The Park Place Economist

Volume 16 | Issue 1 Article 15

2008

Capital Investment and Rural-Urban Migration in China

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Abstract
This paper explores the linkages between the population, investment, and wages in both China nationally and in each of China's provinces. The expected result of these linkages is twofold. First, provinces with the greatest per capita investment, whether state-sponsored or private, should in theory experience the greatest change in per capita wage. This is due to the increased marginal product of labor resulting from capital investment, which ultimately will be reflected in per capita wages in a perfectly competitive market. From this hypothesis, it follows that the provinces experiencing the greatest change in wage per capita will experience the greatest change in population. It is logical to assume that rural workers will move to urban areas if the wage incentive is great enough. Though the population increase will, in theory, push urban wages down, this effect is secondary and should take a longer period of time.

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I. Introduction

As the world's largest developing country, China has thrived on capital investment since the economic reforms of 1978. Whether the source is ambitious government programs or lucrative foreign expansion, this investment has played a major role in the transitioning of the Chinese economy from its centrally planned state of the Communist era to the global power it is today through tremendous export growth. With an abundant workforce and relatively low costs, China has become the ideal site for infrastructural investment, and much of the labor in these newly created factories and offices has come from China's rural areas. People have left their hometowns and flocked to China's urban centers in search of better jobs and higher wages, and although migration has provided a steady source of labor for the ever growing number of firms, it is not without negative consequences.

Unfortunately for migrants, the hukou, a residential permit from China's pre-reform era still remains and restricts Chinese citizens from receiving public benefits in any region except the one in which they were born. Therefore, rural migrants who move to the cities looking for work are not entitled to healthcare or a pension plan, cannot purchase housing, and have children that are not eligible for public schooling. This has created numerous social problems including inadequate housing for migrant families and lack of schooling for their children; however, in many cases, jobs in rural areas simply do not exist or pay enough, leaving families with no choice but to move. Although it is possible for rural migrants to get an urban *hukou* and receive benefits in the cities, it is a lengthy and expensive process not usually affordable to them (Chan and Li, 1999). Because the *hukou* system combined with rural-urban migration has created so many problems in China and would discourage migration, it is important to understand what exactly is motivating people to move.

This paper explores the linkages between the population, investment, and wages in both China nationally and in each of China's provinces. The expected result of these linkages is two-fold. First, provinces with the greatest per capita investment, whether state-sponsored or private, should in theory experience the greatest change in per capita wage. This is due to the increased marginal product of labor resulting from capital investment, which ultimately will be reflected in per capita wages in a perfectly competitive market. From this hypothesis, it follows that the provinces experiencing the greatest change in wage per capita will experience the greatest change in population. It is logical to assume that rural workers will move to urban areas if the wage incentive is great enough. Though the population increase will, in theory, push urban wages down, this effect is secondary and should take a longer period of time. Therefore, an increase in capital investment in any given province should be accompanied by an increase in both wages and in population, thus explaining the mass migration occurring in China today. The implications of this study are incredibly important from the perspective of Chinese policy makers; if the trends in Chinese population growth can be understood, then the government can begin

developing methods of controlling migration and decreasing its detrimental effects on society.

The second section of this paper reviews the current literature on Chinese rural-urban migration and investment, and discusses ways in which this study contributes. It touches on studies highlighting the negative consequences of rural-urban migration in China in order to underscore the gravity of the problem and looks at the different sources of capital investment in China. The third section explains the relevant theory, including both labor productivity theory and the Harris-Todaro model. The fourth outlines the empirical model used in this study, which finds the linkages that exist between population, wages, and capital investment, and also examines the effects of public versus private funding. The fifth section reviews and interprets the results of the regressions and comparisons made from the data, and the sixth concludes and explores both policy implications and areas for future research.

II. Literature Review

There is abundant literature on the effects of rural-urban migration; however, very little exists on its causes. Chan and Zhang (1999) review the implementation and evolution of the *hukou* system since the founding of the People's Republic of China (PRC) in 1949. They discuss the difficulties of moving from a rural to an urban hukou and also bring up alternatives to the hukou such as the temporary residence permit. This study is useful in understanding the government-imposed barriers on movement within China, especially within the context of the Harris-Todaro model which will be described in the next section. Whalley and Zhang (2007) go even further and estimate the inequalities that result from the *hukou* system due to its rural and urban classifications and the difficulties that arise when attempting to move from a rural to an urban area. They find that provincial inequalities in China would be significantly less without the hukou. This data is useful in explaining why people choose to migrate; eventually the income inequalities grow so great that rural residents find the urban wage to outweigh the monetary costs associated with moving and ultimately migrate. Chai and Chai (1997) discuss the negative effects of the migration that is already occurring, such as over-urbanization, pollution, and lack of schooling for migrant children. It is important to be aware of these adverse effects in order to understand the challenges currently faced by the migrant population and to remedy the problem.

