Developing Domestic Entrepreneurship and Growth through Imported Expertise

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Abstract

Liberalization can target many different markets and activities, ranging from goods markets, to capital markets, to direct investment in goods and services. These alternatives differ with respect to the types of barriers that must be removed and the effect of the liberalization on knowledge transmission and growth. This paper builds a model based on the premise that an important source of knowledge transmission to developing and transition economies is direct contact with foreign experts such as engineering and management consultants. The services of these experts allow the immediate incorporation of knowledge into production that would be costly in terms of time and resources to develop domestically, and in addition there may be an (uncompensated) spillover to domestic managers and engineers through working with the foreign experts.

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1. Introduction

Liberalization in developing and transition economies can take many forms. There has been considerable focus in the international trade literature on liberalizing trade in goods, with the liberalization of capital markets a close second. Closely related to these discussions is a literature on the transmission of technical knowledge between countries and whether trade or investment is a more important channel of transmission. Other authors have focused on legal infrastructure and general "good government" as a precondition for growth.

It is important to understand the transmission mechanism in order to understand the priorities for liberalization. This is due to the fact that very different barriers impact on the ability to trade goods, versus capital, versus knowledge. If trade in goods is the most important transmission mechanism, then developing countries have a rather simple liberalization problem and agenda. But if capital markets are key, then we conjecture that the liberalization agenda is considerably more complicated, generally involving many types of domestic restrictions and regulations in addition to explicitly foreign ones. Encouraging inward direct investment, which some authors suspect is the most important growth-transmission mechanism, requires perhaps the most far reaching reforms to domestic laws and institutions. Contract and tax law, property rights, national treatment of foreign firms, and liberal entry requirements for foreign workers are all important in foreign firms' direct investment decisions.

In this paper, we will focus on direct imports of the services of foreign consultants or experts as a method of improving domestic productivity. These may be supplied by foreign companies through direct investment in owned subsidiaries, or they may be associated with once-off contracts with foreign consultants. Our model more closely resembles the latter,

although the basic idea is independent of the mode (arm's length versus direct investment) by which the foreign services are supplied.

Our model is based on differentiated intermediate inputs, as developed by Ethier (1982) and Markusen (1989), with dynamic versions by Romer (1990), Grossman and Helpman (1991) and Rutherford and Tarr (2002).. We assume that a new intermediate input requires some type of engineering and/or managerial input, perhaps a technical or managerial "blueprint" or "business plan" (BP), which can only be provided by a certain class of skilled workers. Thus the *change* in range of intermediates and therefore aggregate productivity growth depends on the *level* of human capital (skilled knowledge workers). Empirical support for this formulation can be found in Benhabib and Spiegel (1994). The (developing) economy in question initially has a very small supply of these workers. This limits the initial productivity of the economy, but productivity can grow through time by a learning-by-doing process incrementing the expertise of the domestic workers.

Instead of relying solely on the scarce domestic knowledge workers, the economy may import foreign consultants who have accumulated expertise from previous activities. These consultants facilitate the immediate creation of new firms (intermediates) giving an immediate boost to productivity. In addition, there may be an uncompensated spillover from the foreign consultants working with the domestic knowledge workers, a sort of learning-by-watching effect.

Permitting the entry of foreign consultants creates an immediate jump in the developing country's income. Any spillover effect to the domestic workers augments this effect. The technical/managerial blueprints / business plans are a permanent, non-depreciating form of

capital, so this jump creates a permanent increase in domestic income even though the economy settles down to the same steady-state growth rate in income with or without the foreign consultants. Interestingly, the use of foreign consultants, while very important initially, may (endogenously) disappear in the long run as the demand price for their services falls through the accumulation of domestic expertise. The foreign consultants thus jump-start the economy, create a permanently higher level of income, but disappear in the long run.

An interesting result is that the strong growth and welfare effect of entry by the foreign consultants relies on the ability of the country to finance their services through international capital markets by running a current-account deficit in the early years. Growth and welfare effects are much smaller if there is a period-by-period balance-of-payments constraint. Thus reforms to allow in foreign consultants are complementary to reforms which permit easier access to foreign capital markets.

We also show that the effect of the entry of foreign consultants on the real wages of domestic skilled workers depends closely on the nature of the spillover. If the spillover is in the form of training currently unskilled workers in a sort of "learning by watching" mode, then domestic skilled workers have their wages depressed. But if the spillover increases the expertise and productivity of the existing cohort of skilled workers, then the use of foreign consultants increases the long-run real wages of domestic skilled workers.

We hope that the model helps to inform the policy debate over the prioritization of targets for liberalization and also, from the developed countries' point of view, the debate about how to most effectively support growth in the developing and transition economies through the choice of aid project and targets. The model may be particularly appropriate for transition

economies such as the Baltic countries and the Central European economies, where there is a high level of basic human capital and skills, but where specific managerial and engineering expertise are missing. In those countries, domestic knowledge workers may be particularly able to absorb the skills demonstrated by foreign consultants and so more quickly generate productivity growth through imported expertise.

2. Model Formulation

Aggreate output Y is produced from unskilled labor (L) combined with differentiated intermediate goods (x_i denotes a single intermeidate good):

$$Y = \overline{L}^{1-\alpha}\left[\sum_{i=1}^{N} x_i^{\beta}\right]^{\alpha/\beta} \tag{1}$$

Assuming symmetric firms, the effective supply of all firms is described by:

$$X \equiv \left(\sum_{i=1}^{n} x_i^{\beta}\right)^{1/\beta} = n^{\frac{1}{\beta}} x \qquad X^{\alpha} = n^{\alpha/\beta} x^{\alpha} \qquad \sigma_x = \frac{1}{1-\beta} \tag{2}$$

in which σ_x is the elasticity of substitution among the intermediates. For a given output level for individual goods, there are increasing returns to the X aggregate in the number of varieties. As a final restriction, we use an established assumption from the "new growth theory" that $\alpha = \beta$. This assumption ensures that the aggregate production function for Y has constant returns to scale in the number of X varieties. This in turn allows for the existence of a steady-state in growth rates in the model, in which x is a constant and output growth solely through the introduction of new goods. We then may express the aggregate production function as:

$$Y = \bar{L}^{1-\alpha}\left(n x^{\alpha}\right) \tag{3}$$

Figure 1 provides a schematic representation of economic flows is a single time period. In this economy good *Y* is a differentiated product for sale in the domestic and international markets. A constant elasticity of transformation (CET) function shows the transformation possibilities in a given period between domestic (*D*) and export (*E*) sales for a given composite output level (*Y*). The shares of sales at home and abroad are determined by relative prices given that firms produce the final good to maximize profit subject to the CET constraint:

$$Y = \left[\mu D^{\epsilon} + (1-\mu)E^{\epsilon}\right]^{\frac{1}{\epsilon}} \qquad \sigma_y = \frac{1}{\epsilon - 1} \qquad \epsilon > 1 \tag{4}$$

σ_y is the elasticity of transformation between production for the domestic and export markets.

