

Economic-Demographic Relationships and Urban Development in Taiwan: An Exploratory Analysis

Li-Wei Liu*

*Department of Urban Planning, Feng Chia University

(Date Received : February 20, 2001 ; Date Accepted : May 12, 2001)

Abstract

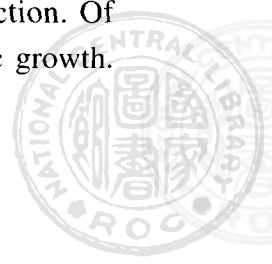
This paper examines the available empirical evidence on the complex set of interrelationships between population growth and economic growth in Taiwan over the past forty years from a perspective other than that found in the prevailing literature. It attempts to understand how population change affects economic growth in a specific country. This paper thus argues that there is no direct relationship between population growth and economic growth. Population growth is expected to influence economic growth only through some intermediate mechanisms. Changes of industrial structure and the timing of the development policy are identified as such intermediate mechanisms. Both mechanisms are related to urban development in the context of Taiwan's experience. Urban development therefore serves as an important linkage between population growth and economic growth.

Keywords: population growth, economic-demographic relationships, intermediate mechanism, urban development

A preliminary version of this article was presented at the 40th Annual Conference of the American Association for Chinese Studies held in New York City (October 1998).

I. Introduction

For the past four decades, several East Asian countries have achieved extraordinary economic success, and all of them have experienced demographic transition, Taiwan among them. Some scholars argue that slower population growth causes faster economic growth, whereas other scholars suggest that these factors do not have any causal connection. Of course, many scholars claim that population growth tends to exacerbate economic growth.



Instead of cross-national analyses, this paper uses the time-series approach, attempting to relate population growth to economic growth through some intermediate mechanisms, in the context of Taiwan's experience from 1950 to 1995. It argues that urban development is an important linkage between population growth and economic growth. The paper begins with a selected literature review of various economic-demographic models. Section II also applies the models which result from the cross-national analysis to Taiwan's context, and then examines whether these models can work. Section III states the economic-demographic hypotheses which are unique in Taiwan's context. Section IV then discusses in detail the linkage between population growth and economic growth, followed by a conclusion section.

II. Economic-Demographic Relationships

Simon (1989) reviewed the empirical studies of the cross-national relationship between the rate of population growth and the rate of economic growth per capita and claimed that no significant relationship between them exists. According to Simon (1989: 325), the absence of a correlation between two variables can be considered a strong indication that neither variable is influencing the other; that is, slower population growth does not cause faster economic growth. Barlow (1994), responding to Simon's invitation for a persuasive argument against such a conclusion, added lagged fertility as one omitted variable, producing the result described by Simon. He indicated that an increase in fertility tends to have negative effects on per capita income growth in the short run and positive effects in the long run. Because current population growth rates capture both the short-run negative and the long-run positive effects, current population growth seems to have a zero impact on current per capita income growth in a two-variable correlation (Barlow, 1994: 153-4). Finally, Barlow (1994: 158) concluded that there can be a negative partial correlation between population growth and economic growth, even for data sets producing zero correlation in the two-variable model.

Kelley and Schmidt (1995) pointed out that a key procedure to this population-development issue is sorting out the short-and long-run effects of the components of demographic change. On this point, they seconded Barlow's modeling (Kelley and Schmidt, 1995: 546). In other words, in the short run, current population growth increases the dependency rate and leads to negative effects on economic growth, whereas, in the long run, past population growth, say 15 or 17 years ago, brings about today's labor force growth and has positive effects on development (Barlow, 1994; Kelley and Schmidt, 1995; Bloom and Williamson, 1997).

Several recent works deal with the same issue but focus on the Asian countries which have achieved extraordinary economic success over the past three decades. Mason (1997), for instance, demonstrated that slower rates of population growth have accelerated economic

development in East Asia: a rapid decline in fertility, in conjunction with effective economic policies and other favorable conditions, can have a strong positive impact on economic growth. Rapid growth of the working-age population resulting from changes in age structure brings about a "demographic bonus" because an increase in the proportion of the population earning income can produce an increase in the overall income per capita. Furthermore, Bloom and Williamson (1997) adopted Barlow, Kelley, and Schmidt's ideas and further incorporated demographic variables into an economic growth model. They proposed that population dynamics matter in the determination of economic growth: age distribution, rather than the population growth rate, is the mechanism by which demographic variables affect economic growth. In other words, population growth has a purely transitional effect on economic growth. They also found that population dynamics account for a substantial share of East Asia's economic miracle¹.

There is one thing in common in most of the empirical work dealing with the economic-demographic model: the use of cross-national analyses. In fact, the impact of population change on economic growth has been found to be negative, neutral, or positive (Ahlburg, 1987: 479). The phenomenon may reveal only one thing: this impact varies from one country to another country. Countries with similar population growth rates have different combinations of birth and death rates; thus, they may have very different labor supply and economic growth experiences (Bloom and Freeman, 1988:65). Even if countries have the same labor supply, this does not mean that their economies are equally strong enough to absorb the growing workforce without increasing unemployment or depressing wages (Mason, 1997). Thailand's recent financial crisis, as it emerged in late 1997, exemplifies the fact that short-run economic fluctuations can undermine economic progress, even when fundamental demographic conditions are favorable (Mason, 1997).