A study by Liang and Ma (2004) separated the migrant population into floating and non-floating groups, reflecting the choice of many to travel alone and remit money to their families (floating population). This distinction is particularly useful, as it presents a potential challenge to this study in the form of unregistered "floating" migrants. This paper will attempt to consider both the floating and non-floating populations as reflected by changes in the registered population; however, the total number of floating migrants cannot be determined. For example, if a floating migrant from a rural area is not authorized to live in an urban area, then he or she will not be reflected in the population statistics, and will not be counted in the scope of this study, which utilizes national data published by the Chinese government. The Liang and Ma study, which relies heavily on census data, shows that the floating population was an estimated 80 million people in the year 2000, but in reality that number could have been nearly 150 million due to undocumented workers. Liang and Ma also find that the number one reason cited by migrants for moving to the cities is to find work. This fact is particularly useful given the Harris-Todaro model of rural-urban migration, which actually postulates that people in rural areas will migrate in response to a wage gap. The work done by Liang and Ma presents some of the challenges faced by this paper and also supports one of its major hypotheses. Another study by Braunstein and Epstein (2002) shows that specifically foreign direct investment (FDI) increases jobs, which would theoretically cause migration, but it does not elaborate much

further. Although the study does not address other types of investment, this finding is also helpful in understanding the causes of migration using Harris-Todaro, and will be discussed more in depth later in the empirical model section.

Wan, Lu, and Ming (2007) look into the sources of regional inequalities in China, which are often the same factors causing rural-urban migration. They observe both domestic and foreign capital and conclude that domestic capital is the greatest source of inequality. This finding is particularly relevant to the scope of this paper, which will attempt to separate the wage and population effects according to the different types of investment in China. These investment categories will be discussed in detail in the empirical model section. This paper will expand on the current literature by comparing national population growth in China with growth in each province and exploring the linkage between investment, wage, and population within the context of the Harris-Todaro model. Other studies have explained reasons for migration through census data and polls, but this paper will directly examine the correlation between population growth and the various types of investment in China.

III. Theory

Two main theories underlie the predictions made in this study. First, in order to establish the connection between capital investment and increased wages, the concept of marginal productivity of labor must be introduced. This theory assumes a perfectly competitive market, which does not completely exist in China yet; however, the Chinese labor market is competitive and mobile enough that wages should be bid up when labor productivity increases. According to the marginal productivity of labor theory, if there is capital investment in any given firm, then that firm's workers will become more productive and output will increase. Given that a capital investment leads to higher output per worker, then each worker's wage should theoretically reflect his increased productivity. Turning back to the case in China, an increase in per capita capital investment nationally or in a particular province should also be accompanied by an increase in average wage, *ceteris paribus*.

The other major theory underlying this study is the Harris-Todaro model, which assumes free movement and specifies conditions under which people will migrate from rural to urban areas. Although migration is not entirely free in China, the government has liberalized its migration laws within the last two decades and migration undoubtedly occurs today. According to Harris and Todaro (1970), migration will occur if the expected urban wage is greater than the rural agricultural wage. It may not be fair to assume that all migrants were formerly farmers, but a large agricultural sector does still exist in China and the emphasis will be more on the expected urban wage. The size of the migrating population also depends on the wage gap between rural and urban areas. The greater the gap, the more people that move. As a whole, the model fits well with China's current situation as a rapidly growing, but still developing country.

As previously stated, migration will occur if the expected urban wage is greater than the rural agricultural wage. However, the model also works in the opposite manner. If the rural agricultural wage is greater than the expected urban wage, people will migrate back to rural areas. The expected urban wage (w_e) consists of the number of available jobs in the urban sector (l_e), the number of people looking for jobs (l_{us}), and the urban wage (w_u). It is written as follows:

$$w_e = w_u (l_e / l_{us})$$

Given the above equation, any increase in the number of available jobs or in the urban wage will increase the expected urban wage. Conversely, any increase in the job seeking population will decrease the expected urban wage. Therefore, if the migrant population grows too large and there are too many people seeking jobs in the urban sector, equilibrium will occur and migration will stop (Harris and Todaro, 1970).

