital Economies

We begin with a benchmark case where both types of sector-specific physical capital receive a share of national income at least equal to the shares of national income received by human capital in either sector. The dominant form of wealth in the economy is therefore physical rather than human capital. We then have:

#### *Proposition 1*

*If physical capital is the dominant form of aggregate wealth (as defined above), domestic asset markets permit all individuals to hold diversified portfolios of industry-specific claims consistent with consensus for free-trade policies.*

The nontradeable component of idiosyncratic risk due to the individual's human capital (given the conditions of *Proposition 1*) is offset by acquiring a portfolio with a composition skewed towards physical capital in the opposite industry. In the perfectly pooled equilibrium, where all idiosyncratic risk is eliminated and where each agent thus receives a constant proportion of national income, agents hold different portfolios composed of both sectors' physical capital and own-sector human capital, but receive the same ex-post total real income.<sup>21</sup> Consequently, the agent's portfolio delivers a return that is independent of initial factor endowments. The portfolio composition for a j-sector agent is given by

$$(13) \quad \alpha^j = (\alpha_X, \alpha_Y, \alpha_H^X, \alpha_H^Y) \quad ,$$

the perfectly pooled portfolios are

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<sup>21</sup> Thus, we follow Lucas (1982) and choose to examine the portfolio allocations consistent with perfect pooling subject to the constraint implied by the existence of nontradeable claims to human capital.

$$(14) \quad \alpha^x = \left( \frac{1}{2} - \frac{1}{2}\varepsilon, \frac{1}{2} + \frac{1}{2}\varepsilon, 1, 0 \right)$$

$$\alpha^y = \left( \frac{1}{2} + \frac{1}{2}\varepsilon, \frac{1}{2} - \frac{1}{2}\varepsilon, 0, 1 \right)$$

$$\text{where } \varepsilon \equiv \frac{\sigma_{Hj}}{\sigma_{Km}} \text{ for } j \neq m$$

That is, if there were no risk associated with human capital so that  $\varepsilon$  (the ratio of the cross-industry standard deviations of the dividends paid to human and physical capital) were zero, the perfectly pooled portfolios would be characterized by agents of each type holding one-half of each type of physical capital. But with  $\varepsilon$  positive there is human capital risk that is diversified by holding more of the opposite-sector physical capital, and the greater is  $\varepsilon$ , the more of this capital agents will acquire to achieve perfect pooling. Observe also that  $\varepsilon$  is proportional to the quantity of human capital in industry  $j$ . Thus, *Proposition 1* is in effect based on an upper bound to  $\varepsilon$ . In this equilibrium each agent chooses to hold a portion  $\varepsilon$  of claims to physical capital in the alternate industry which delivers an amount of dividends that exactly offsets fluctuations in human-capital income. Consequently,

$$\varepsilon |\delta_{KY}(s) - E\delta_{KY}| = |\delta_{HX}(s) - E\delta_{HX}| \quad \forall s = 1, 2$$

where  $\varepsilon$  is a constant due to the symmetry of deviations of  $r_{Mj}$  (which underlie changes in dividends) from its expected value and  $\varepsilon$  is the ratio of the standard deviations of the dividends. This symmetry guarantees that the absolute values of fluctuations in dividends paid to  $H_x$  and  $K_y$  differ by a constant proportion across states, so that (non-state-contingent) trade in claims to capital suffices to achieve perfect pooling of idiosyncratic risk. Since ex-ante wealth is the same across individuals, each agent also holds one-half of the remaining shares to  $K_x$  and  $K_y$ , which equals  $(1-\varepsilon)$  in both sectors.<sup>22</sup> The

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<sup>22</sup> This remainder reflects the normalization of the total number of shares to unity.



total holdings of claims to physical capital are therefore given by equations (14) wherein the X-sector agent is seen to hold more than half the claims to Y-sector capital, while Y-type agent holds more than half the X-sector capital.<sup>23</sup>

