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Economic boom, financial bust, and the fate of Thai agriculture

Was growth in the 1990s too fast?

Ian Coxhead
Department of Agricultural and Applied Economics
University of Wisconsin-Madison
412 Taylor Hall, 427 Lorch Street
Madison, WI 53706, USA

coxhead@facstaff.wisc.edu
http://linux.aae.wisc.edu/~coxhead/

1 Thailand's economic boom and agricultural bust

In the middle and late 1980s, a remarkable combination of domestic and international phenomena came together to "make a miracle" in Thailand: an acceleration of real economic growth from about 6% per year in 1976-85 to above 8% in 1986-95. At its peak in 1988-90, growth averaged 12% per year. Low wages, reductions in trade barriers, and conservative economic management resulting in low inflation and a stable exchange rate made the Thai economy an ideal host for a foreign investment. And from late in the decade financial liberalization (The opening of the capital account) facilitated a flow of foreign-currency denominated borrowing that by the mid-90s had become a torrent. This fueled an investment boom that by the early 1990s had spilled over from tradables sectors into demand for non-traded assets, particularly stocks and real estate. The boom drove up non-traded goods' prices, sometimes in spectacular fashion. The Bangkok skyline became a forest of cranes as property developers competed to construct ever-taller and more prestigious office blocks and apartment towers. Construction sector employment grew from an average of 6% of non-agricultural labor in 1980-89 to over 10% in 1990-95.

In spite of sharply rising inequality, there could be few complaints that the gains from this growth were not widely shared. With employment demand outpacing labor force growth, real wages rose dramatically from 1989, and as a result, overall poverty incidence declined.[1] Political instability notwithstanding, and despite doubts about the robustness of its financial institutions, Thailand had become a model developing economy, winning a place in the group of eight "high-performing Asian economies" that the World Bank in 1993 dubbed *The East Asian Miracle.*

The gains from the boom were not uniformly shared among sectors, however. Agriculture, historically the mainstay of the Thai economy, the primary employer and major source of export earnings, captured only a tiny fragment of the investment boom, and as the most labor-intensive set of industries, found itself increasingly unable to compete with wages offered in other sectors. After 1989, as close to three million workers out of a total agricultural labor force of about 20 million walked off the land, planted area began to decline and agricultural output growth rates decelerated (Table 1). The *relative* decline of agriculture, an inevitable and generally welcome trend in a growing economy, threatened for a time to become an *absolute* contraction.

In an open economy, the relative decline of agriculture is an inevitable feature of economic growth and is not in itself a cause for concern. However, if the decline is caused by growth that is unsustainable, and if it involves transactions costs or irreversibilities, then aggregate welfare as well as that of the rural poor may be reduced, and policy interventions may be merited. In this paper we use quantitative methods to examine aggregate and sectoral inducements to labor and land use changes in Thai agriculture. We then use a variant of the Dutch Disease model to examine the likely impacts of an abrupt cut in non-agricultural labor demand, such as occurred in late 1997.

2 The fate of agriculture

As is well known, economic growth reduces the relative profitability of agriculture through several mechanisms. Of these, the most important are domestic terms of trade changes (Stolper-Samuelson effects), and unequal rates of factor endowment growth, which cause factors to migrate to sectors where their relative productivity is higher (Rybczinski effects). Both of these intersectoral effects are important features of explanations for the relative decline of Thai agriculture over the period 1960-85 (Ammar 1996; Martin and Warr 1994). Rising prices for non-traded goods (produced mainly in non-agricultural sectors) and growth of non-agricultural capital have apparently been the main engines of structural change in the Thai economy. Both rising prices and non-agricultural investment increase labor productivity outside the farm sector. Wage pressures and declining relative agricultural prices squeeze farm profits and discourage investment, and this reduces the agricultural growth rate relative to rates in the rest of the economy.

The intersectoral source of agriculture’s decline in recent years can be seen with the aid of a simple model and econometric analysis. We begin by asking what factors explain agricultural factor demand at the level of the sector. The conventional approach is to model the sector as a price-taking firm and to derive optimal output and factor demands in terms of exogenous prices, fixed factor endowments, and technology. However, Thai agriculture cannot be said to be a price-taker in the labor market. While the total agricultural labor force is by no means fixed even in the short run, the agricultural wage is endogenous to agricultural labor demand. Therefore, we must simultaneously explain agricultural wage formation. The dividend from doing so is that we are able to gauge the determinants of Thai agricultural factor demand in an economy-wide setting. In particular, since land and labor are complementary inputs, we expect to find that some part of the explanation for the observed area decline is to be found in intersectoral labor market trends.