Consider again Figure 1 and let subscript t denote time period. In any time period t, the domestic economy can exchange good *E* for an imported consumption good *M* and/or imported consulting services, denoted S^M. Let the prices of the export good *E*, the imported consumption good *M*, and foreign consultants be denoted by p^E, p^M, and p^S respectively. In period t, current account balance (*B*) is given by:

$$B_t = p_t^E E_t - p_t^M M_t - p_t^S S_t^M \tag{5}$$

Figure 1 notes that the domestic good *D* has three uses. Its first use is in final consumption, which is denoted *C*. Instantaneous utility in period t is represented by a nested

constant elasticity of substitution function of C, M and leisure (l). Skilled workers can chose to supply their endowment to the market or take it as leisure. Current utility is then given by:

$$u_t = \left[\tau C_t^{\eta} + (1-\tau) M_t^{\eta}\right]^{\frac{\zeta}{\eta}} l^{1-\zeta} \qquad \sigma_c = \frac{1}{1-\eta} \tag{6}$$

where σ_c is the elasticity of substitution in consumption between the domestic and imported goods.

A second use of the domestic good D is for production of new capital (I for investment). Units are chosen such that one unit of the domestic good is need for one unit of new capital. A third use for the domestic good D is in the actual production of intermediate goods once the BP is created; one unit of D is required for one unit of any intermediate good. Market clearing condition for D in period t is then:

$$D_t = C_t + I_t + n_t x_t \tag{7}$$

A fixed number of units of capital a_K are also needed for each unit of any intermediate once the BP is created..

$$K_t = a_K n_t x_t \tag{8}$$

Taken together, (7) and (8) are assuming that production of any intermediate is a has fixed coefficients requiring one unit of D and a_K units of K to produce one unit of any x_i.

One unit of investment in period t produces a unit of additional capital in the following

year which may be used for production in the future as illustrated in Figure 1. Physical capital stock depreciates at a constant geometric rate:

$$K_{t+1} = \lambda K_t + I_t \qquad \lambda < 1 \tag{9}$$

Let $\bar{H}_t$ denote the economy's endowment of human capital at time t. H_t denotes the amount of the total endowment supplied to production, with the difference taken as leisure. The creation of a new intermediate firm requires inputs of both entrepreneurial skills and expertise (e.g., engineering or other scientific aptitude). Entrepreneurial expertise can be provided by domestic entrepreneurs or by imported consulting services. Domestic entrpreneurial services, S_t^D, and expertise, E_t, are both assumed to be in fixed proportion to the domestic human capital stock, hence:

$$S_t^D = \theta_S H_t, \qquad E_t = (1-\theta_S) H_t \tag{10}$$

In this formulation, θ_S is the fixed fraction of the skilled workforce which has entrepreneurial skills. The remaining fraction of the skilled workforce has some other non-entrepreneurial expertise.

Domestic and imported entrepreneurial services and domestic skilled expertise are combined to produce new firms (BP). . We assume in the present model that there is no international trade in business plans, a term we use to describe technical and managerial inputs which must be provided "on site" in the country in question. Hence firms may not license franchises but must purchase resources to develop new products from scratch.

$$n_{t+1} = n_t + \psi \left(\delta S_t^{\nu} + (1-\delta) E_t^{\nu}\right)^{1/\nu} \qquad \sigma_h = \frac{1}{1-\nu} \tag{11}$$

where $S_t = S_t^D + S_t^M$ is the supply of entrepreneurial services and σ_h is the elasticity of substitution between entrepreneurship and other forms of expertise. The perfect substitutability of S^D and S^M in (11) allows the model to have a well-defined steady state with no imported consultants, and allows for the use of foreign consultants to go to zero should they become more expensive than their domestic counterparts. At the same time, there are diminishing returns to increasing the number of foreign consultants relative to domestic skilled workers, so the model captures the idea that the economy provides an endogenous constraint on the aggregate number of foreign consultants.

The growth equation for human capital is given as follows:

$$H_{t+1} + l_{t+1} = (1+g)H_t + l_t + \gamma S_t^M \qquad H_0 + l_0 = \bar{H}_0 \tag{12}$$

g is "learning by doing" growth in the human capital supply. We assume that only skilled workers who are actually working learn by doing. γ is a spillover from foreign consultants to domestic skilled workers. We will interpret this spillover in two different ways: as increasing the number of domestic skilled workers, or increasing the efficiency of a given number of domestic skilled workers.

Foreign consultants enter the economy is periods where their marginal product is at least as great as the return to domestic entrepreneurial activity. This arbitrage condition and

associated complementary slackness condition is written:

$$p_t^s \geq q_t \qquad S_t^M \geq 0, \qquad S_t^M (p_t^S - q_t) = 0 \tag{13}$$

where p_t^S is the import price for foreign consultants, and q_t is the wage rate for entrepreneurial services in period t. In our simulations, the price p_t^S is reduced to represent reductions in non-tariff barriers to consulting services. (The economic externality associated with foreign consultants is indicated in equation (13) through the absence of any remuneration for spillover effects. In a first best equilibrium, the arbitrage condition would read: $p_t^S \geq q_t + \gamma\, p_{t+1}^H$.)

Welfare of the infinitely lived representative consumer is the discounted sum of the utility of consumption over an infinite horizon:

$$W = \left(\sum_{t=o}^{\infty} \Delta^t \, u_t^{\rho} \right)^{\frac{1}{\rho}} \tag{14}$$

In this equation the parameter ρ controls the intertemporal elasticity of substitution, and Δ is the single period discount factor.

The agent's intertemporal and within-period consumption decisions are weakly separable. Thus, the typical static first order condition applies on consumption decisions within a time period, given a decision on how much to spend on consumption in any period. In the standard manner, the intertemporal decision is based on the maximization of the utility function subject to the constraint that the present value of consumption equals the present value of income:

$$\max\ W = \left(\sum_{t=0}^{\infty} \Delta^t\, u_t(C_t, M_t, l_t)^{\rho} \right)^{\frac{1}{\rho}} \qquad s.t. \tag{15}$$

$$\sum_{t=0}^{\infty} p_t^D\, C_t + \sum_{t=0}^{\infty} p_t^M\, M_t + \sum_{t=0}^{\infty} r_t^H\, l_t = \sum_{t=0}^{\infty} w_t\, \bar{L} + p_0^K K_0 + V_0 + p_0^H \bar{H}_0 + \gamma \sum_{t=0}^{\infty} p_{t+1}^H S_t^M$$

In this expression, p_t^D is the present value price of domestic inputs, p_t^M is the present value price of imported final goods gross of tariff, r_t^H is the rental price of human capital, w_t is the wage rate, p_0^K is the price of period 0 capital stock, V_0 is the present value of firm equity, and $p_0^H \bar{H}_0$ represents the value of human capital in period 0. All prices are defined in present value terms, discounted to year 0.