Since each agent will hold claims to both types of physical capital, we have an interior solution to the Kuhn-Tucker conditions, and domestic asset prices will satisfy:

$$(15) \quad E \left\{ V_I [I^j(s), p_y(s)] \delta_{KX}(s) \right\} = \lambda^j q_{KX}$$

$$E \left\{ V_I [I^j(s), p_y(s)] \delta_{KY}(s) \right\} = \lambda^j q_{KY}$$

which with  $R_{Kj} = \delta_{Kj} / q_{Kj}$  as the rate of return on  $K_j$  yield

$$(16) \quad E \left\{ V_I [I^j(s), p_y(s)] \right\} \left\{ E R_{KX} - E R_{KY} \right\} + Cov \left\{ V_I (\cdot^j), R_{KX} - R_{KY} \right\} = 0 \quad .$$

Portfolio diversification here results in equal constant real income over states of the world. The covariance in (16) is therefore zero and expected returns to sector-specific physical capital are confirmed to be equal.

Given the diversification of income sources obtained through trade in domestic asset markets, the inefficiencies created by trade protection can only reduce real income for all agents in every state. Note also that since all idiosyncratic risk has been eliminated via the risk-pooling opportunities provided in domestic capital markets, there are no further potential gains from asset diversification opportunities in international capital markets, nor any consequences of international markets for trade-policy preferences.

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<sup>23</sup> Even if ex-ante wealth is not equal, equilibrium portfolios will arise with perfect risk pooling, but individuals will receive different, fixed proportions of national income.

*B. Nondiversifiable idiosyncratic risk*

When human capital is the dominant component of an individual's wealth, sector-Y agents will wish to hold only claims to X-sector specific physical capital,  $K_X$ , and sector-X agents will wish to hold only claims to  $K_Y$ . In equilibrium, the X-sector agent's portfolio satisfies the conditions of the Kuhn-Tucker problem of equations (7) and (8):

$$(17) \quad E\left\{V_i[I^X(s), p_y(s)]\delta_x(s)\right\} = \lambda^X q_{KX} - \gamma_x^X$$

where  $\gamma_x^X \alpha_x^X = 0$  and  $\alpha_x^X = 0 \rightarrow \gamma_x^X \geq 0$

$$E\left\{V_i[I^X(s), p_y(s)]\delta_y(s)\right\} = \lambda^X q_{KY}$$

where  $\gamma_y^X \alpha_y^X = 0$  and  $\alpha_y^X > 0 \rightarrow \gamma_y^X = 0$

Analogous conditions for a Y-sector agent are:

$$(18) \quad E\left\{V_i[I^Y(s), p_y(s)]\delta_x(s)\right\} = \lambda^Y q_{KX}$$

where  $\gamma_x^Y \alpha_x^Y = 0$  and  $\alpha_x^Y > 0 \rightarrow \gamma_x^Y = 0$

$$E\left\{V_i[I^Y(s), p_y(s)]\delta_y(s)\right\} = \lambda^Y q_{KY} - \gamma_y^Y$$

where  $\gamma_y^Y \alpha_y^Y = 0$  and  $\alpha_y^Y = 0 \rightarrow \gamma_y^Y \geq 0$

A strictly positive value for  $\gamma_j^i$  indicates that agent  $j$  would gain from the opportunity to sell short claims to asset  $i$  and thereby indirectly sell claims to own human capital which is prohibited in this economy. Combining (17) and (18) yields the equilibrium relative price between claims to X- and Y-sector capital,

$$(19) \quad \frac{E\left\{V_i^X \delta_x(s)\right\} + \gamma_x^X}{E\left\{V_i^X \delta_y(s)\right\}} = \frac{q_{KX}}{q_{KY}} = \frac{E\left\{V_i^Y \delta_x(s)\right\}}{E\left\{V_i^Y \delta_y(s)\right\} + \gamma_y^Y}$$

Two general cases, identified by relative intensities of human and physical industry-specific capital (used in production of industry-specific intermediate goods), can now be distinguished. The two cases serve to describe the range of possibilities for portfolio allocations, risk exposure, and trade-policy preferences.

