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# CLARION BUSINESS AND ECONOMIC REVIEW

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## CLARION BUSINESS AND ECONOMIC REVIEW

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It is my hope that the *Clarion Business and Economic Review* will continue to display the fine work of university faculty and businesses. Likewise, I anticipate that our best graduate students, faculty members, and a broader range of researchers will continue to contribute their work. Again, welcome to this edition.

Sincerely,

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# CLARION BUSINESS AND ECONOMIC REVIEW

Volume 6, Number 2

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## TABLE OF CONTENTS

<i>Lucille Pointer and Charles A. Smith</i> Income Levels and Investment Practices of Commercial Property Managers .....	6
<i>J. R. Clark and Dennis Pearson</i> Economic Freedom, Entrepreneurship, Migration, and Economic Growth .....	10
<i>Silvia Schoen</i> E-waste, an Ethical Issue of the 21 <sup>st</sup> Century – Can the European Union Be used as a Role Model? .....	24
<i>Patricia Driscoll and Pamela Baker</i> Judicial Interpretation of Restrictive Covenants in a Knowledge Economy .....	32
<i>Adrian M. Austin, Swarna (Bashu) Dutt, and Dipak Ghosh</i> A Threshold Cointegration Test of the Fisher Hypothesis: A Study Across Alternative Inflation Measures .....	42

# **Income Levels and Investment Practices of Commercial Property Managers**

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## **Introduction**

With the favorable growth in the American economy and more investment opportunities being created in the real estate industry, there is a large and growing demand for professional commercial property managers. A commercial property manager's job is to manage rental property so as to show the highest profits possible for the owner. In years past, this usually meant being a leasing agent and building superintendent. In today's highly competitive markets, commercial property managers are required to do much more than just collect rent and oversee building maintenance. Among their many jobs are completing financial analysis, collecting marketing research, staying abreast of changes in rental legislation and marketing the property to prospective tenants (Mattson-Teig 2005; Epley 2004). Properties are now viewed as assets that the property managers must effectively manage and therefore, they act as both economists and marketers according to Charles Achilles, VP of the Legislative and Research Division at the Institute of Real Estate Management (IREM) (Chapman 2004). As the responsibilities of commercial property managers increased, so have their incomes increased. The income levels of certified commercial property professionals can easily reach six figures (Chapman 2004). Because of the increased financial rewards being reported, more and more individuals are attracted to this field with the hope of earning high-incomes and saving for the future. However, some commercial property managers often enter retirement with few resources and in financial distress due to improper financial planning and personal spending habits. Although several articles have reported on the favorable rise in the incomes of these professionals, little research has been done to explore the savings and retirement practices of the commercial property manager (Chapman 2004, Hudgins 2004; Bruno and Mitchell, 1996)

The primary purpose of this study was to examine the income level and the retirement saving habits of commercial property managers and to determine whether those who are certified fair better financially than those who are not certified. The data were also evaluated by gender to determine if differences existed.

## **Data Collection Procedure**

The data was collected through face-to-face interviews from a random sample of a hundred and twenty-nine commercial property managers in a large diverse city in the Southwest. Of those participating, roughly 21 % were certified commercial property managers (CPM). Prior to the interview, each manager was called to explain the purpose of the study and to ascertain his or her permission to participate. The survey participants managed a variety of properties including office, retail, industrial and multi-family.

## **Demographic Profile of Commercial Property Managers**

The survey results, as reported in Table 1, reveal that on average a typical commercial property manager is a 40-year-old male with a bachelor's degree and thirteen years of work experience. Most work forty-four hours per week and earn an average \$65,000 a year with an average commute time of thirty minutes. Approximately 60 per cent of the respondents had at least a bachelor or a higher educational degree.

## **Certified Commercial Property Managers Earn More**

As reported in similar studies on real estate agents and property managers, education and training is positively correlated to income (Izzo and Vitell 2003; Rabianski 2003). Certified property managers (CPM) are certified by the Institute of Real Estate Management (IREM) and must have a minimum of 5 years of full time decision-making responsibilities in a real estate management capacity (Chapman 2004). Generally, they have more education and experience than other individuals who are property or asset managers. Although, the average income is good for all participants, certified commercial property managers earn considerably more. In our study, certified property managers on average earned \$70,000 compared to only \$52,000 for non-certified property managers as shown in Table II. They also had 8 more years of experience compared to non-certified property managers, which probably contributed to their higher earnings.

The study statistics compare favorably with those reported by the Institute of Real Estate Management (IREM), which indicated that the median annual compensation of certified commercial property managers was \$95,000 nationwide in 2004

(Chapman ). Certified commercial property managers normally earn more than more certified commercial property managers but the actual magnitude of the difference will vary by locations (Jud and Winkler 1998).

**Table I**  
**Commercial Property Managers Demographic Data**

	Total	Male	Female	CPM*
N	129	71	58	27
Age (average)	40 yrs	43 yrs	37 yrs	45
Married	56%	40%	30%	89%
Experience (Yrs)	13.0	13.6	12.8	18
Education				
HS	5.4	2.7	2.3	--
Some Col	34.9	10.8	24.9	11.1
Bachelor	48.1	34.9	12.4	74.1
Masters+	11.0	6.9	4.6	14.8
Annual Income	\$65,000	\$62,794	\$57,096	\$70,556
Type of Property Managed				
Office	50%	49%	48%	67%
Retail	40	48	28	52
Indus	10	14	12	30
Multi-family	30	31	39	19
Other	20	21	22	19

\*Certified Property Manager

**TABLE II**  
**Income and Experience of Certified Managers**

	<u>Non-Certified</u>	<u>Certified</u>
Income	52,843	\$70,556
Experience	10 Yrs.	18 Yrs.