Take Barlow's empirical analyses (1994), for example. He added lagged fertility² to the current rate of population growth as a second predictor of current economic growth. Then, he applied this model to a sample of 144 observations including Taiwan. The empirical result showed that the correlation between current economic growth and current population growth becomes significantly negative, and the correlation between lagged fertility and economic growth is significantly positive. In fact, it is not surprising to get a robust empirical result from this three-variable, economic-demographic model because more observations increase the variability in the values of the explanatory variables. However, the most important question concerns whether or not this relationship can apply to individual countries. This issue becomes interesting because it is the decision makers in each country in the world who decide how to promote economic growth and adjust the population policy of their own nation.

Therefore, can fertility reduction help Taiwan produce favorable economic growth?³ Table 1 shows the empirical result produced by a three-variable model following Barlow's approach. This model uses Taiwan's economic and demographic data from 1965 to 1995 (see

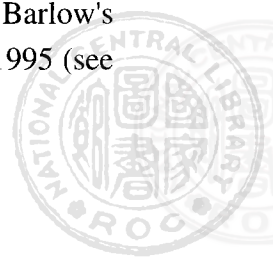


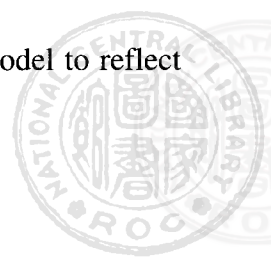
Table 2). Equations 1, 2, and 3 use the rate of economic growth (*ECGR*) as the dependent variable; equations 4, 5, and 6 use the rate of growth of per capita gross national product (*PCGNPGR*) as the dependent variable. Although most of the empirical work, including Barlow, adopts the *PCGNPGR* variable, this paper prefers the use of *ECGR*. Since the economic-demographic model usually uses one or more demographic variables as the predictor(s), it is better to utilize the rate of economic growth, which is not adjusted by any demographic factor, as the dependent variable. In this three-variable analysis, the rate of population growth (*POPGR*) and the lagged total fertility rate are used as the predictors. Equations 2 and 5 use the 17-year lagged total fertility rate (*LGTFR17*). Thus, the economic growth period is 1965-95, and the lagged fertility is the total fertility rate over the years 1948-78, as the level of fertility 17 years ago is expected to influence today's economic growth through its consequences for today's labor force growth (Barlow, 1994: 155). However, equations 1 and 4 adopt the 15-year lagged total fertility rate (*LGTFR15*) as an alternative predictor because the employed population refers to those aged 15 years and over who are engaged in works.⁴ Moreover, because Barlow (1994: 155) used the total fertility rate adjusted for infant mortality, equations 3 and 6 use the 15-year lagged net reproduction rate (*LGNRR15*).

From Table 1 it can be seen that, although the expected signs of the explanatory variables are all correct, the coefficients of these six equations are not statistically significant at the 5% level, except for the constant terms. Moreover, the R-squared and adjusted R-squared values are quite low. This means that there is no evident relationship between population dynamics and economic growth in Taiwan's case based on a three-variable economic-demographic model. While Barlow's work decomposing population growth into the short-and the long-run effects provides an insightful view in the economic-demographic issue, when applying the three-variable analysis discussed above to an individual country, the results may be disappointing. The effects of population growth are likely to vary widely with national context. In the following sections, a more sophisticated model is developed to clarify this economic-demographic relationship.

III. Population-Development Hypotheses

From the previous examination, no evident relationship was found between population dynamics and economic growth in Taiwan's case. Is this true? Intuitively, it is not. A well-known production function, the Cobb-Douglas production function, states that output is a function of capital and labor (i.e., $Y = AK^\alpha L^\beta$). It is evident that the total product of a country is closely related to its capital and labor force. But how come the equations in Table 1 do not work well? Following, this paper posits some possible reasons.

First, Barlow uses the level of fertility from 17 years in the past in the model to reflect



the long-run effect of population dynamics because this fertility level is expected to influence today's economic growth through its consequences for today's labor force growth (Barlow, 1994: 155). However, whether or not the 17-year lagged fertility is a good proxy for the current labor force growth rate in Taiwan's case is questionable. In fact, from 1950 to 1990, the huge increase in the labor supply, while in part due to the increase in the population, was further augmented by the increasing participation of women in the labor force (Speare, Liu, and Tsay, 1988: 12; Liu, 1992: 366). In addition, the fact that many young persons continued their education into senior high school and college delayed their entry into the labor force (Speare, Liu, and Tsay, 1988: 12). Therefore, the use of the 17-year (or 15-year) lagged fertility rate cannot completely capture the current labor force growth.