Our model explains agricultural land and labor demand in terms of product prices, prices of other variable inputs, fixed input quantities, and technical progress, and wages are explained by reference to the intersectoral labor market, as follows.

Labor demand. Agricultural labor demand is determined by the agricultural wage (WA)[2] and the price of fertilizer (PF), both expressed in terms of agricultural prices (PA); the quantities of non-labor factors including land (NA), irrigation (IR) and agricultural machinery (KA); and a measure of technological progress (T):

$$LA = LA(WA/PA^{-}, PF/PA^{+}, NA^{+}, IR^{+}, KA^{-}, T),$$

where superscripts indicate the signs of the partial derivatives as predicted by theory.

Land demand. While the total land endowment may be regarded as fixed in the short run, planted area may fluctuate from year to year. In our model the demand for land, measured as the area planted in each period, is determined by agricultural prices, a measure of labor availability or wages, the price of fertilizer, the quantities of other inputs (irrigation, labor, agricultural machinery), and technology. Whether the quantity of agricultural labor or the wage should appear in this equation depends on our assumption about labor mobility. If labor were intersectorally immobile (or at least of very limited mobility) then it would be appropriate to use the quantity of agricultural labor as a measure of a fixed factor endowment. Alternatively, if labor were mobile so that farmers, having made land use and technology decisions, could readily hire the required labor, then the wage would a more appropriate explanatory variable. Neither specification is likely to be strictly correct in a short-medium run analysis of Thai agriculture, and we lack sufficient information to test them empirically. Accordingly, we fit both models and compare their results. The alternative explanations for land demand are shown as (2a) and (2b):

(2a) $NA = NA(PA^{+}, WA/PA^{-}, PF/PA^{+}, IR^{-}, KA^{+}, T)$,

or:

(2b) $NA = NA(PA^{+}, PF/PA^{+}, LA^{+}, IR^{-}, KA^{+}, T)$.

Equations (1) and either (2a) or (2b) are interdependent since endogenous variables appear on their right hand sides. There are two additional complications. First, some or all equations may be underidentified, depending on the exact combination of exogenous variables included and excluded from each. Second, due to the large share of agriculture in total employment, the agricultural wage is also not invariant with respect to changes in agriculture, another source of simultaneity bias. We resolve these problems, and capture economic links between agricultural and non-agricultural development, by explaining the agricultural wage by reference to intersectoral labor market.

Agricultural wages. The Thai labor market exhibits a high degree of intersectoral mobility at the margin, and the agricultural wage has tracked the non-agricultural wage fairly closely over time. We expect that agricultural wages (WA) and non-agricultural wages (WN) are related, but that the correspondence is not exact due to transactions costs and adjustment lags, i.e. $WA = WA(WA_{-1}, WN)$. We then explain WN by constructing an inverse non-agricultural labor demand function in terms of non-agricultural prices (PN), the aggregate capital stock (KN), labor supply (LF), and a time trend (T) capturing technical progress:

$$WN = WN(PN^{+}, KN^{+}, LF^{-}, T).$$

If a linear combination of these variables is correlated with the non-agricultural wage, then we can explain the agricultural wage by (3):

(3) $WA = WA(WA_{-1}, WN) = WA(WA_{-1}^{+}, PN^{+}, KN^{+}, T, LF^{-})$,

in which the current value of WA depends on contemporaneous and lagged values of exogenous variables determining the non-agricultural wage.[3]

The simultaneous solution of (1), (2a) or (2b) and (3) resolves the identification problem, and captures the main intersectoral linkages through product and labor markets. By substitution from (3) into (1) and (2) it can readily be seen that the reduced form of the system is a pair of agricultural factor demand equations in which the explanatory variables are prices (PA, PN), fixed factor stocks (KA, KN, IR), and technological progress (T).