### *1. Symmetric factor intensities*

When the relative intensity of human and physical capital is symmetric across intermediate-goods industries, agents in both sectors confront the same degree of nondiversifiable human-capital risk. The expected return to human capital and the variance are the same across industries. Each agent maximizes expected utility by allocating all physical-capital wealth to diversify, albeit partially, human-capital-income risk by exchanging claims to own-sector physical capital to obtain claims to alternate-sector capital which covaries negatively with own-sector human capital. The X-sector agent sells all initial claims to  $K_X$  and buys claims to  $K_Y$ , while the Y-sector agent sells all initial claims to  $K_Y$  in exchange for claims to  $K_X$ . The consequent equilibrium portfolio allocations are

$$(20) \quad \alpha^x = (0, 1, 1, 0)$$

$$\alpha^y = (1, 0, 0, 1) \quad .$$

Due to the symmetric position of the agents, the equilibrium relative price between claims to X-sector and Y-sector capital is unity. The equilibrium portfolio allocations are depicted in Figure 3a where point  $E$  denotes the initial physical capital endowments and  $A$  the equilibrium asset holdings after trade. The further introduction of international capital markets again provides no additional diversification opportunities, since each agent's tradeable wealth is already invested in an asset which covaries negatively with nontradeable human capital and world capital exhibits the same risk and return characteristics as does this domestic capital.

We summarize the above in the following:

## ***Proposition 2***

*When human capital is the dominant factor in the economy, and when relative factor intensities of human and physical capital are equal across sectors, then*

*(a) with access to domestic asset markets only, each agent benefits from protection for the industry to which own human capital is devoted, since*

*(i) the representative individual in each sector sells all own-sector physical capital and acquires all claims to alternate-sector physical capital,*

*(ii) each individual remains exposed to sector-specific risk;*

*(b) access to international asset markets provides no further diversification opportunities and so changes neither equilibrium portfolios nor individual agents' trade-policy preferences.*

## ***2. Differing factor intensities***

The above equilibrium is symmetric, in the sense that whatever transpires for one type of sector-specific agent likewise transpires for the other. By contrast, when relative factor intensities of human and physical capital differ across sectors, asymmetries appear in the degree of portfolio diversification available to different agents. Let the X-sector be more human-capital intensive. Then X-sector agents have relatively little physical-capital wealth with which to diversify. In the Y sector, by contrast, agents have greater physical-capital wealth, but claims to  $K_x$  deliver a smaller degree of diversification since the distributive share of physical capital in sector X is relatively small. In domestic asset-market transactions, Y-sector agents consequently retain ownership of some of their initial claims to  $K_y$ , and hold all claims to  $K_x$ . The equilibrium portfolio allocations for X- and Y-sector agents are

$$(21) \quad \alpha^x = (0, \epsilon, 1, 0)$$

$$\alpha^y = (1, 1 - \epsilon, 0, 1)$$

where  $\epsilon$  is the fraction of Y-sector capital which the X-sector agent obtains with initial, limited own-sector physical capital. These allocations are depicted in Figure 3b where  $E$  denotes the endowment of factor ownership and  $A$  the equilibrium portfolio holdings of claims to domestic physical capital.

The equilibrium conditions are similar to (17) and (18) with the following notable exceptions: (i) the dividends from the capital assets now differ, and (ii) since Y-sector agents hold both types of sector-specific physical capital in the equilibrium portfolio,  $\gamma_y^Y = 0$ ; a Y-sector agent's marginal rate of substitution thus equals the equilibrium relative asset price, while the marginal rate of substitution of an X-sector agent differs from the equilibrium relative asset price by the presence of  $\gamma_x^X$ .

Now access to international asset markets becomes critical since such access provides a further measure of diversification. The Y-sector agent exchanges claims to own-sector physical capital  $K_Y$  (which remain after domestic asset-market trades) for claims to world sector-specific capital that covaries negatively with own-sector human capital. Since world industry-specific returns are negatively correlated with the same sector-specific returns in the home country, the Y-sector agent uses international asset markets to obtain claims to  $K_Y^w$ . Equivalently, domestic agents may sell all their claims to domestic physical capital and hold only claims to world capital, since the mean and variance of the returns are the same. In this case each agent would invest all physical capital wealth in the specific capital of the foreign competing industry. Agent  $j$  has an equilibrium portfolio

$$(22) \quad \beta^j = (\beta_x, \beta_y, \beta_{xw}, \beta_{yw}, \beta_H^X, \beta_H^Y) \quad ,$$