Table 1. Regression equations relating economic and demographic variables: Taiwan, 1965-1995

Equation No.	1	2	3	4	5	6
Observations	31	31	30	31	31	30
Dependent Variable	<i>ECGR</i>	<i>ECGR</i>	<i>ECGR</i>	<i>PCGNPGR</i>	<i>PCGNPGR</i>	<i>PCGNPGR</i>
Constant	4.699**	4.025*	4.075*	4.66**	3.941*	4.131*
<i>POPGR</i>	-0.546	-0.472	-0.637	-0.706	-0.76	-0.772
<i>LGTFR15</i>	1.063			0.755		
<i>LGTFR17</i>		1.129*			0.889	
<i>LGNRR15</i>			2.734*			1.99
R-squared	0.145	0.154	0.142	0.055	0.073	0.06
Adjusted R-squared	0.084	0.094	0.078	-0.012	0.007	-0.01
F-statistic	2.371	2.557*	2.231	0.821	1.099	0.862

* significant at 10% level.

**significant at 5% level.

ECGR: the rate of economic growth.

PCGNPGR: the rate of growth of per capital gross national product.

POPGR: the rate of population growth.

LGTFR17: the 17-year lagged total fertility rate.

LGTFR15: the 15-year lagged total fertility rate.

LGNRR15: the 15-year lagged net reproduction rate.



Table 2. Economic and demographic data for Taiwan

Year	ECGR(%)	PCGNPGR(%)	POPGR(%)	LGTFR15	LGTFR17	LGNRR15
1965	11.13	7.94	3.0	6.03	5.56	2.36
1966	8.91	6.06	2.9	7.04	5.90	2.83
1967	10.71	7.89	2.3	6.62	6.03	2.70
1968	9.17	6.56	2.7	6.47	7.04	2.73
1969	8.95	6.61	5.0	6.43	6.62	2.75
1970	11.37	9.02	2.4	6.53	6.47	2.82
1971	12.90	10.73	2.2	6.51	6.43	2.84
1972	13.32	11.30	2.0	6.00	6.53	2.62
1973	12.83	10.70	1.8	6.01	6.51	2.67
1974	1.16	-0.66	1.8	5.99	6.00	2.63
1975	4.93	2.52	1.9	5.75	6.01	2.55
1976	13.86	11.42	2.2	5.59	5.99	2.49
1977	10.19	8.06	1.8	5.47	5.75	2.44
1978	13.59	11.90	1.9	5.35	5.59	2.40
1979	8.17	6.37	2.0	5.10	5.47	2.30
1980	7.30	5.09	1.9	4.83	5.35	2.20
1981	6.16	3.82	1.9	4.82	5.10	2.20
1982	3.55	2.20	1.8	4.22	4.83	1.92
1983	8.45	6.90	1.5	4.33	4.82	1.97
1984	10.60	9.97	1.5	4.12	4.22	1.89
1985	4.95	4.11	1.3	4.00	4.33	1.85
1986	11.64	11.30	1.0	3.71	4.12	1.72
1987	12.74	11.07	1.1	3.37	4.00	1.57
1988	7.84	7.11	1.2	3.21	3.71	1.49
1989	8.23	6.80	1.0	2.93	3.37	1.41
1990	5.39	4.37	1.2	2.77	3.21	1.36
1991	7.55	6.37	1.0	3.09	2.93	1.44
1992	6.76	5.20	1.0	2.70	2.77	1.26
1993	6.32	5.04	0.9	2.71	3.09	1.26
1994	6.54	5.13	0.9	2.66	2.70	1.24
1995	6.03	4.96	0.8	2.52	2.71	1.18

SOURCES: for economic data, *National Income in Taiwan Area of the Republic of China*, Directorate-General of Budget, Accounting & Statistics, Executive Yuan, R.O.C.; for demographic data: *Statistical Yearbook of the Republic of China*, DGBAS; *Taiwan and Fukien Demographic Fact Book*, Ministry of the Interior, R.O.C.

Second, the use of the population growth rate in Barlow's model may not appropriately reflect the negative, short-run effect of population dynamics. The increase of the current population growth rate implies the increase of a dependent population consisting of the very young and the elderly. However, the increasing population of the elderly does not depress the rate of economic growth, although it does not elevate the economic growth either (Bloom and Williamson, 1997: 3-4). Therefore, the use of the population growth rate cannot completely reflect the negative impact of population dynamics on economic growth.

Third, rapid population growth may be only a secondary factor in economic growth, and its negative effects will largely be countered by market reactions if markets are allowed to function freely. In fact, economists have long expressed concern that demographic factors may be inadequately reflected in the simple model. Moreover, the effects of population growth are likely to vary widely with national context (UNPF, 1993: 37-40).

Therefore, this paper argues that *there is no direct relationship between population growth and economic growth. Population growth is expected to influence economic growth only through some intermediate mechanisms.* The first hypothesis, that there is no direct relationship between population growth and economic development, is clear and has been proved in the previous section. In Table 1, equations 1 to 6 reveal this fact. The second hypothesis introduces the intermediate mechanisms which link population growth with economic development. The intermediate mechanisms, however, vary according to the country. This paper identifies two major mechanisms in Taiwan's context: changes of industrial structure and the timing of the development policy.