The right side of the constraint, which is the present value of income, includes the present value of wage income[1)] together with profits from existing capital stocks, firm equity and patents. In a steady-state equilibrium, there are no pure profits, but along an adjustment path moving to a new steady-state there may be returns associated with existing capital and markups over marginal cost. In other words, pure profits and losses are only associated with current (extant) firms, and these give the value of V_0. All firms formed during the model horizon earn zero economic profit. The final term on the right-hand-side of the budget constraint represents rents associated with the spillovers from foreign consultant workers.

The model is deterministic and firms have perfect (point) expectations of future prices. Hence, a new firm will enter at time *t* if and only if the present value of markup revenue over marginal costs into the future is equal to or greater than the fixed costs of initial product

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[1)] Note that population is fixed over the time horizon. Economic growth results solely from productivity improvements due to the accumulation of varieties, and the real wage increases over time relative to the prices of domestic output and imports.

development plus the present value of the fixed costs of operation. It is possible to interpret this decision using Tobin's *q* theory (see Baldwin and Forslid, 2000). The rate of investment in blueprints occurs to the point that the stock market value of the net income (i.e., the present value of net surplus) equals the replacement costs, namely the marginal cost of a business plan, since the market for entrepreneurial services is perfectly competitive. We introduce a state variable for each firm type which tracks the present value of future markup earnings; this effectively treats the knowledge capital embodied in business plans in the same analytic framework as is conventionally applied to physical capital formation. The free-entry assumption assures zero profit over the infinite horizon, and the time path of future prices affect not only investment activity but the decisions by firms to enter markets and undertake product development. Optimization over the infinite horizon applies not only to consumers and competitive firms, but also to the managers of monopolistically competitive firms.

The current account balance in period *t* is a function of commodity exports, imports of goods for final demand, and imports of consulting services as noted in equation (4). We consider two alternative closures for the open economy model. The *unrestricted capital flow model* is one in which the current account is balanced over an infinite horizon:

$$\sum_{t=0}^{\infty} B_t = 0 \tag{16}$$

where prices in (4) are present value prices as assumed in (15). The international interest rate used in computing present-value prices is a constant parameter assumed equal to 0.05.

The *constrained balance of payments model* assumes that the current account clears in

every period, hence:

$$B_t = 0 \qquad \forall t \tag{17}$$

In this model the real exchange rate changes over time, effectively decoupling the domestic and international interest rate. In the long-run, however, the domestic interest rate returns to the international rate.

3. Results

The model is calibrated to a steady-state path in which the economy grows by 2% a year and the interest rate is 5%.. However, unlike most of the "new growth theory", we are not interested in the steady state per se. We are interested in the transition from one steady-state path to another as a consequence of liberalizing trade in consulting services. Most results are presented as deviations from the initial steady-state path.

The initial steady-state calibration for the cost of foreign consultants is to $p^S = 1$, at which value no foreign consultants are used. Table 1 shows results for lowering p^S from one to $p^S = 0.95$ and $p^S = 0.90$. The former value, for example, is thus interpreted as an experiment where foreign consultants are priced at 95% of their prohibitive price. Two values of the spillover parameter γ are considered, $\gamma = 0.2$ and $\gamma = 0$.

Tables 1 presents results for present value of the change in utility over the infinite time horizon (Hicksian EV - equivalent variation) under alternative assumptions. Table 1 also shows the yearly growth rate from the base year to years 10 and 50 (G_{10} and G_{50} respectively). IRS stands for increasing returns to scale, with the benchmark value of $\alpha = \rho = 0.66$. Since the X

sector expands only through the creation of new firms, we see from (2) that effective *X* output is homogeneous of degree $1/\alpha$ or 1.5.

CRS in Table 1 stands for constant returns to scale, and assumes that $\alpha = \rho = 1$. CAPFLO is the benchmark assumption of perfect intertemporal capital markets, so that the balance of payments constraint is as given in (16). The alternative assumption is BOPCON, which constrains international payments to balance every period (17).

Our "base case" in presenting the results will use the parameter values shown in the first column of Table 1: IRS (homogeneity of degree 1.5), CAPFLO, $p_s = 0.95$, and $\gamma = 0.2$. The first column shows that the ability to hire consultants at the price which is 5% lower than the cost. This opportunity raises welfare by 3.4% over the infinite time horizon. The growth rate increases above 2%, but converges back to the steady-state value of 2% in the long run. The second column of Table 1 shows that the welfare gains are almost doubled if the price of foreign consultants falls to 0.90.

The remaining three columns of Table 1 illustrate that the welfare gains are greatly reduces relative to the base case if (1) there are no spillovers (column 3), (2) there are no scale economies (column 4), or (3) the country cannot borrow on international capital markets in order to finance the hiring of foreign consultants (column 5).

Table 2 presents sensitivity analysis on three parameters of the model, in each case column 2 giving the base case. These results illustrate that raising either the elasticity of substitution between domestic and foreign goods in consumption, raising the elasticity of transformation between outputs for domestic sale and export, or especially increasing the elasticity of substitution between entrepreneurship and expertise in (11) increase the welfare

gains substantially.

Now let's examine the full path of adjustment, in which we "shock" the economy in the year 2000 by allowing in foreign consultants, initially at a price of 0.95 or 0.90 with a spillover parameter of $\gamma = 0.20$ or 0.. Figure 2 shows the effects of entry on the consultants' share of the total number of entreprenuers, $(S^D + S^M)$. A quite interesting result is that, when γ is positive, the use of consultants is only temporary. Spillovers increase the ability of domestic knowledge workers to supply the market such that the foreigners eventually become unaffordable. Foreign consultants presence in the domestic economy is permanent in the absence of spillovers (i.e., when $\gamma = 0$). To develop some intuition for this result, begin by observing that services provided by foreign substitutes are a perfect substitute for services provided by a fraction of domestic skilled workers, hence the competitive economy will only choose to import these services when they are relatively cheaper. When $\gamma > 0$, the domestic stock of skilled workers increases and the value of new firms is driven down relative to the wage for foreign consultants, at which point imports of foreign consultant services become unprofitable and are driven to zero.

Figure 3 shows the percentage change in the number of firms relative to the initial steady state path for the same three scenarios as in Figure 2. There is a sharp rise in the number of firms during the time that foreign consultants are employed. Recall from the model that new firms become permanent (there is no depreciation of firms), thus the number of firms in the economy is permanently higher even after the foreign consultants are priced out of the market. Figure 3 makes clear the importance of the spillover effect in new-firm creation.