and the particular portfolios that satisfy the conditions given in (12) are

$$(23) \quad \beta^X = (0, 0, 1 - \beta_H^X, 0, \beta_H^X, 0)$$

$$\beta^Y = (0, 0, 0, 1 - \beta_H^Y, 0, \beta_H^Y) \quad .$$

Only the Y-sector agent, with the greater physical wealth, increases expected utility from this

internationally diversified portfolio. For such an agent, the greater degree of diversification via international markets dampens the income fluctuations due to terms-of-trade variability, and individual income more closely matches the economy's aggregate income. Access to international capital markets therefore generates asymmetric individual self-interested trade-policy preferences: the Y-sector agent's trade-policy preferences are more liberal than those of the X-sector agent.

Hence we have:

### ***Proposition 3***

*When human capital is the dominant factor in the economy, and when relative factor intensities of human and physical capital are unequal across sectors, then,*

*(a) with domestic asset markets alone, each agent remains exposed to sector-specific risk and so benefits from protection for the industry to which own human capital is devoted, since*

*(i) the representative individual in the human-capital intensive sector sells the entire<sup>9</sup> limited supply of own-sector physical capital,*

*(ii) the representative agent in the physical-capital intensive sector acquires all claims to alternate-sector physical capital, but also retains own-sector physical capital;*

*(b) access to international asset markets provides further diversification opportunities for the physical-capital-rich agent, and reduces such agent's gains from protectionist policies for industries in which they hold human capital.*

## **4. Nontraded Goods**

We have thus far made no allowance for the presence of nontraded goods. Following standard portrayals of the specific-factors model of international trade, we have assumed that all final consumption goods are traded. Nontraded goods, however, account for substantial portions of

aggregate consumption and production in developed economies: empirical research by Irving Kravis, Alan Heston, and Robert Summers (1982) and by Alan Stockman and Linda Tesar (1995) suggests a range of 40-54 percent of GDP. The introduction of nontraded goods, therefore, is justified by the prominence of this sector across developed economies. Moreover, a nontraded-goods sector generates a further range of outcomes for portfolio allocations, risk exposure, and trade-policy preferences. These outcomes emerge because, while nontraded goods are consumed in the country in which they are produced, there need be no such autarkic restriction regarding trade in claims to capital specific to nontraded-goods production. We therefore allow international capital markets to facilitate trade in claims to *all* types of physical capital, whether or not that capital is employed in an industry that produces a final traded or nontraded good.<sup>24</sup> The dividends on claims to capital specific to nontraded-goods production must, of course, be transferable internationally to foreign asset owners in the form of one of the traded goods. In these circumstances, international capital markets can provide diversification opportunities that are not available via domestic capital markets alone. Specifically we shall establish:

***Proposition 4***

*If, without nontraded goods, domestic asset markets and access to international asset markets have failed to establish perfectly pooled equilibria (and hence have resulted in equilibria where agents have protectionist interests), the presence of nontraded goods liberalizes individuals' preferred trade policies, and a sufficiently large nontraded-goods sector permits a degree of portfolio diversification consistent with all agents having a preference for free trade over any protectionist policy.*

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<sup>24</sup> Tesar (1993) also recognizes the possibility of trade in assets associated with the nontraded sector in examining the role of nontraded goods in explaining the high correlation between domestic savings and investment.

In demonstrating this proposition, we impose symmetry in human-physical capital intensities in traded goods and assume dominance of human capital in agents' wealth.<sup>25</sup> We also extend symmetry in the nature of uncertainty such that a constant level of demand for labor is maintained in the traded-goods sector across different states. The introduction of a nontraded sector is then in itself not the source of additional uncertainty. Consequently, when only domestic capital markets are available, the introduction of nontraded goods does not change portfolio allocations across capital in traded-goods sectors. The production structure for nontraded goods is analogous to that in the traded-goods industries. Nontraded goods are produced with inputs of a sector-specific intermediate good and mobile labor, and the intermediate good is produced with sector-specific physical and human capital. Owners of capital specific to the X and Y traded-goods sectors are now also each endowed with equal amounts of the specific factors used in the nontraded sector. In the rest of the world, there is also a nontraded sector with a similar production structure. Home nontraded production is given by

$$(24) \quad Z = Z[M_Z, L_Z] \quad \text{and} \quad M_Z = T(K_Z, H_Z) = H_Z t(k_Z), \quad k_Z \equiv \frac{K_Z}{H_Z} .$$