Rapid growth of the working-age population has been likened to a "demographic bonus" (Mason, 1997). As a consequence of the slowing population growth, the age structure of Taiwan's population changed quickly. Fertility and mortality have fallen rapidly to a low level, and the pace of population and labor force growth has moderated. As a result, the proportion of persons in the working age groups has increased steadily (Liu, 1992: 367). However, the growth of the labor force constitutes one of the greatest challenges, as well as one of the greatest opportunities, to the economy (Liu, 1992: 367). If the economy is not strong enough to absorb the growing labor force, there will be increasing unemployment and depressed wages emerging in the economy (Mason, 1997). Taiwan has shifted over the past several decades from agriculture to industry and from local to international trade. The peak demand for labor during the expansion of laborintensive, export oriented-industries occurred when there was the most rapid growth in persons reaching labor force age (Speare, Liu, and Tsay, 1988: 13).⁵ Therefore, due to changes in the industrial structure, Taiwan has realized this demographic bonus and has experienced rapid economic growth.

With regard to the second intermediate mechanism, effective economic policies set by the government account for the timing mechanism. Indeed, government policy has played an important role in Taiwan's rapid economic growth. From the early use of government-owned



industrial companies to develop the basic industrial infrastructure, to the provision of capital to various sectors of the economy through government owned banks, the Taiwan government has used various measures to implement economic policy and to encourage economic growth (Meyers, 1994: 4). For example, in order to support a global economy and international markets benefiting export-oriented industries for the past three decades, the Taiwan government encouraged small and medium enterprises (SMEs) via the development of labor-intensive industries (Hermalin, Liu, and Freedman, 1994: 82). The Statute for Encouragement of Investment was promulgated in 1960 and offered significant tax incentives for investment, exports, and savings. In 1962, the Export Processing Zone at Kaohsiung was established to encourage exports. In 1973, the Taiwan government began the Ten Major Construction Projects to improve infrastructure for industrial development (Meyers, 1994: 10-11). Although these government policies aimed at economic growth, they also reflected domestic demand resulting from population dynamics.

VI. The Economic-Demographic Model

As previous mentioned, there is no direct relationship between population growth and economic growth, and population growth affects economic growth through two mechanisms: changes of industrial structure and the timing of government policies. This hypothesis indicates that demographic variables should be introduced into an economic model. The model is shown as follows:

$$ECGR = \beta_0 + \beta_1 NRR + \beta_2 LBMCGR + \beta_3 SAVEGR + \beta_4 PRINVGR + \beta_5 GOVTINVGR + \varepsilon$$

where, *ECGR*: Economic growth rate (%)

NRR: Net reproduction rate (% , female births per 100 females)

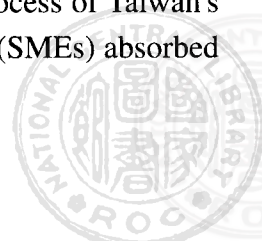
LBMCGR: Labor force growth rate for manufacturing and commerce (%)

SAVEGR: Growth rate of savings (%)

PRINVGR: Growth rate of private investment (%)

GOVTINVGR: Growth rate of government investment (%)

The net reproduction rate (*NRR*) is added to test the impact of the current population growth on economic growth, that is, the short-run effect in Barlow's modeling. The variable of the labor force growth rate of manufacturing and commerce (*LBMCGR*) reflects the long-run population effect as well as changes in the industrial structure. In the process of Taiwan's industrial transformation, the development of small and medium enterprises (SMEs) absorbed



the ample labor force and accelerated economic growth (Pack, 1992: 103; Hermalin, Liu, and Freedman, 1994: 82). Since SMEs account for about 70-80% of total employment in Taiwan, and manufacturing and commerce account for more than 50% of employment in SMEs, this paper uses the variable *LBMCGR* to explore the impact of changes in the industrial structure on development. The rest of the explanatory variables, that is, *SAVEGR*, *PRINVGR*, and *GOVTINVGR*, are used to examine the timing of the government policy. The coefficients of all explanatory variables are expected to have a positive sign except for the net reproduction rate (*NRR*).

IV. Empirical Results

This paper applies Taiwan's demographic and economic data from 1966 to 1995 to the suggested model. The empirical results of the data used are shown as Tables 3 and 4. From Table 3, the sign of the coefficients matches what the model suggests. In addition, all estimated coefficients are statistically significant at 5 or 10% level. The R^2 value is also desirable.