Building further on the model, the urban sector in China contains many subsectors which are especially relevant and should be considered. A rural-urban migrant may be employed with a state-owned enterprise, a privately-funded enterprise, or often within the informal sector. Each of these subsectors will offer a different wage and have different people in competition for jobs; however, those in the informal sector will not be included in formal statistics and therefore lie outside the scope of this study (Seeborg et al, 2000). Because it is impossible to determine the informal wage, the average wage data used in this model may be understated. It is also important to note that this study focuses on only one aspect of the Harris-Todaro equation, which is the urban wage, as it is affected by capital investment. Unemployment is not studied, nor is the size of the urban labor force; however, these both would be appropriate topics for further research.

Based on the relevant theory, it is justifiable that an increase in capital investment will ultimately lead to a positive increase in population. First, it is hypothesized that there will be a positive correlation between capital investment and average wage. Then, a positive correlation between average wage and population change is expected. Urban areas with greater amounts of investment should show the greatest population changes as compared to rural areas.

IV. Data and Empirical Model

This paper will observe population growth in both China as a whole and in 29 of its provinces, including the cities of Beijing, Shanghai, and Tianjin which have provincial status, from the years 1993-2005. Chongqing and Sichuan were excluded from the data due to their combined status until 1997, when they were separated into two provinces. Using the Harris-Todaro model as a guideline, average wages and patterns in various types of investment will be examined along with movements in population. All data were gathered from the China Statistical Yearbook, a government-sponsored publication (PRC, 1994-2006). Average wage and per capita investment data were adjusted into the year 2000 RMB using the World Bank's consumer price indexes from 1993-2005 (World Bank, 2007).

Over the 12 year period studied, China's national population has grown immensely, reaching 1.3 billion people in 2005 (PRC, 2005). Some regions have grown more quickly than others due to their relatively rapid industrialization and greater job availability. Shanghai's population, for example, has increased by a much greater factor than the population of Qinghai, one of China's more rural provinces located in the west. Admittedly, a portion of the population increases can be attributed to natural growth resulting from more births than deaths; however, a fair amount of growth also occurs due to migration. In fact, the institution of the One-Child Policy increases the chance that the urban population increases are a result of migration, as the strict enforcement of the law in urban areas ensures low natural population growth rates.

The empirical model developed in this paper will explore how trends in investment influence population growth in various regions in China. Shanghai, Beijing, and Tianjin will be the major focal points as they are the only areas which are certain to be entirely urban. Other provinces, such as Guangdong and Jiangsu, will also be important as they contain uncommonly large urban centers which have attracted much investment in recent years. In contrast, Tibet, Qinghai, and Xinjiang will be considered rural provinces since they contain relatively few or no urban areas and had the lowest populations as of the year 2005. Definition of urban and rural areas is imperative for the successful outcome of this study given the context of the Harris-Todaro model. Due to large discrepancies in the data, the yearly percent change in population was averaged in each province over the 12-year sampling period.

Underlying both hypotheses in this study is investment. The investment statistics in the data used for this study were broken down by the following types: state-owned, collective-owned,

individual, joint-owned, shareholding, foreign-funded, funded by entrepreneurs from Hong Kong, Macau, and Taiwan, and other. State-owned enterprises are those funded and controlled directly by the government. Collective-owned enterprises are typically rural and are often town and village enterprises (TVEs). These are also funded by the Chinese government; however, they are technically owned by workers (All China Data Center). The remainder of the enterprises is characterized by private funding; therefore, these enterprises will be grouped together as "privately funded" for the purpose of this study. Investment will be examined by both province and by type of investment: state, collective, or private. While some broad generalizations can be made about whether investments are rural or urban (i.e. investment in collective-owned enterprises is typically rural), the classification of investment will be based primarily on location for the purpose of this study. By distinguishing the different types of investment, it is possible to both examine which types of investment have greater effects on population and wage and also to expand on the Harris-Todaro model by introducing the role of investment spending on wages and migration patterns.