## Type of Retirement Investment

Overall, most commercial property managers prepare for the day when they will retire from the business. The study found that over 90% of the commercial property managers surveyed are making retirement investments as shown in Table III. The most popular investment type is mutual funds/stocks. Overall, 70% of respondents have invested in this option for retirement. The second most popular investment vehicle was real estate (43%) with CD's and Bonds being the third most used instruments. Although females were almost equally likely to invest in mutual funds/stocks and real estate, they were less likely to invest in CD's and bonds compared to males for retirement.

**TABLE III**  
**Types of retirement investment**

	Total	Male	Female
	120	65	55
<b>Retirement Tool</b>			
Real Estate	43%	42%	33%
Mutual Funds/Stocks	70	73	67
Bank CDs/Bonds	29	34	19
Others	29	21	36
<b>Personal Property</b>	<b>129</b>		
Personal Home	87%	89	79
Boat/Airplane/RV/ Motorcycle	26	26	12
2 <sup>nd</sup> Home	6	8	4

## Other Significant Gender Differences

Earlier studies of real estate professionals reported that females often earn less than their male counterparts (Sirmans and Swicegood (1997); Glower and Handershott (1988); Crellin, Frew and Judd (1988)). Our findings continue to support this difference. On average, the female commercial property manager makes approximately \$6,000 less than her male counterpart. This could be due to either the education level or the mix of properties managed by each. Approximately 52.7% of male CPMs have college experience (attended college or college graduates) and 41.9% of females have college experience. Males are likely to manage office, retail and multi-family units with the highest level given first. However, females are most likely to manage the same type but in a different order of significance. They manage office, multi family and retail, which may mean less income because retail tends to be more lucrative than housing properties in this market. Although, both males and females had about the same level of experience, there is a significant difference in age. Both males and females average about 13 years of experience as property managers. Male commercial property manager average age was 43 years compared to 37 years for females. Apparently, men may have migrated to the profession after working jobs in one or more other fields; whereas, females may have started working in the field very soon after college. Most commercial property managers have begun to focus on saving for retirement. Both sexes highly favor mutual funds/stocks as the number one investment for retirement but differ slightly in their second and third choices. Males preferred real estate secondly and females preferred other investments.

## Conclusions

Commercial property managers who are certified tend to earn more income than non-certified property managers. As in other studies, females are younger and tend to earn less than their male counterparts. The majority of the commercial property managers surveyed have begun to focus on saving for retirement. Although many have real estate investments, they rely more heavily on mutual funds/stocks for retirement purposes.

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# Economic Freedom, Entrepreneurship, Migration, and Economic Growth

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## Abstract

We investigate the effects of both economic freedom and entrepreneurial activity on U.S. state economic growth. Secondly, we examine the Tiebout Hypothesis via net-migration, and the effects of economic freedom and entrepreneurial activity. As far as we know, economic freedom, entrepreneurship, and growth for U.S. states has not been presented in this manner before. To encourage economic growth, state and local governments should encourage entrepreneurial activity, and to do so, they must focus on creating an environment consistent with economic freedom. Our results show that a state's degree of economic freedom significantly impacts state economic growth and state migration.

## INTRODUCTION

One of the most enduring questions in economics is what causes economies to grow. Adam Smith in *The Wealth of Nations*, argued that free markets, the protection of private property rights, and a minimal government presence in the economy leads to prosperity. In other words, economic freedom leads to economic growth. Perhaps one of the greatest economic freedoms is the freedom to start and own a business.

Recently, the conceptual link between entrepreneurship and economic growth has received renewed interest by economists. For example, Henderson [2002] shows that entrepreneurs significantly impact local economies by fostering localized job creation, increasing wealth and incomes, and ultimately helping to connect local economies to the larger, global economy.

However, entrepreneurship alone can not drive economic progress. According to Sobel, Clark, and Lee [2006], "for the seeds of entrepreneurship to germinate and flourish, they must be nourished by the mixture of freedom and informed discipline that is possible only in market economies where this freedom and accountability enhances the productivity of all economic activity." In understanding the power of entrepreneurship in promoting economic growth, it is critical to make the connection between economic freedom and prevailing economic institutions. Specifically, how the rules and incentives provided by economic freedom encourages new entrepreneurial activity, and therefore fosters growth.

Frequently however, governments intervene into this creative process resulting in economic stagnation. Clark and Lee [2006] argue that when economies become overly politicized, entrepreneurial ventures can become suppressed, not because of their failures, but because of their own successes. In countries where the government gives into these interest group demands, those entrepreneurs who have already found success, then turn to lobbying for legislation to protect them from potential competitors and competition. When enacted, this legislation actually slows down the same creative entrepreneurial process of which these entrepreneurs were previously a part.

In this paper we focus on the two part hypothesis that economic growth of U.S. states depends heavily upon both economic freedom and entrepreneurship. Entrepreneurship is increasingly becoming recognized as a key factor contributing to economic growth. As argued by Minniti [1999], entrepreneurs are the catalysts for economic growth because they create a networking externality that promotes the creation of new ideas and new market formations. We also provide further evidence by discussing the relationship between population migration, entrepreneurial activity, and economic growth. According to the Tiebout [1956] hypothesis and other work on population migration, people move where opportunities present themselves. The hypothesis is that there should be a flow of population away from states where economic growth, economic freedom, and entrepreneurship is relatively restricted into states where these elements are relatively available.

## ENTREPRENEURSHIP AND ECONOMIC GROWTH

Much research has been undertaken on the factors which stimulate entrepreneurial activity, and also on the contribution entrepreneurial activity makes to growth. The existence of entrepreneurial activity, it is argued, contributes to future economic growth. However, there appears to have been limited empirical research which tests the hypothesis that entrepreneurial activity contributes to state economic growth.