Data, estimation and results

We use a time series of Thai regional data that spans 35 years (1961-95) and four regions as well as the Bangkok metropolitan area (for full details see Coxhead with Jiraporn 1998). For estimation we select some specific categorical variables for inclusion in each of the factor demand equations. In addition to the variables shown in (1)-(3) we add regional dummy variables and a set of categorical variables (FT, IN) accounting for the combination of crops with different characteristics into aggregate agricultural output and factor demand. Defining all continuous variables except the time trend in logarithms (denoted by a prime, e.g. LA′ = ln(LA)), the system to be estimated, excluding regional dummies, is:

(4) $$LA' = a_1 + b_1(WA' - PA') + c_1(PF' - PA') + d_1NA' + e_1IR' + f_1KA' + g_1FT' + h_1T + \varepsilon_1 ,$$

(5a) $$NA' = a_2 + b_2PA' + c_2(PF' - PA') + d_2(WA' - PA') + e_2IR' + f_2KA' + g_2IN' + h_2T + \varepsilon_2 ,$$

or

(5b) $$NA' = a_2 + b_2PA' + c_2(PF' - PA') + i_2LA' + e_2IR' + f_2KA' + g_2IN' + h_2T + \varepsilon_2 ,$$

(6) $$WA' = a_3 + b_3PN' + c_3KN' + d_3LF' + e_3WA'_{-1} + h_3T + \varepsilon_3 .$$

We use 3SLS to fit systems consisting first of (4), (5a),(6), then of (4), (5b), (6) (White 1993). Most of the estimates are highly significant and of the predicted sign. Since the two sets of results are very similar, we report only those for the former system in Table 2.

Labor demand. As expected, labor demand is positively associated with land area, and negatively with the agricultural wage and the stock of agricultural machinery. Contrary to expectations, an increase in the fertilizer price contributes to increased labor demand. This may be due to high correlation between fertilizer use and irrigation, since most fertilizer is used in irrigated rice production. Alternatively, a fertilizer price increase may result in reallocation of resources to more labor-intensive, less fertilizer-using crops, a shift masked by our use of an aggregate output measure. The coefficient of the time trend suggests that over the entire period, technical progress in agriculture has been labor-using at a rate of approximately 3% per year.

Land demand. The estimated parameters of the land demand function conformed entirely with expectations, and all are significant at conventional levels. Higher agricultural prices are associated with increased land demand, as are increases in the quantities of complementary inputs (agricultural capital) and the price of a substitute (fertilizer). Higher agricultural wages reduce land demand. An increase in irrigated area represents a positive land supply "shock" that causes planted area to expand, but by less than a proportional amount—indicating that as irrigated area expands, demand for non-irrigated land contracts. Technical progress in agriculture has been land-saving over the period covered by the data, at a rate of about 1% per year.

Agricultural wages. All estimates of (6) were of the predicted sign. Surprisingly, the dynamic component of the model had no impact, with the estimated coefficient of WA_{-1} being just smaller than its standard error and very small in magnitude. By contrast, the contemporaneous determinants of non-agricultural wages, PN, KN and LF, were all found to exert strong effects on WA. The coefficient of non-agricultural productivity growth was not significant.

Table 3 shows elasticities of the reduced form equations. In the shorter-run estimates it is assumed that agricultural land use decisions are made on the basis of a fixed amount of labor. In the longer-run estimates, labor is assumed to be mobile. The results confirm that in spite of significant agricultural investments, for example irrigation, the evolution of agricultural factor demand is largely driven by non-agricultural phenomena, specifically non-agricultural prices and investment. These raise agricultural wages and this in turn drives agricultural resource allocation decisions. The estimates help quantify the Rybczinski effect of non-agricultural growth.[4]

The econometric result provides strongly intuitive explanations both for the decline of agricultural land area, and for some of the reasons behind the rapid mechanization of Thai agriculture since 1989. With massive outflow of labor, a considerable amount of agricultural land was idled. It is also of interest to note from that in the shorter run, labor and machinery are clear substitutes. Mechanization diminishes employment opportunities in agriculture, a point with significant implications in the current economic crisis.

3 Was growth in the 1990s "too fast"?

As we have just seen, the economic boom of 1988-95 was associated with the reversal of long-term growth rates of employment and land area in Thai agriculture. Agriculture's sudden decline may also be a source of policy concern if it has occurred at a rate greater than warranted by long-term trends in factor endowment and productivity growth rates, and if the economy is characterized by significant market or technological irreversibilities.