Average wage data by region will be included in this study because of its central role in the Harris-Todaro model as a determinant of mobility. The data were again broken down by province and also by state-owned units, collective-owned units, and other types of ownership. This study will focus mostly on the total average wage data in specific provinces known to be mostly or entirely urban, as with the population and investment data. It is expected that the provinces with the highest per capita investment will also be the provinces with the highest average wages and the highest change in population, providing evidence that capital investment does indeed cause migration.

The following regression models will be used to test the hypothesis that investment causes an increase in the average wage:

$$WAGE = \alpha_1 + \beta_2(INVEST)$$
$$WAGE = \alpha_1 + \beta_2(STATE)$$
$$WAGE = \alpha_1 + \beta_2(COLLECT)$$
$$WAGE = \alpha_1 + \beta_2(PRIVATE),$$

where WAGE represents the average wage, INVEST represents total investment, STATE represents investment in state-owned enterprises, COLLECT represents investment in collective-owned enterprises, and PRIVATE represents private investment.

All coefficients are predicted to be significant and positive, and private investment is predicted to have a relatively greater impact on wage than the others.

The second hypothesis that an increase in wage causes an increase in population change will be tested by the following regression equation:

$$POP = \alpha_1 + \beta_2(WAGE),$$

where WAGE again represents average wage and POP represents percentage change in population. The wage coefficient is also predicted to be both significant and positive.

V. Results

First, a single variable regression was run in order to test the connection between investment and wages with average wage being the dependent variable and investment the independent variable. Using the 12-year averages of the average wage data and total per capita investment, a statistically significant relationship between total investment and average wage was found with an adjusted R^2 of .674 and an investment coefficient of .936 with standard error of .120 (Table 1). The positive coefficient shows that an increase in investment leads to a fairly significant increase in the average wage. These results support the marginal productivity of labor theory and point to China's growing labor market competition, as capital investment appears to be increasing productivity, which in turn is reflected in wages. With the established connection between average wage and

Table 1: Regression Results: Dependent Variable = Average Wage (RMB)

Model (Variable)	Model I (TOTAL)	Model II (STATE)	Model III (COLLECT)	Model IV (PRIVATE)
Constant	6747.263	6487.095	8319.655	7318.112
Coefficient	0.936	2.107	4.227	1.930
Std. Error	0.120	0.248	0.987	0.374
Adj. R^2	0.674	0.711	0.374	0.556
n	30	30	30	30

per capita investment, it can be assumed that an increase in per capita investment does contribute to an increase in the expected urban wage as described in the Harris-Todaro model.

Next, the effects of different types of investment on average wage were tested. Table 1 shows the results including total investment, investment in state-owned enterprises, investment in collective-owned enterprises, and private investment. Contrary to the expectation that private investment would have the greatest impact on average wage, the data showed that investment in state-owned enterprises was the most significant and had the second highest coefficient. Collective-owned investment had the highest coefficient, but its adjusted R^2 value was significantly lower, and private investment came in between the two. This result is consistent with the findings of the Wan, Lu, and Ming study; however, it seems counterintuitive given the recent trend of private firms acquiring state-owned enterprises. This unexpected outcome could mean, contrary to popular belief, that state-owned enterprises utilize capital more efficiently and that this efficiency is reflected in wages; or, more likely, it could be due to the fact that private investment did not take off in China until the late 1990's and was not accurately reflected in the average data from the 12-year period. Furthermore, there could have been a fair amount of colinearity among the different types of investment.

Next, a regression was run in order to ascertain the relationship between average wage and change in population. It was hypothesized that a higher wage would lead to a higher positive change in population, and the results supported this hypothesis. The regression had a coefficient of $1.77 * 10^{-6}$ with standard error .005 and an adjusted R^2 of .535 (Table 2). Although the wage coefficient is small, it is important to note that the unit of wage (RMB) increases much more easily than the unit of population change (%). Therefore, the coefficient may appear to be insignificant, but a relatively small increase in the average wage implies the movement of a significant number of people through a small percentage change. This means that people are indeed moving in response to relatively higher wages.