Figure 5 traces the impact on macro variables for the base case ($p^S = 0.95$, $\gamma = 0.2$), with all variables measured as % changes relative to the benchmark steady state growth path. The

number of firms (N) is permanently higher by a fixed percentage after foreign consultants are no longer used. The stock of human capital (H) and the capital stock (K) continue to growth relative to the benchmark. Instantaneous utility (u) takes an initial jump and is then flatter than the other series due to consumption smoothing, which also explains the initial small drop in K.

Figure 5 plots the current-account deficit for the same three scenarios considered in Figures 2 and 3. There is a zero current-account balance in all years in the benchmark calibration with no foreign consultants. In all three cases, the country finances the services of the foreign consultants and finances consumption smoothing by running a current-account deficit in the early years.

Figure 6 continues this analysis, contrasting firm entry in the base case ($p^S = 0.95$, γ=0.2, CAPFLO) with a case where payments must balance on a period-by-period basis (BOPCON). The effect of the period-by-period balance of payments constraint is rather dramatic, something we also noted in Table 1, column 5, where it is shown that the BOPCON case reduces the welfare gain from 3.4% to 1.5%. In effect, the period-by-period constraint means that foreign consultants must be financed by postponing consumption and this is so costly that fewer foreign consultants are hired. There is an important policy point here, in that liberalizations that permit the hiring of foreign consultants are complementary to capital-market liberalizations and domestic reforms that facilitate international borrowing. Furthermore, we observe in Figure 6 that in the presence of capital-market constraints, the cost advantage of domestic substitutes for foreign consultants does not emerge, and there a permanent positive level of foreign consultants in the economy on the new steady-state growth path.

In Figure 6, we also show a result for a higher value of the substitution elasticity between

entrepreneurial services and expertise from (11). A higher value of σ_h means that there is less diminishing marginal product to using large numbers of foreign consultants early on. But we also see that this causes them to be priced out of the market earlier as well. These results correspond to the sensitivity analysis in the bottom panel of Table 2.

Figures 7-9 consider a subsidy to foreign consultants, motivated by two sources of market failure: (1) the aggregate scale economies in production, and (2) the knowledge-spillover effect. We plot the base case ($p_s = 0.95$, $\gamma = 0.2$) along with the case of a 20% subsidy (s), other parameters held at base-case values. We also plot results for a third case, in which the subsidy results in a domestic cost of consultants of 0.95; working backwards this means that the world price of consultants is $p_s = 1.1875$ (1.1875(1 - 0.20) = 0.95). This last case, when compared to the base case of $p_s = 0.95$ and s = 0, shows the burden of having to force the entry of foreigners through the subsidy. Figure 7 shows a very large response in terms of firm entry to the subsidy. Having to lower the price of consultants to 0.95 through the use of the subsidy makes virtually no difference to the rate of firm entry relative to being able to pay a world price of 0.95.

Figures 8 and 9 show the effect of the entry of foreign consultants on the return to domestic human capital (knowledge workers) under the same three scenarios as in Figure 7. These two figures are constructed under two alternative interpretations of the spillover effect in equation (15). Figure 8 assumes that the spillover creates additional domestic skilled workers. Perhaps we could think of this as untrained workers who work with the consultants learning by watching. Figure 9 assumes that the spillover leads to higher productivity among a fixed number of domestic skilled workers. Obviously, the first interpretation will mean a lower wage for domestic skilled workers relative to the second interpretation.

Figure 8 shows that the effect of the subsidy is to lower the return to an individual domestic skilled worker initially and perhaps in the long run as well. But with $p_S = 0.95$ and with 20% subsidy, a large early drop is eventually changed into a large long-run gain for skilled workers. The domestic workers must compete with foreign consultants and an increased number of domestic counterparts in the short and medium term. But with $p_S = 0.95$ and with 20% subsidy, the resulting negative effect on their nominal wage is outweighed in the long run by a boost in aggregate productivity due to having a larger range of intermediate inputs (lowering the price of the consumption good).

Figures 9, on the other hand, shows that if the spillover is a boost in productivity to an existing cohort of domestic workers, then a temporary fall in their wages becomes a real-wage increase after a few years. Under this second interpretation of the spillover, the imported consultants are "complements" to domestic knowledge workers.

Figure 10 completes the analysis by showing the effect on consumption (again relative to the benchmark steady-state path) under the same three scenarios. The 20% subsidy at $p_s = 0.95$ gives a very strong boost to consumption. Interestingly, lowering the price to 0.95 via the subsidy has virtually no distinguishable effect from being able to hire the consultants at 0.95. This is because the subsidy payments are an extremely fraction of (the present value of) GDP, and in part because we are assuming that the subsidy is financed by non-distortionary lump-sum taxation. Table 3 gives figures corresponding to Table 1 for the subsidy case. "Subsidy cost" denotes the value of subsidy payments as a percent of (present value of) baseline income, using the same base as EV in the top row. Although we would wish to be extremely cautious about advocating a subsidy in practice, even if the welfare burden of the subsidy is two or three times

its non-distortionary cost, it still has a very large payout in this simulation model.

4. Summary and Conclusions

We consider here a source of knowledge transfer to developing and transition economies which, although surely recognized by businessmen and practitioners, has escaped formal economic modeling. We assume that specialized consultants or "knowledge workers" are needed to start new firms or produce new products/services. The *change* in the number of firms and hence the *change* in aggregate productivity depends on the *level* of these knowledge workers. The economy has an initially small supply of these workers, although it calibrated to an initial steady-state growth path. The alternative is to hire foreign "consultants", who provide and immediate additional supply of expertise to start new firms. In addition, there may be an uncompensated spillover from these foreign consultants to domestic managers and engineers working with the foreigners.

We show that the use of these foreign consultants can indeed have a large impact on growth and welfare for the domestic economy. In the presence of a spillover, the use of foreign consultants is transitory, and they cease to be used when domestic expertise is sufficiently built up. Although the economy returns to the same steady-state growth rate eventually, income remains at a permanently higher level in addition to the income gains during the transition period. Because of the non-internalization of aggregate scale economies and the knowledge spillover, a subsidy to the use of foreign consultants can be welfare-improving.

Several other results are interesting and important for policy purposes. First, the ability to capture the large welfare gains from the use of foreign consultants depends crucially on the

country's ability to run a current-account deficit in early years in order to pay for the consultants. Thus reforms which encourage the use of foreign experts are complementary to reforms which allow the country to borrow internationally at favorable rates. Second, the effect of the introduction of foreign consultants on domestic knowledge workers depends crucially on the form of the spillover. If the spillover leads to the creation of additional domestic skilled workers, then the existing pool suffers a lower real wage in the short run and possibly in the long run as well. But if the spillover accrues in the form of increased productivity for the existing cohort of knowledge workers, then the latter gain substantially in the long run. If we think of the foreign consultants as working closely with workers who have a high level of general education but lack specific modern engineering and management skills, then the latter interpretation of the model seems more relevant. In this case foreign consultants are complements to domestic educated workers.