Where does the problem arise? In the standard "Dutch disease" (DD) model, the long-term decline of a tradable sector occurs in response to a permanent change in relative prices or rates of factor accumulation, technical progress, or changing consumer preferences (Corden and Neary 1982). In such cases the decline (e.g. of agriculture) is socially optimal, and any intervention directed at slowing or reversing the sector's decline would reduce welfare. The Thai case, however, violates key assumptions of this result. The fuel for the boom was the accumulation of capital which, in contrast to the standard DD model, was internationally mobile after 1990. Therefore, resources upon which the boom was built could relatively easily be withdrawn from the economy, with consequent reductions in non-agricultural production and labor demand. The fact that much of this investment was financed by borrowing in short-term international money markets is of course relevant, since it means that the end of the boom, when it came, was marked by very rapid capital outflow. It is also significant that much of the boom occurred in labor-intensive non-tradable sectors such as property development and construction, where asset prices were driven to unjustifiable heights in a fashion characteristic of a "bubble" economy.

Seen this way, the investment boom of the 1990s was analogous to a temporary resource boom of the kind experienced by most oil-exporting countries in the 1970s. As those countries discovered, treating a boom as permanent when it is in fact temporary can be costly in terms of long-run growth. The same may now be true of Thailand. First, the decline in agriculture's domestic terms of trade with other sectors—caused by the investment boom and by spending on non-traded, non-agricultural goods and services—was probably exaggerated. Second, too-rapid growth in non-agricultural labor demand may have stimulated a faster rate of non-agricultural wage growth than long-term factor market trends would warrant. This in turn provided incentives for migration, and thus for a contraction of planted area as well as for agricultural mechanization.

Even so, the boom poses a long-term problem only if it has long-term effects. Although the data for a formal test are not yet available, we contend below that the boom may have stimulated a pattern of agricultural and labor market responses which will be costly to correct in the long run. Transactions costs associated with labor migration, and sunk costs of agricultural mechanization suggest that the investment boom may have induced some changes in labor markets and agricultural technology that will be difficult to reverse in the very different economic climate of the late 1990s. Some resources will have to be expended to correct them, leading to a welfare loss. In this sense Thai growth in 1988-95 may have been “too fast”, and corrective policies to inhibit it, and thus to prevent such a rapid agricultural decline, were merited.

The Thai wage boom and the crash of 1997 threw tens of thousands of unskilled or semi-skilled workers out of work, in construction as well as in traditional labor-intensive manufacturing sectors. In late 1997, the Thai press reported huge increases in open unemployment and predicted widespread migration ‘back to the farm’. A question that immediately arises is whether such a movement would actually occur, and if so, with what consequences. Although the rapid transfer of labor out of agriculture in the past indicates a high degree of mobility, this may be much greater away from the farm than back again. The Harris-Todaro migration model predicts that with urban wages higher than those in rural (i.e. agricultural) occupations, but with the probability of urban unemployment being less than one, there will always be a pool of unemployed urban workers for whom the prospect of a high-paying job in the future is still more attractive than returning to the farm to receive a low, but certain, wage (Harris and Todaro 1970). Their decisions can be reinterpreted in terms of irreversible investments. By deciding to leave the farm, migrant workers have *exercised an option* —in this case, the option of staying home and earning a low but certain wage, and invested in the rural-urban move and associated costs. Having done so they are unlikely to give up their new situation readily, especially if they continue to believe that a recovery is imminent and that they should therefore remain "in line" in the urban job market.

A second reason may have to do with the nature and rate of agricultural and non-agricultural investment in recent years. Agricultural mechanization grew exponentially during the period of very rapid intersectoral labor transfer, and as we have seen, labor and machinery are short-run substitutes. Therefore, even if labor were to return to the farm, sunk costs of mechanization may mean that creation of new farm jobs occurs only with a lag of a year or more.

The key aspects of the problem can be captured in stylized form with a simple geometric model of the labor market (Diagram 1). The width of the diagram measures total labor supply at any point in time. If agricultural labor demand is measured from the right and non-agricultural demand from the left, and if non-agricultural wages are fixed by some criterion other than equality of marginal product with the wage, the diagram shows how labor will move between sectors in response to fluctuations in non-agricultural demand. Workers face a choice between accepting rural (farm) work with an assured wage (w_A) and migrating in search of urban (non-agricultural) work at a higher wage (w_N), but with a probability $\rho<1$ of actually finding employment. In this model there is always positive unemployment in the urban labor market as workers seek higher-paying jobs. Labor market equilibrium is given by the condition $w_A = \rho w_N$, where ρ is non-agricultural employment as a fraction of the supply of labor to non- agricultural sectors. In Diagram 1, for given values of W_N and L_N, this condition is satisfied only by points along the rectangular hyperbola *hh*, the so-called "Harris-Todaro curve" (Corden and Findlay 1975). In this way the agricultural wage is seen to depend on non-agricultural wages and employment— as was confirmed in the econometric analysis.