Table 2: Regression Results: Dependent Variable = Population Change (%)

Variable	POP
Constant	-0.008
Coefficient	1.77E-06
Std. Error	0.005
Adj. R^2	0.535
n	30

To this point, it has been established that an increase in investment leads to an increase in wages and an increase in wages causes an increase in population change; however, the rural and urban populations, which are the focus of the Harris-Todaro model, have not been addressed. Because there are no specific data on rural and urban populations in China, rural-urban migration must be observed and estimated by the population changes in each province. Table 3 ranks the average population change by province from highest to lowest and shows the provinces which ranked higher than the national average. The provincial-status cities of Beijing and Shanghai, which are certain to contain entirely urban populations, are both above the national average. This suggests that urban areas are the target of a

significant amount of migration. On the other hand, Tibet, Qinghai, and Xinjiang, the primarily rural areas, are also above the national average, suggesting a higher concentration in these areas as well. This could be a result of population undercounting in certain years, which is common in the western provinces where terrain is rugged and households are few and far between. It could also be due to poor population estimation in years other than 2000, when actual census data were published in the China Statistical Yearbook. In the other 11 years studied, population, wage, and investment data were estimated based on a small sample size, and differ considerably from the year 2000 data. This is reflected in the high standard deviations for all 30 entries and by large jumps in variable values between 1999 and 2000.

Table 3: Percent Change in Population, 1993-2005

PROVINCE	AVE	STDEV	MAX	MIN
Guangdong	0.030	0.068	0.189	-0.099
Beijing	0.028	0.039	0.112	-0.015
Shanghai	0.024	0.042	0.136	-0.036
Xinjiang	0.019	0.024	0.085	-0.025
Ningxia	0.016	0.008	0.035	0.002
Tibet	0.015	0.005	0.023	0.004
Hainan	0.014	0.006	0.033	0.009
Qinghai	0.013	0.003	0.016	0.007
Zhejiang	0.012	0.016	0.045	-0.014
Yunnan	0.011	0.005	0.023	0.000
Tianjin	0.010	0.012	0.044	0.002
Fujian	0.010	0.013	0.047	-0.009
Shanxi	0.009	0.008	0.029	-0.008
Gansu	0.008	0.008	0.025	-0.010
National	0.008	0.002	0.011	0.005

Similarly, the average wage data (Table 4) show that wages in Shanghai and Beijing are significantly higher than the national average. Tianjin, which had come in slightly below the national average in population change data, now appears on the list as well. This is concurrent with the idea that an increase in the urban wage leads to an increase in rural-urban migration; however, the lower wage and population change data for the rural provinces are still missing. Again, Tibet and Qinghai are remarkably higher than the national average wage, with Tibetan wages just under those of Beijing. These results are almost certainly due to the large informal sector in China's western provinces. The majority of the Tibetan people work independently or as farmers; therefore, their wages would not be included in government data. The data reported by the government are most likely drawn primarily from state-owned enterprises and exclude the informal work that comprises the majority of the labor market in China's west.

Table 4: Average Wage in Chinese RMB, 1993-2005

PROVINCE	AVERAGE	STDEV	MAX	MIN
Shanghai	18577.60	8784.12	36749.15	8961.90
Beijing	17121.74	8938.63	36584.37	7158.73
Tibet	16818.35	8722.88	32416.65	6455.56
Guangdong	14261.59	5589.34	25636.13	8447.62
Zhejiang	13873.41	6974.83	27708.72	6668.25
Tianjin	13021.83	6318.47	27039.97	6353.97
Jiangsu	11004.33	5117.59	22423.99	5734.92
Qinghai	10853.55	4723.94	20419.88	6031.75
Fujian	10446.68	4001.39	18346.22	5519.05
National	9941.31	4416.76	19649.48	5350.79

Last, the investment data (Table 5) show that the three urban areas have the highest per capita investment over all of China's provinces, which yet again is concurrent with the hypotheses. In this case, only one of the western rural areas, Xinjiang, ranks above the national average. Curiously, however, it is not one of the rural provinces that appeared above the national average in the wage data. Clearly, some of the western province data is inconsistent with the Harris-Todaro model.

Overall, the data showed support for the linkage between investment, wage, and

population change; however, it did not entirely support the Harris-Todaro model of rural-urban migration. There was strong support for the hypothesis that people migrate to urban areas in response to higher wages caused by capital investment; however, there was little evidence that these people came from rural areas. This could be due to the fact that rural populations in provinces other than Tibet, Qinghai, and Xinjiang cannot be estimated from the data. It could also be a result of the aforementioned population miscounting and informal sector in the labor market. Furthermore, the Chinese government started a "Go West" campaign in 1999 in order to attract investment and create jobs in the western provinces, so the data could be skewed as a result of that program or they could be a sign that it has been effective (China Daily, 2005). Without specific population data from all of China's rural areas, it is impossible to be certain whether urban migrants come from other urban areas or from rural areas. Given the restrictions of the *hukou*, it is entirely possible that many of the documented migrants come from urban areas, and that rural migrants cannot move, are included in the undocumented "floating population", or are employed in the informal sector.