The returns to physical and human capital in Z are given by

$$(25) \quad r_{KZ}(s) = P_Z(s) Z_1 [T(K_Z, H_Z), L_Z] T_1(K_Z, H_Z) = r_{MZ}(s) t'(k_Z)$$

$$r_{HZ}(s) = P_Z(s) Z_1 [T(K_Z, H_Z), L_Z] T_2(K_Z, H_Z) = r_{MZ}(s) [t(k_Z) - k_Z t'(k_Z)] .$$

With utility separable between nontraded and traded goods, the second-stage decision problem for the type-j agent given in equation (5) becomes

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<sup>25</sup> That is, we assume the conditions of *Proposition 2*.



$$(26) \quad \text{Max } u(x^j, y^j) + v(z^j)$$

$$\text{subject to } NI^j(s) = P_x(s)x^j + P_y(s)y^j + P_z(s)z^j$$

where  $P_z(s)$  denotes the home-country nominal price of Z (and  $p_z$  its relative price in terms of X) in state  $s$ , and  $v(\cdot)$  is increasing, homothetic, and strictly concave. In equilibrium, with the relative traded-goods price determined in world markets and that of nontraded goods determined domestically,

$$(27) \quad \frac{u_2(x^j, y^j)}{u_1(x^j, y^j)} = p_y(s)$$

$$\frac{v'(z^j)}{u_1(x^j, y^j)} = p_z(s)$$

Since utility is separable in the nontraded good Z, only income effects from the changes in the relative price between traded goods X and Y affect demand for the nontraded good. The symmetry in production implies that the real wage is constant across states and, consequently, the labor cost of production of the nontraded good is constant across states. In the symmetric two-state environment, ex-post real income is the same in both states of nature so that, given the constant costs, the production of the nontraded good is constant across states. Consequently, the real returns to the specific factors used in the Z industry remain invariant to the state of nature.<sup>26</sup> Since national real income is constant across states, only substitution effects remain to determine consumption of traded goods so that X consumption, and the relative price of Z as given in (27), is high in state 1 and low

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<sup>26</sup> Although changes in X consumption across states create a 'revaluation effect' which causes fluctuations in the relative price of Z in terms of X.

in state 2.<sup>27</sup>

The equilibrium portfolio allocations depend on the presence or absence of access to international asset markets contrary to the results in *Proposition 2*. When only domestic capital markets are available, agents continue to hold claims to traded-good capital as in the purely traded-good economy, and retain the initial endowment of one-half the outstanding claims to nontraded capital of both types. Since both X and Y agents face the same degree of risk ex-ante and are equally wealthy, the introduction of nontraded goods, which in this symmetric environment have nonstochastic returns, leaves demand for claims to traded-sector capital unaltered. Each agent continues to hold all of the physical capital employed in the alternate sector. Individual wealth has but been increased by the amount of the endowment of nontraded-sector assets. As a result, the equilibrium portfolios can be expressed as

$$(28) \quad \alpha^x = (0, 1, 1, 0, \frac{1}{2}, \frac{1}{2})$$

$$\alpha^y = (1, 0, 0, 1, \frac{1}{2}, \frac{1}{2})$$

where the final two asset holdings reflect shares of ownership of physical and human capital in the nontraded industry by agent  $j$ .

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<sup>27</sup> If we relax the condition that demand for labor in the traded sector remains constant across states, then the real cost of the labor input would vary, production of the nontraded good would differ across states, and the return to the specific factors used in Z would become stochastic. Both agents would share in this risk: for one of the agents the returns to assets in the nontraded sector would covary positively with nondiversifiable human capital in the traded-good sector, while for the other, this new source of risk would covary negatively with traded-good human capital. Thus, one of the agents would like to sell claims to  $K_Z$  and buy more claims to the traded-good capital that covaries negatively with traded-sector human capital, while the other would like to obtain more claims to the nontraded capital. With separability in preferences and the ex-ante symmetry in risk exposure of the agents, however, neither agent will want to increase risk in traded-good consumption to decrease risk in the nontraded good and the equilibrium portfolios over traded-good capital will not be altered. Each agent will have obtained all claims to the alternate traded sector's capital with own-sector capital and thus will not trade these claims to  $K_Z$  and will achieve no further diversification.