Gross domestic product (GDP) per capita, is often used as a measure of economic growth, income, standard of living, or wealth [see for example Kreft and Sobel, 2005; Sobel, Clark, and Lee, 2006; and Van Stel, Carree and Thurik, 2005].

Drawing upon a number of sources, Michael and Pearce [2004] conclude that innovation is the key to creating growth, and policies which encourage innovation are most desirable for governments. The Economist [2002] agrees. In the technology quarterly section, it notes “for want of a better explanation, the missing factor in the growth equation is often thought to be the addition of new knowledge gleaned from scientific discovery and technological progress, in short, innovation.” The article then states that “innovation accounted for more than half of the economic growth in both the United States, and the United Kingdom, making it the most important ingredient in any modern economy.”

Innovation has long been considered to be the vision and purpose of entrepreneurs. Drucker [1985] notes that “innovation is the specific instrument of entrepreneurship. It is the act that endows resources with a new capacity to create wealth.” Holcombe [1998] describes the entrepreneur as the engine of economic growth. As Holcombe sees it,

“When entrepreneurship is seen as the engine of growth, the emphasis shifts toward the creation of an environment within which opportunities for entrepreneurial activity are created, and successful entrepreneurship is rewarded. ... When the key role of entrepreneurship is taken into account, it is apparent that emphasis should be placed on market institutions rather than production function inputs. The importance of market institutions has now been generally recognized in practice, but has not been integrated into the mainstream theory of economic growth.”

This raises the question, what conditions cause economic growth to be concentrated in some areas but not in others? One possible answer is that market institutions make the difference. Gwartney, Lawson, and Holcombe [1999], Gwartney and Lawson [2002], and Scully [1988; 1992] come to this conclusion. Scully uses a measure of economic and political freedom, while Gwartney, Lawson, and Holcombe deliberately confine their analysis to economic freedoms. Barro [1996] and Perotti [1996] present evidence that economic freedoms are what count, and that democratic political institutions may even have a negative effect on economic growth.

Contemporary growth theory, built on complex mathematical models, must make simplifying assumptions to keep the models manageable. It is easy to assume away the market institutional details that provide the foundation of economic growth because often institutional details are hard to measure. The market institution we are speaking of is economic freedom. One can come up with measures for capital and labor, but in the past it was difficult to measure the degree to which property rights were protected in an economy, or the degree to which government regulations hampered economic activity. Therefore, the more economic freedom people have, the more likely they are to participate in entrepreneurial activity.

Although economic freedom has been a concept for many years, in the past 10-15 years, its measurement was facilitated by the development of a number of indices which seek to gauge roughly the degree to which economic freedom exists. The Fraser Institute developed economic freedom indices which indicate the degree of economic freedom and broad respect for private property rights for U.S. states, Canadian provinces, and countries around the world. For the purpose of this study, we have chosen to use the widely cited Fraser Institute index, *Economic Freedom of North America*, developed by Karabegovic, Amela, McMahon, and Samida [2005].

While many studies have looked at the relationship between economic freedom and economic growth [see for example, de Hann and Sturm, 2000; Berggren, 2003; Cole, 2003; and Powell, 2003], few have considered the added effect of entrepreneurial activity/innovation. Thus this paper seeks to offer an exploratory analysis of the combined effects of economic freedom and entrepreneurial activity upon economic growth in U.S. states as measured by Gross State Product (GSP) per capita.

Following, we present our model, description of variables, and results. Next we provides further evidence on the Tiebout hypothesis and the possible relationship between population migration, entrepreneurial activity, and economic growth. Last, we presents concluding remarks.

## **EMPIRICAL MODEL**

To enhance the existing evidence and to examine the combined effects of economic freedom and entrepreneurial activity on U.S. state economic growth, we analyze data for all fifty U.S. states from 1993 through 2002. We gathered data for each U.S. state on economic growth, the degree of economic freedom in the state, two measures of entrepreneurial activity (sole proprietorships and patent activity), and other state control variables previously shown in the literature to be correlated with economic growth for that state. The measure of economic growth for each state is GSP per capita. This data is taken from the most current report from the Bureau of Economic Analysis, published by the U.S. Department of Commerce.

As noted earlier, economic freedom is an essential determinant of the state’s ability to grow, and create and attract entrepreneurial activity. We employ the Frasier Institutes’ Economic Freedom of North America Index [Karabegovic,

McMahon, and Samida, 2005] for each U.S. state as a general measure of the freedom of citizens to pursue economic activities. This index is a composite measure of many state policies that affect the economic freedom of individuals. More specifically, it is based on the size of government, discriminatory taxation, the degree of business regulation, and labor market flexibility. The index gives each state a score on a scale of 1 to 10, with a higher number implying a higher degree of economic freedom. The overall index is comprised of two sub-indexes. The first is the all-government index, which includes the impact of all levels of government, federal, state, and local. The second index, called the subnational index, measures the impact of state and local governments on economic freedom for each state. The economic freedom index is expected to carry a positive sign showing that more economic freedom will create more state economic wealth and growth.

Economic freedom is clearly important for wealth creation. For the period 1993 through 2002, states whose economic freedom is in the top quintile, have an average GSP of \$31,270 per person, approximately \$2000 more than the next quintile. States in the bottom quintile have an average GSP of \$29,442 per person.

Economic freedom also generates growth. For the same period, states whose economic freedom is in the top quintile have an average annual growth rate of 6.03 percent, compared to a rate of 5.84 percent in the next quintile. The growth rate for the states in the bottom 20 percent is 4.66 percent which is approximately 30 percent below the top quintile.