Table 5: Per Capita Investment in Chinese RMB, 1993-2005

PROVINCE	AVERAGE	STDEV	MAX	MIN
Shanghai	13524.24	3401.68	21121.37	7558.57
Beijing	10769.82	4298.49	19669.08	5978.22
Tianjin	7268.83	3511.84	15338.03	3859.81
Zhejiang	6283.43	3813.97	14243.58	2910.20
Guangdong	4690.39	1558.33	8120.90	3314.24
Jiangsu	4651.48	2902.47	11688.26	2429.96
Liaoning	3916.89	2479.08	10647.78	2163.69
Shandong	3671.30	2846.84	10768.61	1620.21
Xinjiang	3640.96	1581.38	7128.54	2172.41
Fujian	3477.74	1460.22	7012.36	1869.29
Ningxia	3218.48	2223.46	7958.57	1315.63
Inner Mongolia	3134.81	3269.45	11855.21	1147.36
Hainan	3097.73	795.65	4745.22	2216.82
National	3080.23	1713.87	7264.50	1668.49

VI. Conclusion

The results of this study have confirmed the hypothesized correlations among capital investment and wage, and among wage and change in population. This is especially relevant to the Chinese market today, as its rapid growth has shown no signs of stopping, and the policy implications are highly significant. Given the linkages between population, wages, and investment, the Chinese government can be fairly confident that its investment diversion programs such as "Go West" will have some desirable effects, such as populating sparse areas and increasing wages. Investment diversion could also be part of the solution to the *hukou*'s social problems, although the free mobility of the Chinese rural population is still questionable. Regarding the less clear results concerning China's western provinces and rural areas, better and more complete data would be necessary in order to confirm the rural-urban migration in the framework of the Harris-Todaro model. Unfortunately, the informal sector's size and wages may never be accurately documented.

Future research should focus on other sources of rural-urban migration. For example, research could focus on urban unemployment data to examine the other aspect of the expected urban wage included in the Harris-Todaro equation. It could also focus on other factors like capital investment which, in theory, impact the average wage. In regards to the data reliability issue, it might be more reasonable for future studies to use only census data in order to see if there actually were errors in population estimates or if there are other causes for the data discrepancies. The drawback would be a very small sample size. Other studies could also use different numbers in the China Statistical Yearbooks which focus solely on the floating population in order

to see if it exhibits any unique characteristics not possessed by the non-floating population.

This study has contributed to existing literature by examining capital investment as a cause of rural-urban migration in China rather than focusing solely on the adverse effects of this migration. Many studies unrealistically advocate the abolition of the hukou system in China; however, that would likely cause more problems for the Chinese government and it is unlikely to happen anytime soon. Therefore, this study takes a more practical approach by looking at other ways the government could alter policy in order to alleviate the social issues caused by rural-urban migration. Few others have used empirical research in order to explain the factors which influence the reasons why people migrate (i.e. urban job availability and wage). This study has made progress by establishing that the Chinese people have migrated in response to higher urban wages caused in part by capital investment; however, their origins are still largely unknown. Only by understanding where migrants are coming from is it possible to significantly decrease migration and lessen the negative effects of the Chinese *hukou*.

REFERENCES

All China Data Center. "Industry". <http://chinadataonline.org/info/yearly13.asp>.

Braunstein, Elissa and Gerald Epstein. *Bargaining Power and Foreign Direct Investment in China: Can 1.3 Billion Consumers Tame the Multinationals?* 2002.

Chai, Joseph C. H. and B. K. Chai. "China's Floating Population and its Implications." *International Journal of Social Economics*, 1997, 24 (7-8-9), pp. 1038-1051.

Chan, Kam W. and Li Zhang. "The Hukou System and Rural-Urban Migration in China: Processes and Changes." *The China Quarterly*, 1999, 160, pp. 818-855.

"'Go West' Campaign to Accelerate." 15 Jan. 2005. China Daily. <http://china.org.cn/english/2005/Jan/118055.htm>.