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Table 1 Welfare and Growth Impacts

	IRS-CAPFLOW			CRT-CAPFLOW	IRS-BOPCON
	$p_s = 0.95$ $\gamma = 0.2$	$p_s = 0.90$ $\gamma = 0.2$	$p_s = 0.95$ $\gamma = 0$	$p_s = 0.95$ $\gamma = 0.2$	$p_s = 0.95$ $\gamma = 0.2$
Hicksian EV (%)	3.39	7.91	0.50	0.00	1.53
G_{10} (%)	2.17	2.41	2.02	2.00	2.00
G_{50} (%)	2.10	2.23	2.02	2.00	2.05

Table 2 Sensitivity Analyses

	Armington elasticity of substitution between imports and domestic goods in final demand (σ_c):		
	1	2	4
Hicksian EV (%)	3.20	3.39	3.71
G_{10} (%)	2.14	2.17	2.22
G_{50} (%)	2.10	2.10	2.10

	Elasticity of transformation between goods produced for the domestic and export markets : (σ_y)		
	1	2	4
Hicksian EV (%)	3.08	3.39	3.92
G_{10} (%)	2.14	2.17	2.24
G_{50} (%)	2.09	2.10	2.11

	Elasticity of substitution between foreign-type consultants and domestic entrepreneurs (σ_h):		
	1	2	4
Hicksian EV (%)	2.13	3.39	5.34
G_{10} (%)	2.10	2.17	2.29
G_{50} (%)	2.06	2.10	2.15

Table 3 Welfare and Growth Impacts of a Subsidy to Foreign Consultants

	IRS-CAPFLOW		
		γ=0.2	
	p_s = 0.95	p_s = 1.1875	p_s = 0.95
	s = 0	s = 0.20	s = 0.20
Hicksian EV (%)	3.39	3.23	47.63
G_{10} (%)	2.17	2.16	4.48
G_{50} (%)	2.10	2.09	3.20
Subsidy cost (%)	0.00	0.05	0.68