International asset markets allow for greater diversification of the risky traded-sector human capital, as domestic agents may exchange claims to physical capital in the nontraded sector for claims to world physical capital.<sup>28</sup> International asset markets enable agents to sell claims to the nonstochastic  $K_z$  and buy claims to the world physical capital that covaries negatively with own-sector human capital. To acquire the perfectly pooled portfolio, each agent solves a problem analogous to (11) and (12), but including nontraded assets, with asset prices given on world markets. The representative type- $j$  agent will acquire a portfolio in terms of shares of the agent's wealth allocated to each asset given by

$$(29) \quad \beta^j = (\beta_x, \beta_y, \beta_{xw}, \beta_{yw}, \beta_H^x, \beta_H^y, \beta_{KZ}^j, \beta_{HZ}^j) \quad .$$

With a sufficiently large nontraded sector, all human-capital-income risk will be eliminated for the X-sector agent, for example, through investment of a share of wealth equal to that deriving from human capital in X-sector world physical capital. Any remaining wealth is allocated to risk-free nontraded capital.<sup>29</sup> The perfect-pooling portfolios for each type of agent are

$$(30) \quad \beta^x = (0, 0, \beta_H^x, 0, \beta_H^x, 0, 1 - 2\beta_H^x - \beta_{HZ}^x, \beta_{HZ}^x)$$

$$\beta^y = (0, 0, 0, \beta_H^y, 0, \beta_H^y, 1 - 2\beta_H^y - \beta_{HZ}^y, \beta_{HZ}^y) \quad .$$

These portfolios deliver a sure level of income to each agent equal in value to each agent's expected wealth. Agents with X and Y sector human capital hold portfolios whose composition differs, yet

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<sup>28</sup> As we have noted, the payoffs to nontraded goods' claims must take place in units of either of the traded goods.

<sup>29</sup> This is one possible portfolio composition in which idiosyncratic risk is eliminated. Other combinations of claims will deliver the same ex-post income. Each agent, for example, could divide remaining wealth (after diversifying human-capital risk) equally between claims to the two world physical capital assets and achieve a zero-risk portfolio.

each portfolio delivers constant identical income across states directly proportional to national income.

These diversification opportunities ensure that agents prefer free trade to any protectionist policy, and only arise when the nontraded-goods sector is sufficiently large: the share of national income received by physical capital in the nontraded sector must be at least as great as that accruing to the nondiversified component of each agent's human capital. Such nontraded capital wealth enables the agent to purchase foreign physical capital in an amount that delivers dividends sufficient to offset fluctuations in the remaining, nondiversified human capital returns.

## 5. Concluding Remarks

Political-economy models base predictions of endogenous protection on nondiversified individual income. Beginning with nondiversified industry-specific capital endowments among the members of an economy, we have investigated how asset markets transform individuals' policy preferences. If physical capital is the dominant form of wealth in an economy, domestic asset markets can facilitate the complete risk pooling necessary for a consensus for free trade. Nontradeable human capital may however be the dominant form of an economy's wealth. When this is so, domestic asset markets leave individuals exposed to sector-specific risk and with an interest in protection for the industry in which they hold their nontradeable human capital. Moreover, whether the introduction of access to international asset markets has a liberalizing influence on individuals' preferred trade policies then depends on relative human-physical capital intensities in production. If factor intensities are equal, international asset markets provide no additional diversification opportunities beyond domestic asset markets, and do not influence preferred trade policies; but if unequal, access to international asset markets does provide further diversification opportunities and results in a preference for more liberal policies (but not a preference for free trade) by individuals whose human capital is in the sector with the higher physical-capital intensity. The international

tradeability of nontraded-goods assets further moderates and, if the nontraded-goods sector is sufficiently large, can in principle eliminate the protectionist preferences that then remain.