Table 3. Regression equation relating economic and demographic variables: Taiwan, 1966-1995

Equation No.	7
Observations	30
Dependent Variable	ECGR
Constant	5.20**
NRR	(0.23)*
LBMCGR	0.20*
SAVEGR	0.15**
PRINVGR	0.15**
GOVTINVGR	0.08**
R-squared	0.71
Adjusted R-squared	0.64
F-statistic	11.47

* significant at 10% level

** significant at 5% level



Table 4. Economic and demographic data used in equation 7: Taiwan, 1966-1995

Year	ECGR(%)	NRR(%)	LBMCGR(%)	SAVEGR(%)	PRINVGR(%)	GOVTINVGR(%)
1966	8.91	21.98	4.90	19.92	19.74	15.04
1967	10.71	19.18	15.34	20.10	21.40	12.41
1968	9.17	19.75	8.44	13.20	18.66	15.90
1969	8.95	18.03	7.27	23.39	5.13	18.37
1970	11.37	18.85	9.79	23.59	13.21	25.36
1971	12.90	17.15	6.48	31.22	21.37	5.82
1972	13.32	15.66	8.61	33.67	16.92	12.87
1973	12.83	14.89	15.85	38.82	18.36	11.78
1974	1.16	14.13	3.35	22.70	7.91	10.17
1975	4.93	13.61	0.77	-9.45	-2.30	50.91
1976	13.86	14.39	5.54	45.04	-0.96	31.81
1977	10.19	12.59	8.89	18.11	18.99	18.95
1978	13.59	12.59	9.60	26.75	18.79	-7.35
1979	8.17	12.38	8.80	17.37	16.29	3.40
1980	7.30	11.78	4.17	20.37	9.47	9.99
1981	6.16	11.48	2.19	15.06	5.17	9.50
1982	3.55	10.86	1.35	3.26	-3.49	7.53
1983	8.45	10.08	12.78	18.35	4.23	-5.67
1984	10.60	9.57	2.79	18.44	14.47	6.13
1985	4.95	8.85	1.32	5.46	-6.22	8.09
1986	11.64	7.84	4.68	33.29	10.21	10.73
1987	12.74	7.90	6.06	13.06	23.63	10.87
1988	7.84	8.63	1.93	-2.12	17.63	21.64
1989	8.23	7.81	1.59	0.63	10.76	21.15
1990	5.39	8.33	-2.89	3.26	-7.73	24.42
1991	7.55	8.00	0.84	11.97	3.34	22.63
1992	6.76	8.06	1.07	6.23	19.08	15.48
1993	6.32	8.23	-1.54	7.80	10.61	17.51
1994	6.54	8.24	1.66	1.57	7.87	12.88
1995	6.03	8.37	0.18	4.73	8.33	3.81

SOURCES: for economic data, *National Income in Taiwan Area of the Republic of China*, Directorate-General Of Budget, Accounting & Statistics, Executive Yuan, R.O.C.; for demographic data: *Statistical Yearbook of the Republic of China*, DGBAS; *Taiwan and Fukien Demographic Fact Book*, Ministry of the Interior, R.O.C.; *Monthly Bulletin of Manpower Statistics, Taiwan Area, R.O.C.*, DGBAS.



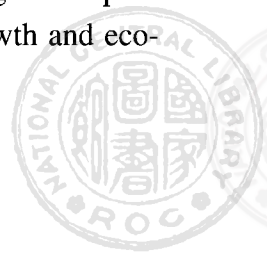
The empirical results reveal that the increase of the net reproduction rate has a negative effect on economic growth; that is, the current population growth has a negative impact on economic growth. The labor force growth rate of manufacturing and commerce has a positive effect and demonstrates that the timely and adequate absorption of the ample labor force resulting from changes in the industrial structure promotes economic growth in Taiwan. The growth rates of savings, private investment, and government investment have a positive effect on economic growth. This implies that the timing of the governmental development policy is important in linking the population dynamics with economic growth.

V. Urban Development as a Linkage between Population Growth and Economic Growth

As previously mentioned, there is no direct relationship between population growth and economic development, and population growth affects economic development only through some mechanisms, that is, changes of industrial structure and the timing of the development policy. Apparently, both of population-development hypotheses place great emphasis on urban employment and urban infrastructure. Therefore, the section is intended to link economic development with population growth through urban development. In other words, intermediated mechanisms identified in previous sections are realized in the course of urban development in Taiwan's context.

The growth and expansion of cities and transition from a rural to an urban society are among the most critical links between population change and economic growth (Goldscheider, 1988). Along with demographic and urban transitions, the Taiwan's economy has shifted over the past several decades from agriculture to industry, from local to international trade, and from relatively simple to more complex economic specialization and diversification.

Some scholars have noticed that the growth of cities and the shift of population to urban centers at unprecedented rates become important issues, especially in the Third World (Kelley and Williamson, 1984). Rapid urban growth and urbanization can be explained by two factors: first, unusually rapid rates of population growth presses on limited farm acreage and pushes landless labor into the cities; second, economic forces pull migrants into the cities (Kelley and Williamson, 1984). It is also interesting that urban growth is usually measured either by population growth or by growth of income per capita (Evans, 1985:86; Glaeser, 1994; Drennan and Lobo, 1997). However, instead of explaining urban development by the means of population growth and growth of per capita income, this paper places great emphasis on urban development as an intermediate mechanism to link population growth and economic development.