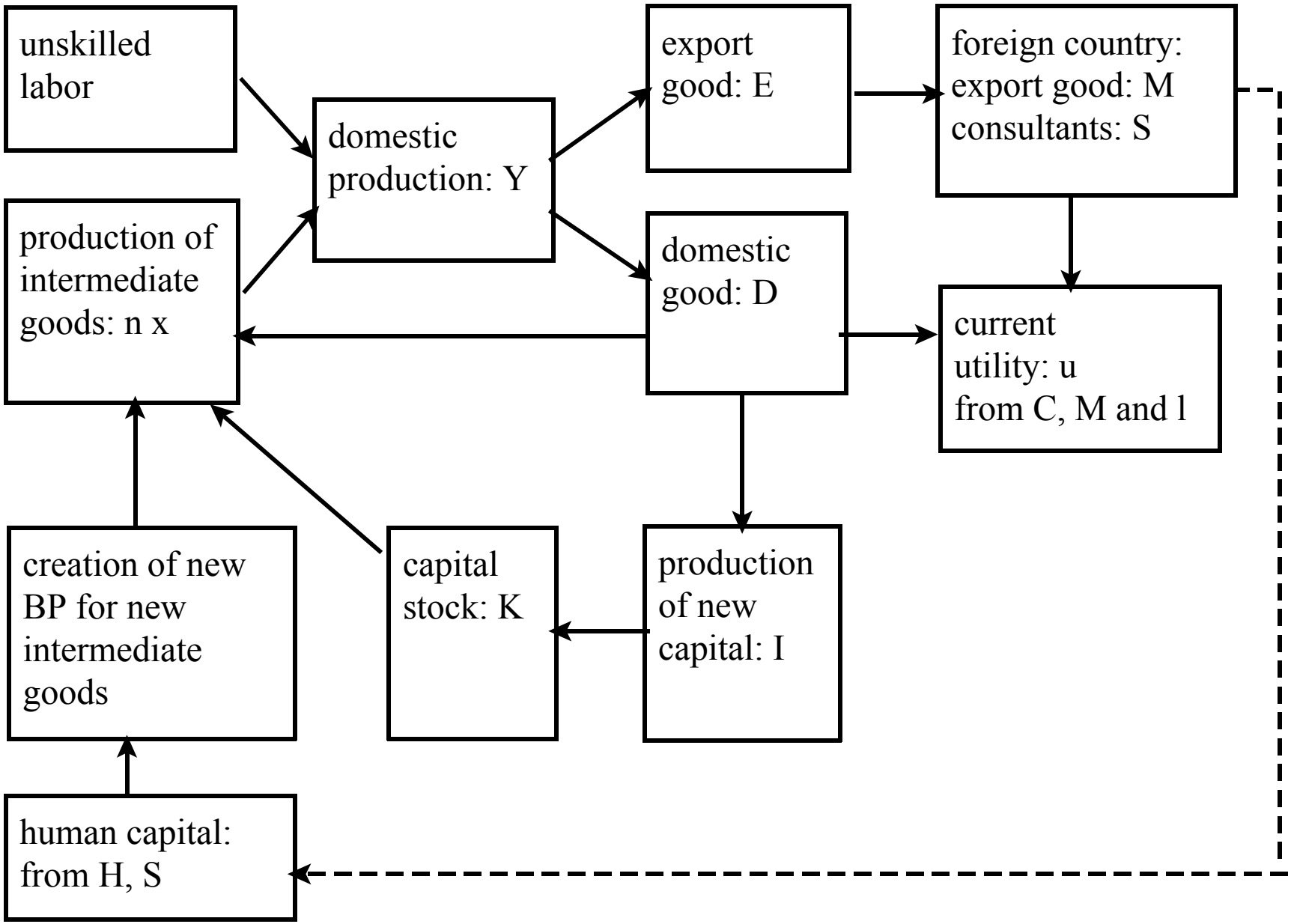

Figure 1: Model Structure

Figure 1: Consultant Share of Domestic Market

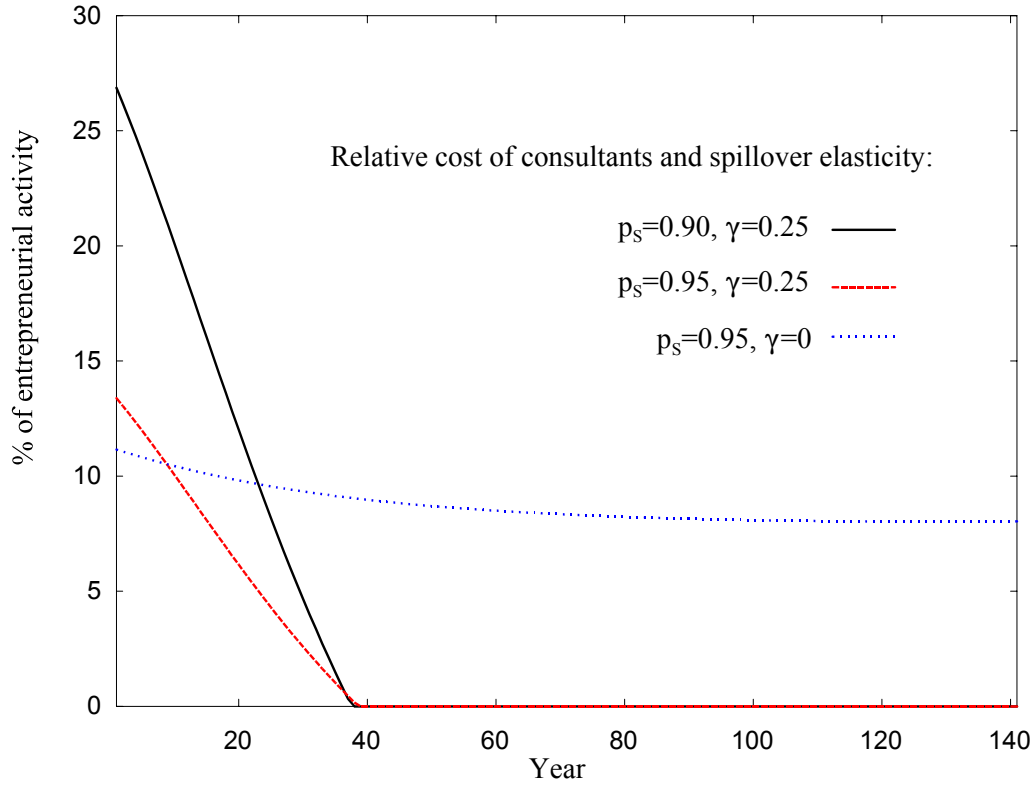

Figure 2: Rate of Entry for New Firms

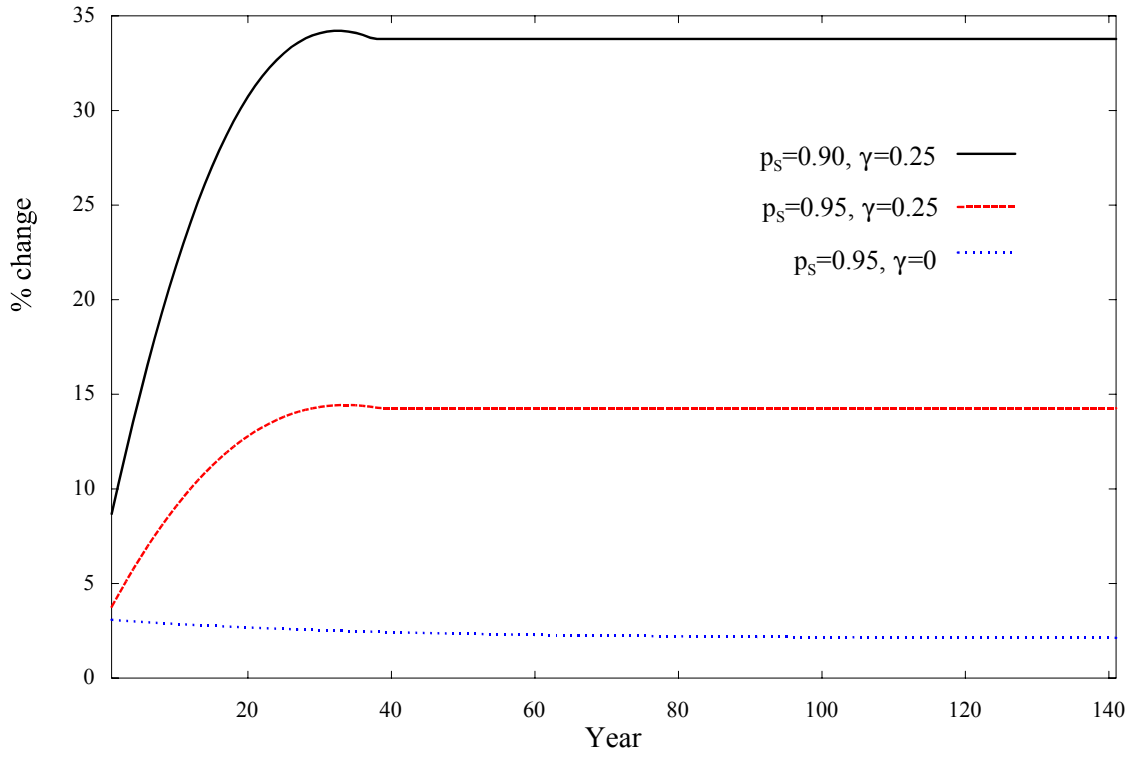

Figure 3: Macroeconomic impacts for p_S=0.95