Entrepreneurship is a multidimensional concept. The multidimensionality produces difficulties in defining and measuring its' extent and also complicates the measurement of its' impact on economic growth. It is clear, then, that entrepreneurship should not be taken as a synonym for behavior that always contributes to productivity and growth. Also, one of the most interesting and challenging issues faced by economists and other social scientists is the relationship between entrepreneurship and economic growth. Nevertheless, empirical studies have not been able to find strong statistical evidence on this relationship. Obviously, the first problem is the measure that studies are using to proxy entrepreneurship in empirical research. Secondly, in much of the entrepreneurship literature, there is a general implicit claim that all entrepreneurial activity is socially beneficial [Mises, 1949; Kirzner, 1973]. However, as Baumol [1990] and Holcombe [2002] point out, entrepreneurship may be harmful if it takes the form of rent-seeking, attempting to influence governments (or management) to redistribute income, but in the process consuming resources and bringing about a social loss. Therefore, policy makers and academics should be careful regarding what kind of entrepreneurship (productive/innovative and/or destructive) they promote.

We identify and measure entrepreneurial activity by using sole proprietorships and patent activity which is supported in the literature. Our intention is to evaluate the impact of both sole proprietorship and patents on economic growth and migration. Sole proprietorships have been widely supported in the literature as a good proxy for the level of entrepreneurship. The second measure of entrepreneurship, patent activity, which is more closely related to productive or innovative entrepreneurship, was presented and utilized by Kreft and Sobel [2005]. They used the number of utility patents (those received for general inventions or innovations) granted annually in each state. The logic behind patent activity as a measure of entrepreneurship rests in the notion that the most direct and visible outcome of the entrepreneurial process is innovation, which should be reflected in the quantity of patents.

In determining the state control variables, we relied heavily on those variables proposed in the literature. In the different strands of research aimed at explaining economic growth and/or entrepreneurs, the control variables are divided into demographic characteristics and economic characteristics for each state. The demographic make up and the underlying economic characteristics of each state should influence the state's propensity for economic growth Bates [1990] shows that an individual's human capital, is a significant determinant in the entrepreneurial process. Most recently, Cowling [2000] confirms that age, gender, and education are all key variables in explaining what individuals become entrepreneurs.

The variables included to capture the demographic characteristics are the percentage receiving a high school education, the unemployment rate, and net-migration. The influence of an individual's level of education has had mixed results in the literature. In particular, there has been some evidence that entrepreneurial activity is heightened by both low levels of education (high school graduate only) and very high levels of education (advanced degrees, such as doctors and lawyers that are usually classified as proprietors). The sign on the high school graduate variable could be either positive or negative. Evidence could point to the finding that high school education leads to greater entrepreneurial activity, while college education leads to less. One additional demographic variable incorporated in the model is the unemployment rate. The unemployment rate is expected to carry a negative sign due to its negative influence on state economic growth.

In addition to the demographic variables, several economic variables were incorporated in the estimation process to see which, if any, significantly affect the state's ability to generate economic growth. Value added manufacturing, and net-migration were included as possible influences on the state environment for growth. Value added manufacturing is a proxy for capital investment. Environments attracting increases in capital spending are seen as havens for economic growth. We hypothesize that states with relatively high levels of economic freedom should experience greater growth in value added manufacturing because capital investment and the assets produced by it are better protected from taxes, discriminatory

regulation, and redistribution. Value added manufacturing is considered to be the best value measure available for comparing the relative economic importance of manufacturing among industries and geographic areas. The sign on the manufacturing variable is expected to be positive.

According to the Tiebout hypothesis and other work on population migration, people move where opportunities present themselves. The hypothesis is that there should be a flow of population away from states where economic freedom is relatively restricted into states where economic freedom is relatively available. Hence a positive statistical relationship should exist between net-migration and state growth.

The formal estimated regression takes the following functional form to explain U.S. state growth.

$$Y_i = C + \sum_{j=1}^k X_j \beta_j + \varepsilon_i \quad (1)$$

e.g.,

$$\begin{aligned} Growth_i = & C + \beta_1 EF_i + \beta_2 soleprop_i + \beta_3 patents_i + \beta_4 hsgrad_i \\ & + \beta_5 unemp_i + \beta_6 manu_i + \beta_7 netmig_i + \varepsilon_i \end{aligned} \quad (2)$$

In dealing with panel data from 1993 through 2002, we estimated the regression using the Random effects model. The definition of the variables used in the empirical analysis are found in Table 1.

The first question we attempt to address is what possible effect economic freedom and entrepreneurship may have on state growth. To gain insight into this question, the first model estimated is the simple model (i.e., simple in the sense that economic growth is estimated in terms of only economic freedom lagged one year, and entrepreneurship). This is broken down into two parts: (1) regressing the all-government economic freedom index and the entrepreneurial variables, sole proprietorship and number of patents, on GSP per capita, and then (2) regressing the subnational government economic freedom index and the entrepreneurial variables, sole proprietorship and number of patents, on GSP per capita. Results for the simple model are reported in Table 2, which provides the estimated coefficients, the standard errors and the *t*-statistics. Upon review, economic freedom, both at the all-government and subnational level, and entrepreneurship has a statistically significant effect on GSP per capita or state growth. Entrepreneurship, as measured by sole proprietorship and patents, has both a statistical and an economic relevance for economic growth. The results for sole proprietorship seem to indicate that sole proprietorship does not promote economic growth. In fact, entrepreneurship, as measured by sole proprietorships, is apparently measuring other activities that do not influence productivity and/or innovation, and thus economic growth. According to OECD [1998, 2000], sole proprietorship may be an important source of entrepreneurship but it is possible that some of the activities captured by the variable could be related to rent-seeking activities or other non-innovative areas instead of productive entrepreneurship. Baumol [1990] differentiated between several forms of entrepreneurship. He mentions that entrepreneurs are individuals who are ingenious and creative in finding ways to add to their own wealth. With this in mind, he argues that the overall environment and rules play an extremely important role in the determination of each type of entrepreneurship. Therefore, state policy makers should pursue policies that ensure growth in economic freedom and innovation (number of patents) in their respective states in order to promote state growth. It is necessary to point out, that economic freedom measures a range of variables which determine how free people are to exchange among themselves, how much of their money they are able to keep, and the security of property rights, and how these properties work collectively not individually.