Given these results regarding the liberalizing influence of asset markets on individuals' preferred trade policies, the questions remain: To what extent is diversification via asset markets in practice feasible? And why do individuals not diversify industry-specific income to the fullest feasible extent? In answering these questions, it should be observed that our specification of asset tradeability, which is based on the distinction between physical and human capital, has been an approximation of convenience only. Diversification opportunities for physical capital are often limited by management-incentive schemes that are directed at resolving principal-agent problems between managers and capital-owners. Shareholders diversified across industries desire free trade. This policy preference is however compromised for shareholders and managers by the resolution of the principal-agent problem which requires a component of nondiversified management income remain (see James Cassing, 1996). More generally, a residual-claimant, monitoring-incentive theory of the firm predicts concentrated nondiversified firm- and industry-specific asset holdings as the outcome of an efficient internal-firm monitoring equilibrium (see the evidence by Harold Demsetz and Kenneth Lehn, 1985). Incentives to seek protectionist policies will be greater than where protectionism has its origins in nontradeable human capital alone. It is also possible that because of information asymmetries, individuals are disinclined to diversify asset portfolios via international asset markets. Indeed, the observed lack of international diversification stands in contrast to predictions by models of optimal portfolio choice (Kenneth French and James Poterba, 1991; Linda Tesar and Ingrid Werner, 1992).

Since the above considerations affect ability or willingness of individuals to diversify sector-specific capital, our distinction is in principle not between nontradeable human and tradeable physical capital, but between industry-specific capital that is encumbered in diversification possibilities

and that which is not. Decisions not to diversify industry-specific capital for whatever reason when diversification is in principle feasible affect individuals' preferred trade policies in the way we have described, and add to nontradeable human-capital sources of individual income asymmetries that sustain protectionist interests in the presence of domestic and international asset markets.

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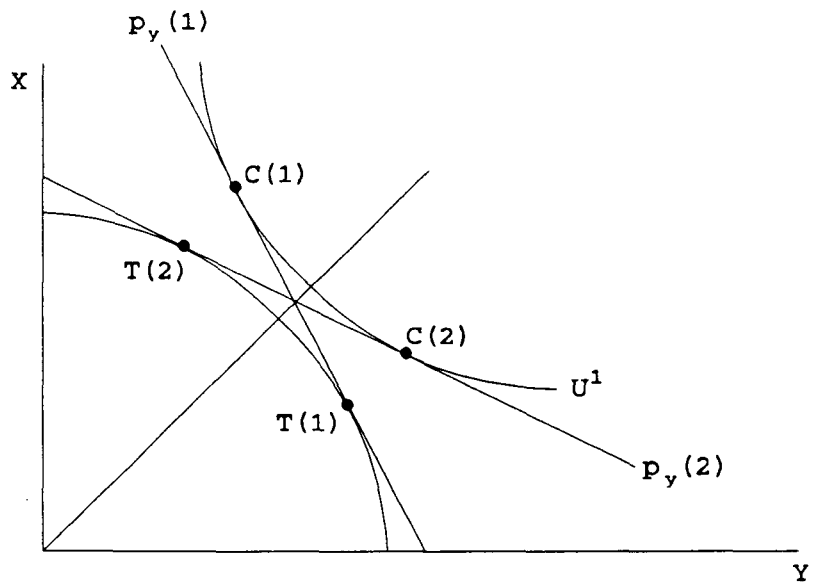