Harris, John R. and Michael P. Todaro. "Migration, Unemployment & Development: A Two-Sector Analysis." *American Economic Review*, 1970, 60 (1), pp. 126-142.

Liang, Zai and Zhongdong Ma. "China's Floating Population." *Population and Development Review*, 2004, 30 (3), pp. 467-488.

Madariaga, Nicole, and Sandra Poncet. "FDI in Chinese Cities: Spillovers and Impact on Growth." *World Economy*, 2007, 30(5): pp. 837-62.

People's Republic of China (PRC). State Statistical Bureau. *China Statistical Yearbook.* Beijing: China Statistics Press, 1994-2006.

Seeborg, Michael C., Zhenhu Jin, and Yiping Zhu. "The New Rural-Urban Labor Mobility in China: Causes and Implications." *Journal of Socio-Economics*. 2000, 29: pp. 39-56.

Wan, Guanghua, Ming Lu, and Zhao Chen. "Globalization and Regional Income Inequality: Empirical Evidence from within China." *Review of Income and Wealth*, 2007, 53(1): pp. 35-59.

Whalley, John, and Shunming Zhang. "A Numerical Simulation Analysis of (Hukou) Labour Mobility Restrictions in China." *Journal of Development Economics*, 2007, 83: pp. 392-410.

World Bank. World Development Indicators Online. 2007. 3 December 2007.

Zhang, Kevin Honglin, and Shunfeng Song. "Rural-Urban Migration and Urbanization in China: Evidence from Time-Series and Cross-Section Analyses." *China Economic Review*, 2003, 14(4) (2003): pp. 386-400.

Stock Index Pricing with Random Walk and Agent-based Models

Scott Swisher

I. Introduction[1]

"The image one gets from the news is that financial markets are dominated by *people*. In contrast, a reading of a standard finance textbook … can create the impression that financial markets are nearly devoid of human activity" (Thaler 1993). The field of asset pricing, specifically the valuation of stock market shares, has historically played host to a number of contradictory theories regarding the determination of prices. As the debate currently stands, the efficient market hypothesis (EMH) has assumed a dominant position following the enumeration of rational expectations theory at the University of Chicago (primarily) in the 1960s by Muth, Fama, and Lucas (Sheffrin 1996; Shiller 2000). Fama's specification is that "security prices always fully reflect the available information" in an efficient market (Shleifer 2000). Initial econometric testing regarding the efficient-markets theory confirmed germane hypotheses, but by the mid-1970s academics were increasingly skeptical due to the restrictive nature of the assumptions and contradictory empirical findings (Sheffrin 1996). As a result, alternative theories involving non-rational actors were developed under the banner of behavioral finance by Shiller, De Bondt, Thaler, Roll, and others; however, the EMH remained the *de facto* central paradigm of finance, a position it has held for over thirty years (Hirshleifer 2001; Sheffrin 1996; Shleifer 2000).

In such a context, questioning the current theory *vis-à-vis* well-developed alternatives is perfectly reasonable because the consensus is not well-defined (Arthur et al. 1997; Baker, Wurgler 2007; De Bondt, Thaler 1984; Hirshleifer 2001; Hong, Stein 2007; Shleifer 2000; Worthington, Higgs 2003). The objective of this work is to empirically test the EMH and compare its results to those of a viable competitor using computational simulation. Specifically, the individual-agent approach has been gaining momentum recently as the appropriate numerical tools are now widely available (Bonaneau 2002; Cioffi-Revilla 2002; Diks et al. 2007; Gilbert, Bankes 2002; Inchiosa, Parker 2002; Tesfatsion 2002). This fact, coupled with intensifying doubts concerning the validity of efficient-markets theory, has led to intensive use of the agent-based approach with computational agent-based modeling (ABM) of financial markets (Bonabeau 2002). Although multiple theories currently compete with the EMH to varying degrees, we focus explicitly on the use of ABM to generate results consistent with Hang Seng and Nikkei 225 price changes. The agent-based results are compared with output from a random-walk model directly inspired by the tenets of the EMH;

1 I would like to thank the members of my honors research committee at Illinois Wesleyan University: T.X. He, S.H. Lee, N. Jaggi, and M. Seeborg. I. Odinaka, an undergraduate at the university, gave me much-needed advice regarding Mathematica programming.