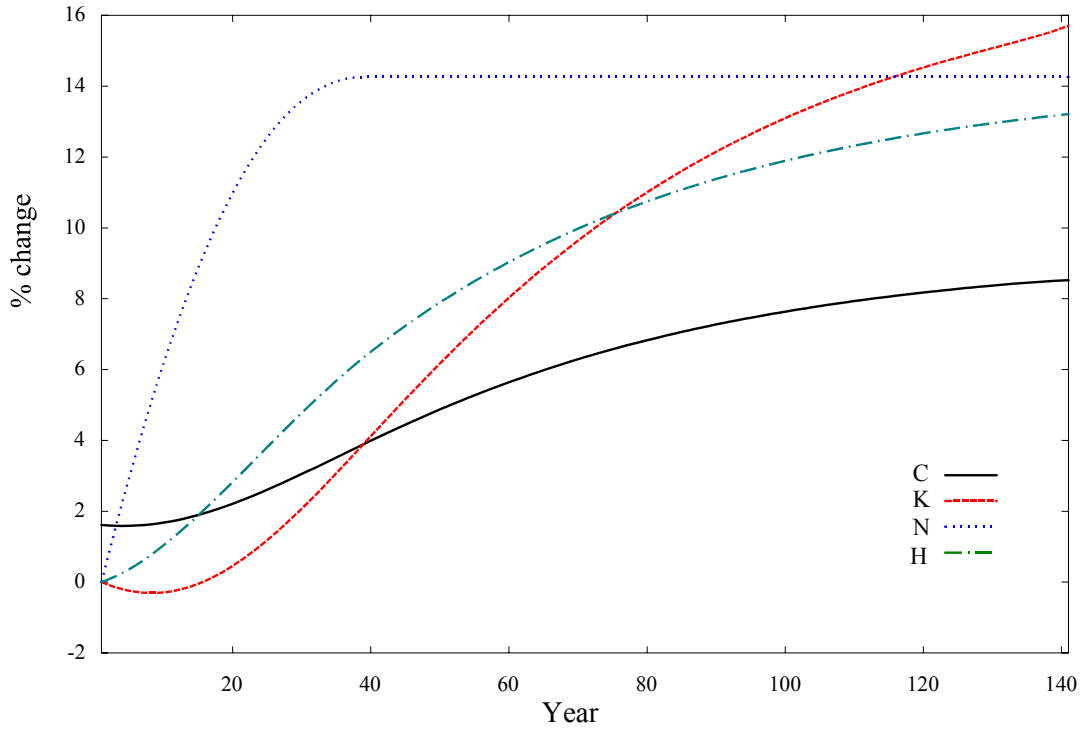

Figure 4: Current Account Deficit

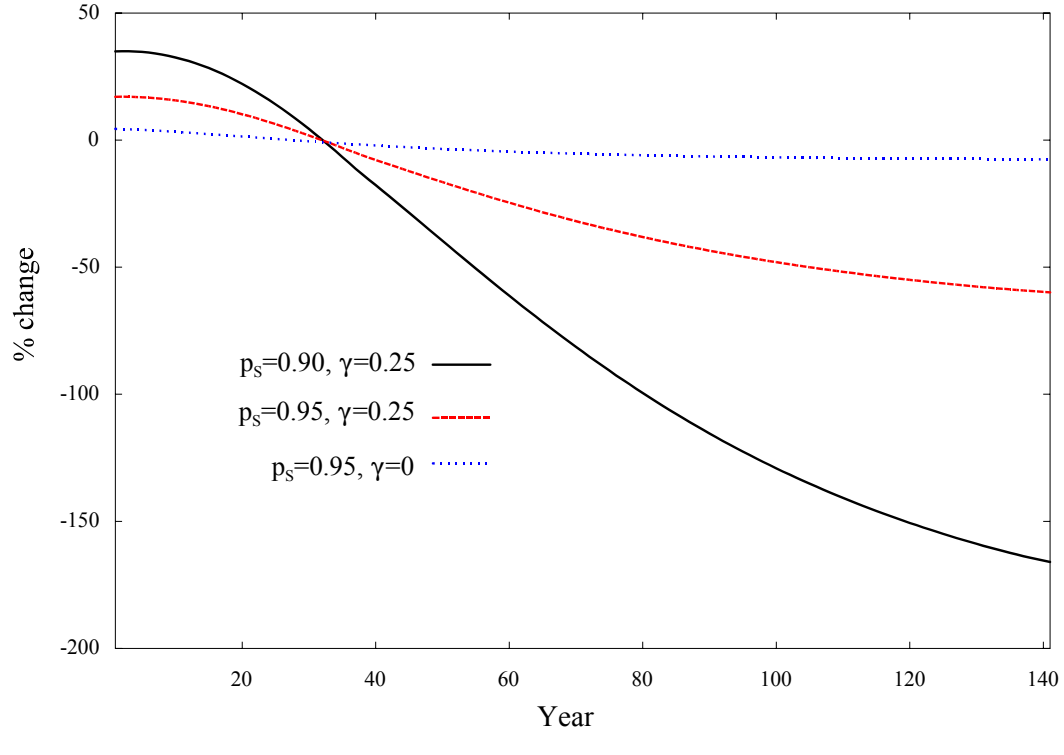

Figure 5: Consultant Share of Domestic Market

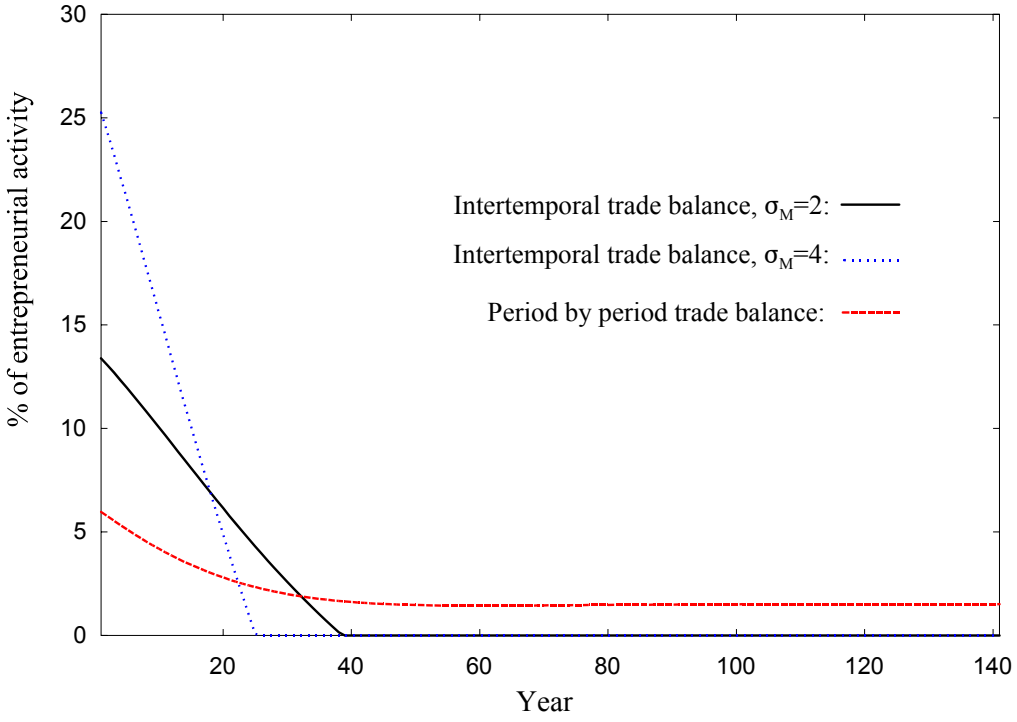

Figure 6: Subsidies and Firm Entry