Diagram 1 captures the essential features of our argument about adjustment and migration in the wake of Thailand's investment boom and collapse. First, since $\rho<1$ it is always preferable to some workers to be unemployed in the urban labor force than to return to the land. For a given (negative) non-agricultural unemployment shock, urban unemployment may rise or fall, depending on the elasticity of the agricultural labor demand curve in the relevant region. The same condition will determine the amount by which the shock reduces agricultural wages. Suppose that curve D_A represents the pre-mechanization labor demand curve, and that mechanization means that agricultural labor demand becomes less responsive to wages as illustrated by curve D_A'. Then a recession resulting in reduced non-agricultural employment will cause fewer workers to return to the land when agriculture is mechanized than when it is not. In the diagram, initial agricultural labor demand is $0_A L_A$. Suppose non-agricultural labor demand contracts (from L_N to L_N'). In non-mechanized agriculture there is a substantial back-flow to rural areas, accompanied by a slight fall in agricultural wages. Urban unemployment contracts from $L_N L_A$ to L_N'L_A'. In mechanized agriculture, by contrast, there is little migration, resulting in a higher unemployment level of L_N'L_A'', and a larger agricultural wage decline.

We have shown that the Thai economic boom of the 1990s caused the rate of agricultural decline to accelerate, primarily through labor market mechanisms. Rapid mechanization was one response to rising wages; declining land area planted to crops was another. In 1998, however, with the bubble burst and the Thai economy facing significant open unemployment for the first time in its modern history, it appears that with hindsight, policies to slow the rate of economic growth, and by extension the pace of structural change, were merited.

We have argued that whether a recession in non-agricultural sectors will lead to out-migration and a boom in agricultural employment will depend on labor market structure and on the elasticity of agricultural labor demand. Irreversibilities associated with migration and mechanization might inhibit the economy's return to something like its pre-bubble structure. Naturally, we still lack the data required to gauge the actual effect of the recession on wages, employment and production. Nevertheless, it seems safe to conclude that a more sustainable economic development strategy in such an open economy would have included some sterilization of the initial investment boom, in other words, a trade-off of short-run growth for longer-run stability.

Table 1: Aggregate and agricultural output growth rates, Thailand (per cent per year)

Period	GDP	Agriculture	Difference	Agr gr. as % of GDP gr.
1965-80	7.2	4.6	2.6	64
1980-90	7.6	4.0	3.6	53
1990-94	8.2	3.1	5.1	38

Source: World Bank, *World Development Report*, various years.

Table 2: 3SLS estimates of labor and land demand and agric. wages (eq. (4), (5a), (6)).

Variable	Abbreviation	Labor demand (LA)	Land demand (NA)	Agricultural wage (WA)
Agr. land	NA	0.8179 (0.0745)[a]	—	—
Agr. wage/agr. price	WA	-0.4874 (0.0876)[a]	-0.1580 (0.0684)[b]	—
– lagged	WA_{t-1}	—	—	0.00007 (0.00008)
Agr. price	PA	—	0.1288 (0.0644)[b]	—
Non-agr. price	PN	—	—	1.2781 (0.1046)[a]
Fert. price/agr. price	PF	0.1825 (0.0462)[a]	0.1198 (0.0481)[b]	—
Irrigation	IR	0.1854 (0.0232)[a]	-0.0399 (0.0174)[b]	—
Agr. machinery	KA	-0.1620 (0.0221)[a]	0.2112 (0.0150)[a]	—
Non-agr. capital	KN	—	—	0.4181 (0.0859)[a]
Field crops/tree crops	FT	-0.0015 (0.0006)[b]	—	—
Land-intensity	IN	—	0.4166 (0.0265)[a]	—
Labor force	LF	—	—	-1.8428 (0.2115)[a]
Time	T	0.0314 (0.0042)[a]	-0.0104 (0.0046)[b]	0.0170 (0.0108)
N / d.f.		140 / 127	140 / 129	140 / 131
Adj. R^2		0.9624	0.9697	0.9511

Notes:
1. Std errors in parentheses. Superscripts *a*, *b*, and *c* denote significance at 1%, 5% and 10% respectively.
2. All variables except time trend are measured in logs. For units and other descriptors see text and Table A-3.
3. R^2 is indicative only (not bounded in [0,1]). Regional dummy variable estimates excluded from this table.