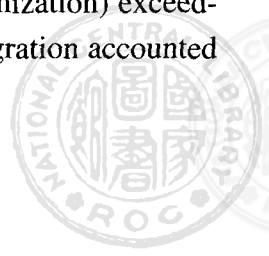
Let's reconsider the relationship between population growth and economic development in Taiwan. Here the Taiwan area is broken down into four regions according to jurisdiction: northern, central, southern, and eastern regions. Table 5 shows the growth rates of per capita income, population, and urbanization in Taiwan from 1967 to 1991.

It is interesting that there is now a strong negative relationship between population growth and economic development. Beginning from the late 1970s, the negative relationship between per capita income growth and population growth loomed up as the degree of urbanization increased in all four regions. This result is different from that discussed in the previous section which adopted the entire Taiwan area as the analytical unit. One may argue that why there is no evident relationship between population growth and economic development (see Tables 1 and 2) since the degree of urbanization of the entire Taiwan area in the past also increased over time (see Table 6). The reasons are discussed in detail as follows:

First, the influential distance of the urban environment needs to be taken into account. Therefore, the unit of analysis does matter while linking economic development with population growth through urban development. A city is by definition a spatial concentration of a large number of people. Take the United States for example, although the population of the United States is overwhelmingly urban, land use is overwhelmingly rural; only about two percent of the land is urbanized (Bogart, 1998: 7-8). That is why urbanization and uneven regional development are always closely related (Krugman, 1996). The use of the entire Taiwan area as the unit of analysis may not be suitable because the linkage between population growth and economic development needs to be established in the urban environment. On the contrary, when Taiwan is broken down into four regions, the distance between the urban environment and the regional boundary in any regions is more desirable although the share of the urbanized land may remain the same within the region. In fact, the use of the metropolitan areas provides a better measure of urbanization (Speare, Liu and Tsay, 1988: 21-22). Because such data are not available, this paper adopts the region as the unit of analysis.

Second, one critical factor underlying urban development and facilitating to establish the linkage is rural-urban migration. Rural-urban migration is endogenous and responsive to various economic and demographic forces in a model of the urban transition (Kelley and Williamson, 1984). When the Taiwan area is used as the unit, the migration issue become international rather than rural-urban. In the past several decades, international migration was the less influential issue in Taiwan's context and thus had nothing to do with this case. On the contrary, rural-urban migration can be explored within and/or between regions.

Initially, urbanization is accomplished mostly by rural-urban migration. Later, urban growth is more through internal growth of the urban population (Henderson, 1987). If urban population growth rates exceed general population growth rates, then rural-urban migration is still occurring. In Table 5, before 1990, urban population growth rates (urbanization) exceeded population growth rates in all four regions, and this means ruralurban migration accounted



for the increase of urban population in all four regions during the period in question. Rural-urban migration also represents a basic structural change in the economy in which national product patterns shift in favor of goods produced in urban areas, and/or technological development in agriculture reduces the demand for agricultural labor. In both cases, urban wages rise relative to rural wages, drawing the rural population into cities (Henderson, 1987). Beginning from 1990, the force driving urban growth becomes internal growth of the urban population. Jones (1984) presents evidence supporting Simon's (1947) model of rural-urban population balance as a function of increasing economic productivity and a higher elasticity of demand for non-rural goods. Simon's model indicates that labor resources are relocated from rural product to urban product, and rural-urban migration results. The mechanisms leading to structural change in a rural-urban two-sector model are technological changes that increase worker productivity resulting in rising real incomes. Jones further disaggregates the economy into four sectors. He argues that technological change will have a spatial impact. The original rural-urban shift will persist as a trickle. However, other shifts will become more important. The expanding industries represent traditional central place functions and will be distributed in some sense as population with major regional concentrations. Producers of distributive and services sectors that are market oriented will follow. Activities which produce fabricative goods for services and distributive sectors will have new locational factors to consider. The end result will be changing patterns of population distribution and changing sizes and structures of regional economies (Jones, 1984). In short, the way linking population growth and economic development lies in, first, rural-urban migration, and then internal growth of the urban population which bring about urbanization and urban growth.

When the Taiwanese economy was in its takeoff phase around the 1950s, the population growth rate was extremely high. The growth rate of labor force was only one half that amount because the number of persons entering the labor force was related to the natural increase rate about 15 years earlier, which had been much lower. This timing was fortunate because the growth in employment, especially urban employment, was barely sufficient to keep up with the growth of the labor force during this period. The natural increase in cities was augmented by a steady flow of rural to urban migrants (Speare, Liu, and Tsay, 1988: 11-19).

When the Taiwanese economy reached its labor-intensive industries phase in the 1960s and early 1970s, the children of the postwar baby boom began to reach labor force ages. This rapid growth in the labor force coincided with the expansion of labor-intensive industries in Taiwan. The natural increase in cities declined and rural-urban migration continued. This was a period of unprecedented economic prosperity for Taiwan, and it was also a period of rapid urbanization in terms of the growth of both large cities and smaller cities (Speare, Liu, and Tsay, 1988: 7-19).