Next we estimate state growth in terms of economic freedom, entrepreneurship, and state control variables which are divided into demographic characteristics and economic characteristics for each state. Consistent with the literature, the control variables reflect demographic and economic parameters that may influence state growth. The regression results presented in Table 3, consistently show that economic freedom both at the all-government level and the sub-national level have a strong positive impact on state growth. Out of the remaining entrepreneurship variables and control variables, the only one that was found to significantly influence state growth was net migration. This is consistent with the hypothesis that states with relatively more growth enjoy less net migration. This is because individuals in higher growth states have more economic freedom, and therefore are allowed to keep more of their income, and thus the market place can more efficiently determine the allocation of resources.

## MIGRATION, ECONOMIC FREEDOM, AND ENTREPRENEURSHIP

The second and equally important question we address is, do people move where opportunities present themselves? The Tiebout hypothesis is that there should be an aggregate flow of population away from states where economic growth, economic freedom, and entrepreneurship is relatively restricted into states where these elements are relatively available.

In recent years there has been a renewed emphasis on decentralized governance in many countries including the United States. A key rationale for this shift is the belief that state and local governments provide policies better suited to citizen preferences. Hayek [1945] addressed this very idea, that, “local governments are more capable of making better decisions than federal officials due to greater access to knowledge concerning the needs of their localities.” This wisdom is grounded in the Tiebout hypothesis which states that “individuals will costlessly sort themselves across local communities according to their public good preferences.” More specifically, Tiebout’s, “vote with their feet” hypothesis, argued that individuals select the communities in which they live by carefully balancing the taxes they must pay against the level of public services they receive in return. Rather than waiting for annual elections or voting referenda to express their preferences (which are satisfied only if they are in the majority), people find more immediate solutions to restoring imbalances that may suddenly arise between taxes and services: they move. One result of the threat to move is that it imposes competition on governmental units and, in theory, forces them to be more efficient in supplying goods and services out of taxes. This simple theory is the workhorse of the public finance literature and has been the subject of hundreds of economic and political science articles [see for example Bewley, 1981; Dowding, 1994; Kollman, 1997; Epple and Sieg, 1999 and the references therein].

Next, net-migration is used as the measure of population movement. The use of gross migration flow data versus net flow data has been widely debated in the literature. Tobler [1979], Constantine and Gower [1982], Greenwood, Hunt et al. [1991], Mueser and Graves [1995], and Douglas and Wall [1993], among others, used net migration flows to model attractivity. It would seem that in this case, attractivity, net-migration and the Tiebout hypothesis are analogous concepts. Smith and Swanson [1998] discuss the strengths and weaknesses of net-migration and provide several examples of how it can be useful for population estimation and analysis.

Although net-migration provides no information on the size of gross migration flows, or the origins and destinations of migrants, it does show whether a region is growing or declining as a result of migration, and by how much. Galle, Burr, and Potter [1993] show that this information could be particularly important to policy makers who are often more interested in the overall outcome of the migration process than its individual components.

Many studies have focused on net-migration as a summary measure of population change. Human ecological theory, for example, views migration in aggregate rather than individual terms. From this perspective, migration is one response through which a population can attempt to maintain a balance between its size and its ability to support itself. Studies from this perspective have frequently used net-migration as an indicator of how a population responds to changes in organizational, technological, and environmental factors [see for example, Sly, 1972; Frisbie and Poston, 1978; and Saenz and Anderson, 1994].

Many economists use net migration as a measure of a region or a state’s relative attractiveness with respect to economic opportunities, cost of living, government services, and recreational, cultural, and climatic amenities, [Clark and Hunter, 1992]. According to Gauthier, Tanaka, and Smith [1992], “as long as the empirical results are interpreted as reflecting aggregate population change rather than individual mobility or uni-directional migration flows, net migration is an appropriate measure.”

Table 4 provides evidence regarding the relationship between net-migration, economic freedom, and entrepreneurial activity. According to these estimates, both economic freedom and entrepreneurial activity have a statistically significant effect on net-migration. Specifically, both proxies for entrepreneurship, sole proprietorships and patents, have a significant effect on migration with sole proprietorships having a negative relation on net-migration and patents having a positive effect. This implies that the innovative entrepreneur is much more likely to migrate whereas the sole proprietor once established is much less likely to migrate. For the economic freedom indexes, only the sub-national index has a significant and positive effect on net-migration. This seems to illustrate Hayek’s very idea, that, local governments are more equipped and capable of governing themselves, and Tiebout’s, “vote with their feet” hypothesis that individuals do relocate to where more economic opportunities exist.

After accounting for just economic freedom and entrepreneurship, we estimate what contribution to net migration is made by economic freedom, entrepreneurship, and the selected control variables. These results are presented in Table 5. In the sub-national specification, the economic freedom is significant. Thus states with more economic freedom at the state and local level are more likely to see higher migration to those states. Therefore, state policy makers should pursue policies that ensure economic freedom grows in order to foster net-migration and economic growth. Both proxies for entrepreneurship were consistently significant (and both of the expected signs). These results are consistent with the findings in Table 4.

The control variable that was statistically significant in both specifications was the percent high school graduation rate. The results for percentage of high school graduates seem to indicate that the percentage of high school graduates is negatively related to net-migration. In fact, according to the estimates, those states with higher percentages of high school graduates are less likely to migrate due to the attractiveness of their current resident state.