Source of basic data : TDRI.

Table 3: Estimated elasticities of agricultural labor and land demand

	Model 1: Longer-run (eq. (4), (5a), (6))		Model 2: Shorter run (eq. (4), (5b), (6))	
Elasticity of:	Labor demand	Land demand	Labor demand	Land demand
With respect to:				
Land use	0.82	—	0.82	—
Labor use	—	—	—	0.53
Agricultural wage	–0.62	–0.16	–0.39	—
Agricultural prices	0.44	0.17	0.29	0.01
Non-agricultural prices	–0.79	–0.20	–0.53	–0.28
Fertilizer price	0.28	0.12	0.11	0.11
Irrigated area	0.15	–0.04	0.18	–0.09
Agricultural machinery	0.01	0.21	–0.18	0.20
Non-agricultural investment	–0.26	–0.07	–0.14	–0.08
Labor supply	1.14	0.29	0.57	0.30
Time trend	0.01	–0.01	0.03	–0.02

Source: 3SLS estimates reported in Coxhead and Jiraporn (1998).

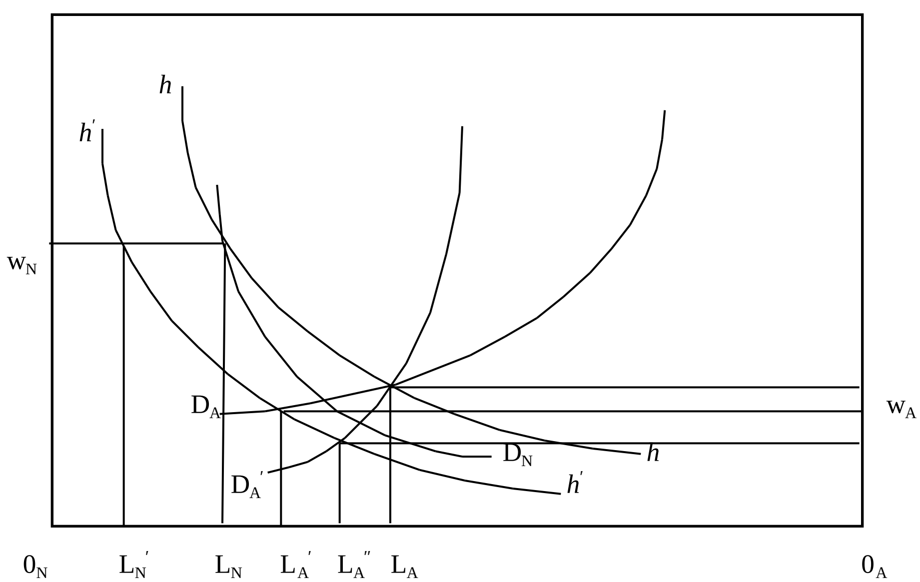

Diagram 1: Migration and wage effects of a recession in the Harris-Todaro model

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Endnotes

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1 During Thailand's rapid growth, poverty in Thailand has declined, with the possible exception of a period from 1982-86, to levels which can only be regarded as trivially low (Ammar 1996; Warr and Bhanupong 1996). On the other hand, income distribution has worsened. The ratio of wealthiest to poorest quintile shares rose from 8.9 in 1975-6 to 14.0 in 1990. The Gini ratio, another univariate measure of income distribution, has risen relentlessly, in 1990 reaching a level usually associated only with Latin American economies (Medhi 1994).

2 Unsubscripted variables are current values. Only lagged values are subscripted e.g. WA_{-1}.

3 A more complete model of the labor market would include the possible effects of wages on the supply of labor through changes in the labor force participation rate.

4 The agricultural labor demand elasticity with respect to an increase in non-agricultural capital stock is –0.26. The labor data are measured in millions of workers and the capital stock in baht*10^{12}, so the elasticity value can be interpreted as follows: other things equal, one agricultural worker migrates to non-agriculture for every 4,000,000 baht invested (US $160,000 at the pre-1997 exchange rate of baht 25:$1). The elasticity of agricultural land area with respect to non-

agricultural investment is about –0.07; by an analogous calculation, every one million baht invested outside agriculture reduces planted area by about 1 rai (0.16 ha). Comparing these numbers with the average agricultural labor-land ratio (approximately 0.16, i.e., one worker per 6 rai), at constant prices, non-agricultural investment growth causes factors to be withdrawn from agriculture at a rate of 4 workers per rai.