Table 5. Growth Rates of Per Capita Income, Population, and Urbanization in Taiwan (by region), 1967-1991

Region	1967~1971	1972~1976	1977~1981	1981~1982	1982~1983	1986~1987	1987~1988	1989~1990	1990~1991
Per Capita Income Growth Rate (%)									
Northern Region	8.14	9.76	4.45	2.99	4.76	11.31	3.82	2.70	6.01
Central Region	7.00	7.07	5.49	3.52	6.67	13.59	4.49	5.54	6.16
Southern Region	7.90	5.17	6.75	4.02	6.45	13.07	4.75	6.07	6.86
Eastern Region	4.45	5.02	5.86	4.03	7.11	13.87	5.65	8.24	8.20
Population Growth Rate (%)									
Northern Region	3.93	3.22	3.21	2.65	2.26	2.03	2.04	1.68	1.18
Central Region	1.58	1.18	1.20	1.27	1.07	0.68	0.71	1.00	1.09
Southern Region	2.40	1.39	1.27	1.19	0.97	0.50	0.64	0.95	0.74
Eastern Region	1.69	0.31	-0.04	0.40	-0.05	-1.45	-1.63	0.09	0.06
Urbanization (%) ^a									
Northern Region			83.7 ^b	3.78 (83.7) ^c	3.02 (84.6)	1.93 (87.2)	3.11 (87.1)	2.27 (87.9)	1.31 (88.4)
Central Region			56.4 ^b	3.44 (56.4)	1.42 (57.6)	2.89 (59.3)	1.21 (60.6)	1.00 (61.6)	0.94 (61.6)
Southern Region			64.7 ^b	4.95 (64.7)	1.43 (67.1)	2.77 (71.0)	0.51 (72.6)	2.34 (72.7)	0.36 (73.7)
Eastern Region			51.1 ^b	6.49 (51.1)	0.61 (54.2)	0.57 (58.9)	2.47 (60.1)	0.09 (62.1)	4.78 (62.1)

Source: *Urban and Regional development Statistics*, Council for economic Planning and Development, R.O.C.; organized by the author

^a measured by the growth rate of urban population

^b using the 1981 data only

^c the number in parentheses refers to urban population as % of total population in the initial year

Table 6. Urban population in Taiwan, 1951-1980

Year	Total Population (1000s)	Urban Population (1000s)	Urban Population (%)
1951	7,868	2,039	25.92
1955	9,078	3,013	33.19
1960	10,792	4,342	40.23
1965	12,628	5,952	47.13
1970	14,676	8,149	55.53
1975	16,149	9,598	59.43
1980	17,804	11,799	66.27

Source: *Taiwan Statistical Data Book*, Council for Economic Planning and Development; *Urban and Regional Development Statistics*, Council for Economic Planning and Development.

By the late 1970s, when Taiwan entered its industrial upgrading phase, the effect of the fertility decline in the 1960s began to have a negative effect because of the looming of labor shortage⁶. Therefore, in the 1980s, the rate of city growth slowed down. Much of the growth was in the peripheral area of the large cities. The slowdown of urban growth corresponded to the economic transition from labor-intensive industries to capital/technology-intensive industries and services (Speare, Liu, and Tsay, 1988: 12-19).

VI. Conclusion

There is no direct relationship between population growth and economic development. This is true especially in the cross-national studies which the country is used as the unit of analysis. Population growth is expected to influence economic growth only through some intermediate mechanism. This paper identifies urban development as an important linkage in Taiwan's context. Urbanization and urban growth are largely accomplished by rural-urban migration and internal growth of the urban population, and represent a basic structural change of in the economy. The strong relationship between population growth and economic development is thus structured along with the course of urbanization and urban growth.

Acknowledgment

The author would like to thank the anonymous referee for her/his insightful and valuable comments.



Notes

1. According to their estimation, population dynamics accounted for somewhere between 1.4 and 1.9 percentage points of East Asia GDP per capita growth per annum from 1965 to 1990 (Bloom and Williamson, 1997: 1-4).
2. The lagged fertility variable is defined as the total fertility rate adjusted for infant mortality over the six-year period beginning 17 years before the start of the period over which economic growth is measured (Barlow, 1994: 155).
3. One of Barlow's findings is that the short-run economic gains of fertility reduction will receive a much higher weight than the long-run losses. Most of the losses are probably generated by the labor force effects, and therefore only become noticeable after 20 years or more (Barlow, 1994: 158).
4. See Technical Notes on the Statistical Tables, *Taiwan-Fukien Demographic Fact Book, Republic of China*.
5. By the late 1970s, when economic development moved from labor-intensive to capital-intensive industries, many young persons continued their education into senior high school and college, thereby delaying their entry into the labor force (Speare, Liu, and Tsay, 1988: 12).
6. Labor shortage was further augmented by the fact that many young people continued their education to senior high school and college and delayed their entry into the labor force (Speare, Liu, and Tsay, 1988: 12).