Figure 1

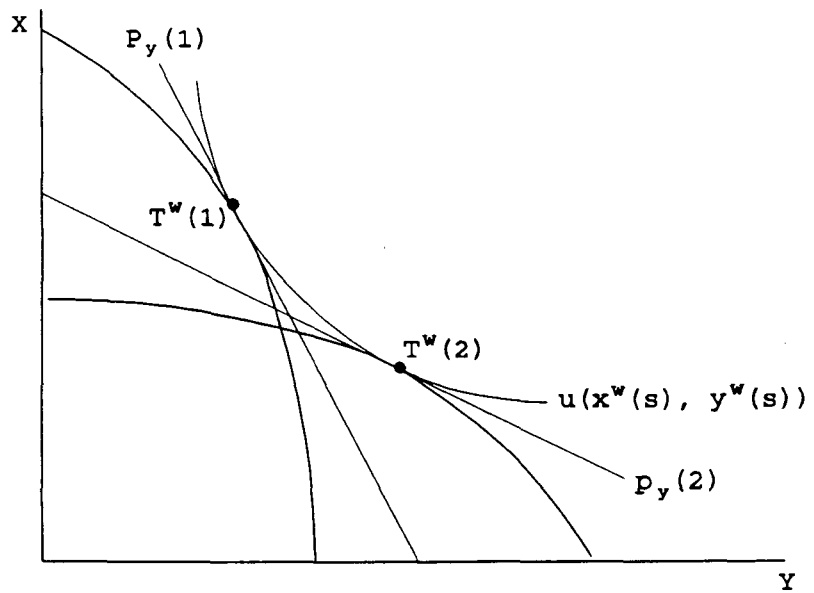


Figure 2

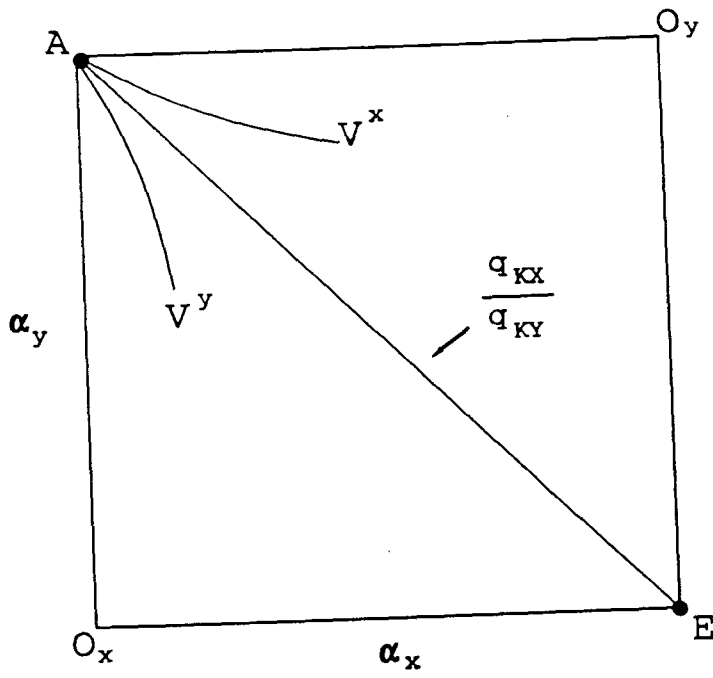


Figure 3a

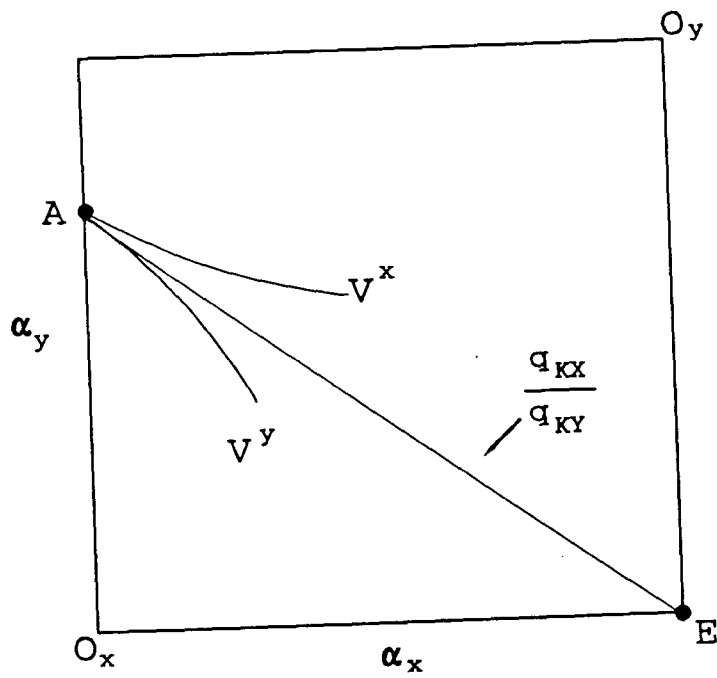


Figure 3b