## CONCLUSION

Entrepreneurship fails to be a well documented factor in the empirical growth literature because of difficulties with defining and measuring entrepreneurship [see for example, Baumol, 1968; Kirzner, 1973; Barreto, 1989; Kirchhoff, 1994; and Van Stel, Carree and Thurik, 2005]. However taken as a whole, the results from the previous two sections have significant policy implications for state and local governments. To encourage economic growth, state and local governments should encourage entrepreneurial activity/innovation, and to do so, they must focus on creating an environment consistent with economic freedom. Our results show that a state's degree of economic freedom significantly impacts state economic growth and state migration.

According to Baumol [1990], "if a reallocation of entrepreneurial effort is adopted as an objective of a state or local community, it is far more easily achieved through changes in the rules that determine relative rewards for entrepreneurs themselves." While most research is demonstrated for countries, we show that this relationship holds for U.S. states. In particular we show that the link between state growth and entrepreneurship is economic freedom. That is, underlying economic freedoms modify and improve the rules and incentives necessary for entrepreneurial activity.

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Table 1: Variable Definitions

Variable	Definition	Source
PCGSP	Per Capita GSP	BEA
EFALL	Economic Freedom All Government	Frasier Institute
EFSUB	Economic Freedom Subnational Government	Frasier Institute
SOLEPROP	Sole Proprietorships	BLS - Current Population Survey
PATENTS	Patent Activity	US Patent and Trademark Office
HSGRAD	High School Graduation Rate	Census.gov
UNEMP	Unemployment Rate	BLS
UNION	Percentage of Unionization	Trinity University – <a href="http://www.unionstats.com">www.unionstats.com</a>
MANU	Value Added Manufacturing	Census.gov
NETMIG	Net Migration	Census.gov

Table 2  
 Estimated Determinants of U.S. State Economic Growth, 1993-2002  
 Dependent Variable: Per Capita GSP  
 standard error  
 t-statistics

Estimation Method	All Government Random Effect	Subnational Government Random Effect
Measure of Economic Freedom	0.00767 5	0.003382
	0.00161 1	0.001526
Entrepreneurship Variables	4.3432	2.2167
Sole proprietorships	-9.69E-09 4.11E-09	-9.33E-09 4.23E-09
	-2.3554	-2.0295
Patents	2.89E-06 1.04E-06	3.09E-06 1.04E-06
	2.7795	2.6716
Sample 1993 - 2002		
Included Observations	9	
Cross-sections Included	50	
Total Pool (balanced) Observations	450	
R-squared	0.1080	0.1232

Table 3  
 Estimated Determinants of U.S. State Economic Growth, 1993-2002  
 Dependent Variable: Per Capita GSP (t-statistics and standard errors)

Estimation Method	All Government Random Effect	Subnational Government Random Effect
Measure of Economic Freedom	0.008351 0.001644 4.514420	0.004527 0.001810 2.500974
Entrepreneurship Variables		
Sole proprietorships	-7.84E-09 4.56E-09 -	-8.60E-09 5.15E-09 -
	1.756205	-1.671507
Patents	2.14E-06 1.01E-06 1.861554	2.60E-06 1.26E-06 2.067932
Control Variable		
Percent High School Graduates	0.004595 0.010597 0.37006	0.004252 0.014247 0.298468
Unemployment Rate	- 0.000334 0.000697 -0.47988	0.000458 0.000765 -0.599338
Value Added Manufacturing	-2.93E-13 3.98E-12 -	-4.06E-13 4.28E-12 -
	0.069955	-0.095042
Net Migration	-3.46E-08 1.58E-08 -1.77512	-4.08E-08 2.29E-08 -1.781004
Sample 1993 - 2002		
Included Observations	9	
Cross-sections Included	50	
Total Pool (balanced) Observations	450	
R-squared	0.1089	0.1306

Table 4  
 Estimated Determinants of U.S. Net Migration, 1993-2002  
 Dependent Variable: Net Migration  
 standard error  
 t-statistics

Estimation Method	All Government Random Effect	Subnational Government Random Effect
Measure of Economic Freedom	-2276.675 5525.2 -0.4121	11256.32 4488.504 2.6862
Entrepreneurship Variables		
Sole proprietorships	-0.119071 0.011967 -9.9501	-0.11966 0.011684 -10.2414
Patents	26.8554 1.8012 14.9094	25.8118 1.8209 14.1753
Sample 1993 – 2002		
Included Observations	9	
Cross-sections Included	50	
Total Pool (balanced) Observations	450	
R-squared	0.9172	0.9139

Table 5  
 Estimated Determinants of U.S. Net Migration, 1993-2002  
 Dependent Variable: Net Migration  
 standard error  
 t-statistics

Estimation Method	All	
	Government Random Effect	Subnational Government Random Effect
Measure of Economic Freedom	-1867.494 5593.622 -0.334865	11771.51 4508.750 2.61081
Entrepreneurship Variables		
Sole proprietorships	-0.124719 0.012173 -10.24516	-0.126307 0.011936 -10.58241
Patents	27.74778 1.870814 14.81236	27.21941 1.874634 14.51338
Control Variable		
Percent High School Graduates	-97934.36 34156.26 -2.768618	-87104.24 35402.27 -2.46042
Unemployment Rate	764.2485 1017.746 0.751195	1707.102 1055.892 1.611729
Value Added Manufacturing	-9.88E-07 4.56E-06 -0.216622	-1.04E-06 4.54E-06 -0.22988
Per Capita GSP	18044.76 51457.53 -0.35067	-27934.49 49221.03 -0.544521
Sample 1993 – 2002		
Included Observations	9	
Cross-sections Included	50	
Total Pool (balanced) Observations	450	
R-squared	0.9175	0.9148

# **E-waste, an Ethical Issue of the 21<sup>st</sup> Century – Can the European Union be used as a Role Model?**

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## **1.0 Introduction**

This paper will discuss the ethical aspects of e-waste treatment. Electronic appliances like computers, printers, cell phones, TV's, microwaves and other home appliances are considered e-waste when they have reached the end of their life cycle. Many of these items contain hazardous or toxic materials thus their disposal is a critical issue.