Bibliography

1. Ahlburg, Dennis, 1987, "The Impact of Population Growth on Economic Growth in Developing Nations." In *Population Growth and Economic Development*, ed. D.G. Johnson and R.D. Lee: 479-521. Madison, WI: The University of Wisconsin Press.
2. Barlow, Robin, 1994, "Population Growth and Economic Growth: Some More Correlations." *Population and Development Review*, 20(1): 153-65.
3. Bloom, D.E. and R.B. Freeman, 1988, "Economic Development and the Timing and Components of Population Growth." *Journal of Policy Modeling*, 10(1): 57-81.
4. Bloom, D.E. and J.G. Williamson, 1997, "Demographic Transitions and Economic Miracles in Emerging Asia." *NBER Working Paper Series*, No. 6268. Cambridge, MA: National Bureau of Economic Research.
5. Bogart, William Thomas, 1998, *The Economics of Cities and Suburbs*. Upper Saddle River, NJ: Prentice Hall.
6. CEPD, 1996, *Taiwan Statistical Data Book*. Taipei: Council for Economic Planning and Development.
7. Drennan, Matthew and Jose Lobo, 1997, "U.S. Metropolitan Economic Growth, 1969-1989: The Roles of Human Capital, Trade, and Specialization," draft, Cornell University.
8. Evans, Alan, 1985, *Urban Economics: An Introduction*. New York: Basil Blackwell.
9. Glaeser, Edward, 1994, "Cities, Information and Economic Growth." *Cityscape*, No. 1: 9-47.
10. Goldscheider, Calvin, 1988, Foreword in A. Speare, P. Liu, and C.L. Tsay, "Urbanization and Development: The Rural-Urban Transition in Taiwan."
11. Henderson, Vernon, 1987, "Industrialization and Urbanization: International Experience." In G. Johnson and R. Lee, eds, *Population Growth and Economic Development: Issues and Evidence*: 189-224. Madison, Wisconsin: The University of Wisconsin Press.
12. Hermalin, A, P. Liu, and D. Freedman, 1994, "The Social and Economic Transformation of Taiwan," ed. A. Thornton and H.s. Liu, *Social Change and the Family in Taiwan*. Chicago, IL: The University of Chicago Press.
13. Jones, Barclay, 1984, "Productivity and the Spatial Implications of Structural Change: Empirical Evidence for Simon's Model," *Paper of the Regional Science Association*, Vol 54: 1-11.
14. Kelley, Allen and Jeffrey Williamson, 1984, "Population Growth, Industrial Revolutions, and the Urban Transition." *Population and Development Review*, Vol. 10, No. 3: 419-441.
15. Kelley, A.C. and R.M. Schmidt, 1995, "Aggregate Population and Economic Growth Correlations: The Role of the Components of Demographic Change." *Demography*, 32(4): 543-555.
16. Krugman, Paul, 1996, "Urban Concentration: The Role of Increasing Returns and

- Transport Costs." *International Regional Science Review*, Vol. 19, No. 1 and 2: 5-30.
- 16.Liu, Paul, 1992, "Science, Technology and Human Capital Formation," ed. G. Ranis, *Taiwan: From Developing to Mature Economy*. Boulder, CO: Westview Press.
- 17.Mason, Andrew, 1997, "Population and the Asian Economic Miracle." *Asia-Pacific Population and Policy*, No. 43. Honolulu, HI: East-West Center.
- 18.Meyers, Neil, 1994, *Statutory Encouragement of Investment and Economic Development in the Republic of China on Taiwan*. Baltimore, Maryland: Occasional Papers/Reprints Series in Contemporary Asian Studies, Inc.
- 19.Pack, Howard, 1992, "New Perspectives on Industrial Growth in Taiwan," ed. G. Ranis, *Taiwan: From Developing to Mature Economy*. Boulder, CO: Westview Press.
- 20.Simon, Herbert, 1947, "Effects of Increased Productivity upon the Ratio of Urban to Rural Population," *Econometrica*, Vol. 15: 31-42.
- 21.Simon, J.L., 1989, "On Aggregate Empirical Studies Relating Population Variables to Economic Development," *Population and Development Review* (15), No.2: 323-332.
- 22.Speare, A., Liu, P., and Tsay, C., 1988, *Urbanization and Development: The Rural-Urban Transition in Taiwan*. Boulder, CO: Westview Press.
- 23.United Nations Population Fund, 1993, *Population Growth and Economic Development*. NY: UNFPA.



台灣經濟及人口關聯與都市發展之關係初探

劉立偉*

*逢甲大學都市計畫學系

(收件日期：90年2月20日；接受日期：90年5月12日)

摘要

本研究以實證分析探討台灣過去四十年來在人口成長與經濟成長間的相互關係。不同於既有文獻橫斷面的跨國分析方式，本文試圖了解單一國家的人口變化與經濟成長間如何互為影響。就台灣之發展而言，人口成長與經濟成長並無直接的關聯，人口成長事實上是透過某些中介機制來影響經濟成長。本文驗證兩種中介機制，分別為產業結構的變遷與國家發展政策的適時性。同時，此二種中介機制必須透過空間性的都市發展的進程才得以呈現。因此，都市發展成為人口成長與經濟成長間的重要聯繫。

關鍵詞：人口成長、經濟—人口關聯、中介機制、都市發展