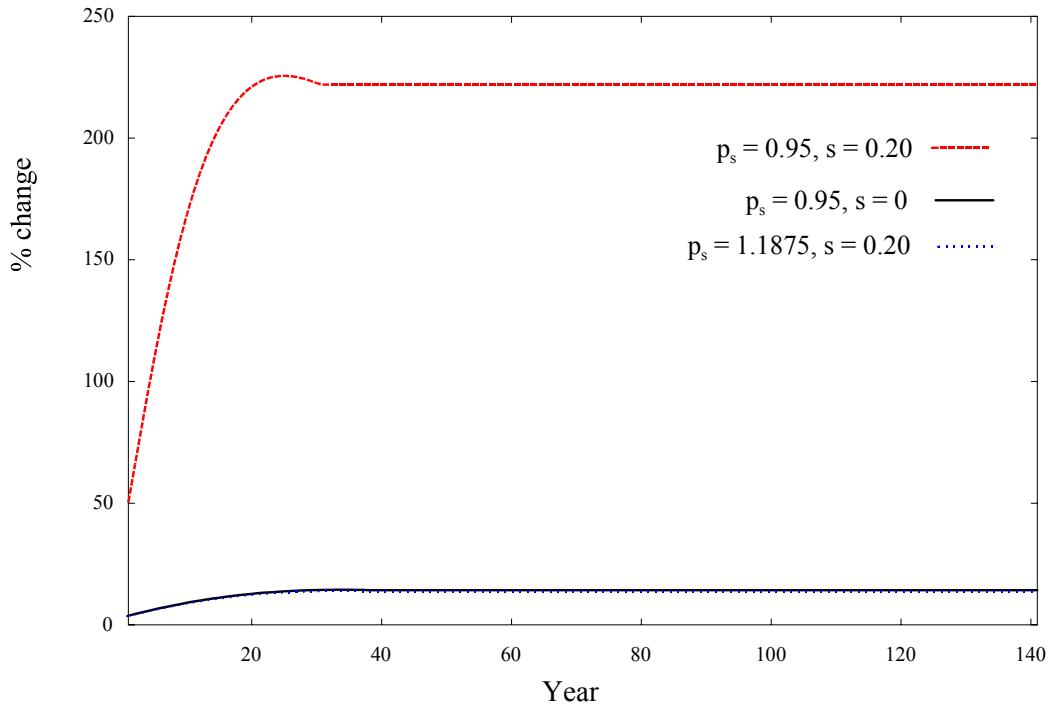

Figure 7: Subsidies and the Return to Human Capital 1

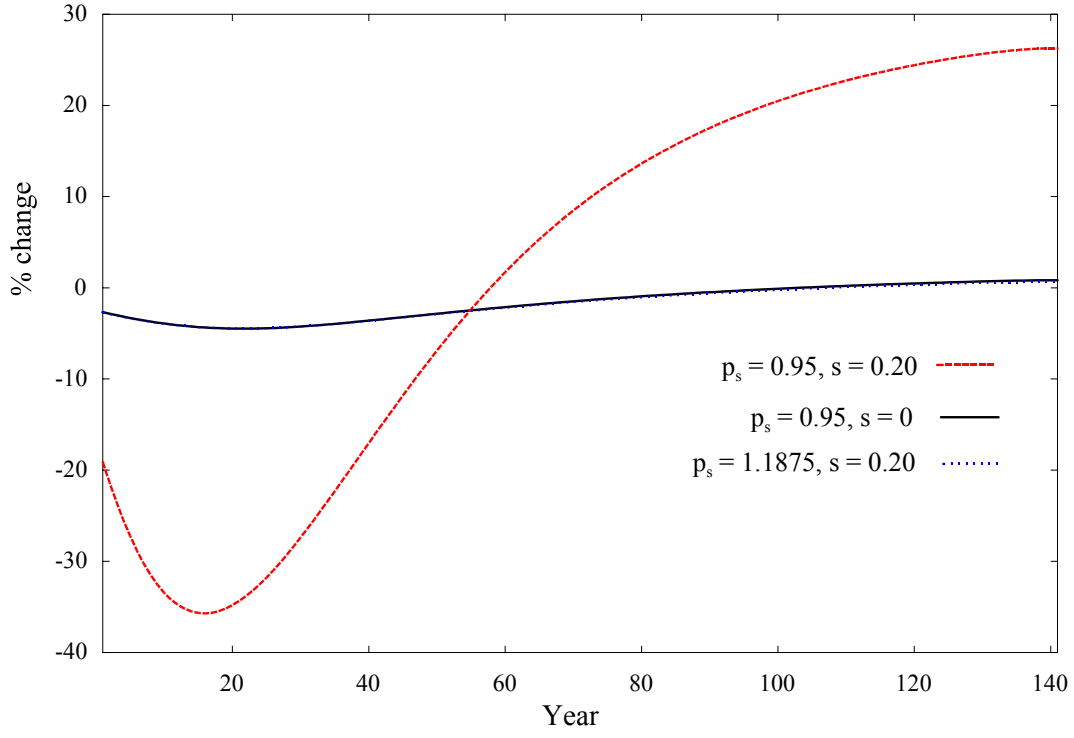

Figure 8: Subsidies and the Return to Human Capital 2

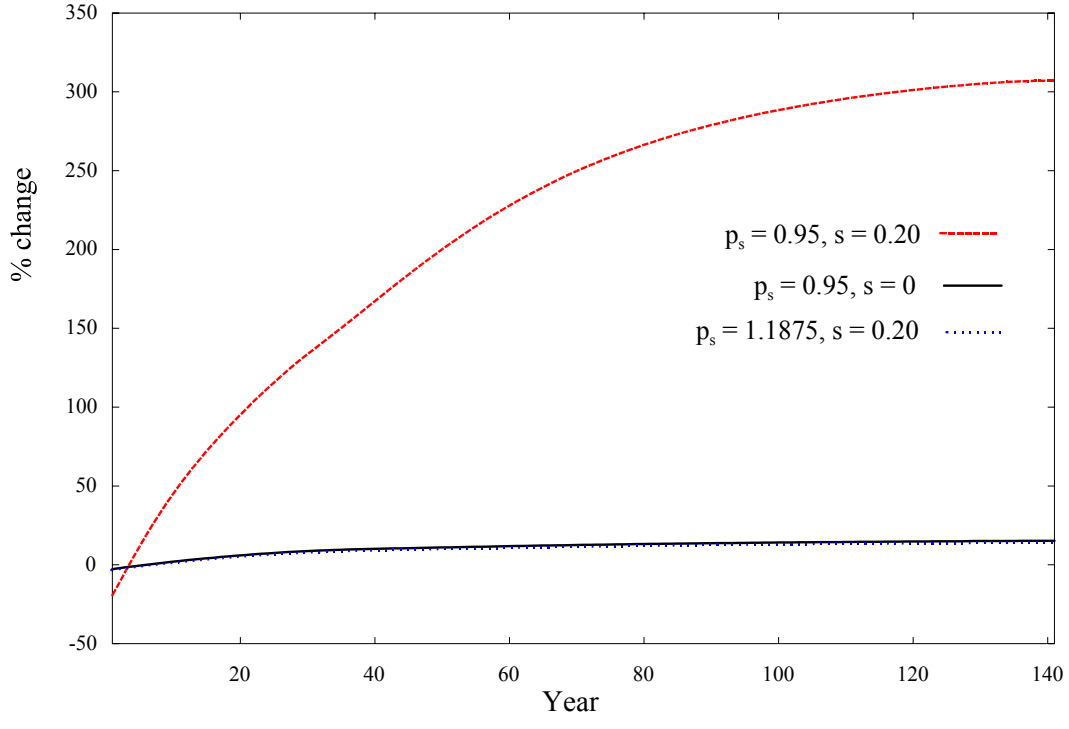

Figure 9: Subsidies and Consumption