What can consumers do with them when they are no longer needed? Can they bring them back to the manufacturers? Or would they just drop them in the garbage along with other trash as it might be regarded as more convenient? What are manufacturers doing with them? Do they recycle them or do they ship them 'far away' along with the responsibilities for it? Pictures of vast e-waste landfills in Africa and Asia come to mind with children crawling all over the trash in hope to find something useful they can sell to get some money while inhaling and getting in touch with toxic and hazardous material. Who has a responsibility for that? Can it ethically be right to simply 'dump the trash' in poorer nations?

Ferguson & Browne (2001) state that there is a "shift in waste management responsibility from the private waste management industry and local governments towards manufacturers, distributors, and retailers". In different countries laws got passed in the last years that obligate manufacturers to take their products back. In addition, consumers are having a greater awareness nowadays of the damaging consequences that e-waste can have on nature and the environment. Together with environmentalist groups, they can exercise influential pressure on manufacturers and governments.

The European Union has passed two EU Directives regarding e-waste and hazardous substances, the WEEE (Waste Electrical and Electronic Equipment) Directive and the RoHS (Restriction of Hazardous Substances) Directive. Can they be used as a role model by other nations?

This paper looks at different stakeholder groups and their interests, as well as different laws currently in practice in various countries and regions and whether the European Union could be used as a role model for other nations.

## **2.0 Stakeholder Groups and their Positions**

Post, Preston & Sachs (2002, p.19) define the stakeholders within a corporation as follows:

*"The stakeholders in a corporation are the individuals and constituencies that contribute, either voluntarily or involuntarily, to its wealth-creating capacity and activities, and that are therefore its potential beneficiaries and/or risk bearers. [...] Their common desire is that the corporation should be run in such a way as to make them better off, or at least no worse off, than they would be otherwise".*

Aside from internal stakeholders, external stakeholders also exist. These can be governments, environmentalist groups, and other organizations. All groups have a common interest in what and how the company is doing and the consequences on their specific interests.

For the purpose of this paper, only the main stakeholder groups and their interests will be outlined as a more detailed analysis would extend the framework of this paper.

### **2.1 Manufacturers**

Manufacturers have different possibilities regarding the treatment of e-waste, depending on in which country they are operating. If no law is existing that bounds them to take back their products, they can refuse to do so and thus transfer the responsibility for it over to the consumers. Though manufacturers have to be aware of the possible consequences: if competitors take back products, this could turn into a disadvantage for them and a loss of customers. In addition, the reputation can suffer and a negative public image be created. Therefore, manufacturers should closely monitor the actions of their competitors in order not to lag behind.

Khanna & Anton (2002) did research among S&P 500 firms regarding corporate environment management and found that "the opportunities for winning the good will of the public and of stakeholders as well as of gaining a competitive advantage globally are driving corporate environmental management". This shows that companies are aware of the significance of their

environmental commitment and how it can influence consumers' perceptions. Thus, implementing a take-back system can improve a company's reputation.

But what happens when manufacturers take back their products? Do they handle the e-waste properly? These questions will be further discussed later in the paper.

## 2.2 Consumer/End-user

Consumers will be faced with the question 'what do I do with my product?' when it has reached its end of life. Product life-cycles are getting shorter and shorter nowadays, new technological features are offered every few months and for some people it is not easy to keep up with them all whereas for others it means a regular replacement of their gadgets. These might be trendsetters or consumers who want to show off.

The consumer has different alternatives: he/she might be able to bring the product back to the point of purchase/retailer if they are willing or obliged to take it back, he/she can sell it online (eg Ebay) and not worry about it any more but even make some money, or just simply throw it in the trash. It is unlikely that a lot of consumers choose the last option as concerns about the environment are increasing. A recent article in the publication *Environmental Design & Construction* (2006) states that "Energy and environmental concerns play an increasingly important role in consumer-decision making". This matches with an article in *Business Credit* (2006) about Corporate Social Responsibility that declares that "more and more consumers and shareholders are putting pressure on corporate board members and executives to care about how their companies impact the environment and society".

## 2.3 Environmentalists

Environmentalist groups can be on an international basis like Greenpeace or WWF (Worldwide Fund of Nature), as well as an on national basis like the NABU in Germany.

Greenpeace publishes their *Guide to Greener Electronics* that "ranks leading mobile and PC manufacturers on their global policies and practice on eliminating harmful chemicals and on taking responsibility for their products once they are discarded by consumers" (Greenpeace Online (a), 2006). In the latest report from August 2006, Nokia and Dell are leading the ranking as they are top in eliminating harmful chemicals as well as follow a voluntary take-back policy of used products. Such publications can greatly influence a company's image among consumers. More about environmentalist groups and their actions can be found later in the paper.

What connects all environmentalist groups is the common claim of a more responsible and environmental-friendly handling of hazardous, toxic materials and e-waste. The Internet is nowadays usually used as main communication platform on a global basis to reach a wider audience than ever before.

## 2.4 Governments

Governments can influence people's behavior regarding environmental issues by passing laws. An example from Germany would be the tax on gasoline: Germans are driving less with their cars due to higher gasoline prices, thus protecting the environment as well as their budget. National governments can pass laws that strive to protect and conserve the environment. They can also provide incentives for manufacturers to use less or no hazardous and/or toxic materials, to introduce take-back programs and to show a responsible handling of the disposal of their products; these incentives could be in form of tax-reductions. Governments can also impose heavy fines on disregard of regulations as company's usually react first when it is addressing their budget and profits.

Governments also have an interest in their country's image and want to keep it positive and 'clean'. For example, Bali is known as a traveler's paradise. Having visited the island before, the author of this paper agrees with the beauty of nature and extreme hospitality of the natives. But the piles of garbage everywhere along the roadside and within temple complexes disturb the overall picture. But this side of the island is never shown in any travel brochure and governments have an interest to keep it that way as it might discourage potential visitors. And in the case of Bali, tourism is one of the main sources of income for the population. When tourist stayed away after the bombing in Kuta in 2002, the economic situation deteriorated drastically for the inhabitants.

Governments also show an interest in the country's own position regarding environmental commitment in international comparison. They monitor how other countries behave in international treaty negotiations like the Kyoto-Protocol or the Basel Convention.

## **3.0 International Legislation regarding the Treatment of E-waste**

Currently there is different legislation in practice regarding the treatment of e-waste in different regions of the world.

### 3.1 EU

The European Union currently has 27 member states. The EU commission in Brussels proposes laws and regulations which then go to the EU parliament and the EU council. If the latter approves the law, it becomes union law that each member state has to follow and that supersedes any national law that might have been in practice.

There are two EU Directives regarding e-waste and hazardous substances, the WEEE (Waste Electrical and Electronic Equipment) Directive and the RoHS (Restriction of Hazardous Substances) Directive.

#### 3.1.1 WEEE

*All quotes are from the WEEE Directive (2003).*

Article 1, Objectives, states:

“The purpose of this Directive is, as a first priority, the prevention of waste electrical and electronic equipment (WEEE), and in addition, the reuse, recycling and other forms of recovery of such wastes so as to reduce the disposal of waste.”

The directive gives the deadline for 13 August 2005 until all member states should have ensured a transformation into national law. This directive does not intend to charge consumers:

“Member States shall ensure that, by 13 August 2005, producers provide at least for the financing of the collection, treatment, recovery and environmentally sound disposal of WEEE from private households deposited at collection facilities”

This directive shifts the responsibility of collection and further processing of used products to the manufacturers and includes all products sold in the member states.

#### 3.1.2 RoHS

*All quotes are from the RoHS Directive (2003).*

Article 1, Objective states:

“The purpose of this Directive is to approximate the laws of the Member States on the restrictions of the use of hazardous substances in electrical and electronic equipment and to contribute to the protection of human health and the environmentally sound recovery and disposal of waste electrical and electronic equipment.”

Article 4, Prevention, states:

“Member States shall ensure that, from 1 July 2006, new electrical and electronic equipment put on the market does not contain lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBB) or polybrominated diphenyl ethers (PBDE). National measures restricting or prohibiting the use of these substances in electrical and electronic equipment which were adopted in line with Community legislation before the adoption of this Directive may be maintained until 1 July 2006.”

Both Directives are pursuing to protect the environment and human health and shall be adopted by all existing member states of the EU as well as by application countries.

### 3.2 USA

The USA does not yet have one nationwide legislation regarding the treatment of e-waste. The following Bills apply nationwide.

The ‘National Computer Recycling Act’ (H.R.425) was introduced in the House of Representatives on January 26, 2005. It wants “to encourage and promote the recycling of used computers and to promote the development of a national infrastructure for the recycling of used computers” (H.R.425, 2005).

The ‘Electronic Waste Recycling Promotion and Consumer Protection Act’ (H.R.4316) was introduced in the Senate on March 3, 2005 and in the House of Representatives on November 14, 2005. This Bill pursues “to reduce and eliminate electronic waste through recycling” (H.R.4316, 2005). The Bill cites the National Safety Council that estimates that “between 1997 and 2007 more than 500,000,000 computers will be discarded” along with its chemical and toxic components. It also cites the EPA (Environmental Protection Agency) that claims that “discarded computer, television, and other electronic equipment [...] is currently managed in most States as municipal solid waste, just like ordinary trash” which results in products put in landfills where the toxic elements can get into the soil, air and groundwater.

California, Maine, and Maryland extended the above mentioned measurements. California is known to be “often at the forefront on environmental legislation” (Business & the Environment with ISO 14000 Updates, 2005). The state passed the ‘Electronic Waste Recycling Act 2003’ that includes the following two key points (IWMB online, 2006):

- Reduction in hazardous substances used in certain electronic products sold in California
- Collection of an electronic waste recycling fee at the point of sale of certain products

The latter one is collected from consumers by retailers, starting 01 January 2005. The fee is then used by the California Integrated Waste Management Board (IWMB) for the recycling and further processing of e-waste.

In 2006, the state passed another law, obliging retailers to take back old cell phones and recycling them appropriately. “More than 13 million cell phones become obsolete in California each year, with only 7% recycled at present” (Business & the Environment with ISO 14000 Updates, 2006). This new law shifts the responsibility to the retailers and manufacturers and makes it easier for consumers to dispose of their old products.

Maine established an E-Waste law (2004) that states that the manufacturers are responsible for proper treatment and disposal of their products when they are no longer needed and demands that less hazardous materials be used in the production of electronic items. Maryland passed its e-waste law in 2005, requiring “computer manufacturers to pay an annual fee to fund local computer recycling programs” (Waste Age, 2005).

### 3.3 Asia

#### 3.3.1 Japan

On May 26, 2000 Japan passed the ‘Basic Law for Establishing the Recycling-Based Society’ that contains “the principle of ‘Extended Producer Responsibility’ (EPR) which requests that those who produce and/or sell products bear a certain responsibility to produce and dispose of goods in an environmentally friendly way” (Harashima, 2000).

#### 3.3.2 China and South Korea

According to Newark InOne (2006) – a distributor of electronic components – “China and South Korea have recognized the need for national RoHS rules and are implementing regulations similar to those in place in the European Union. Both China and South Korea want to ensure that their manufacturers meet international standards and are able to continue exporting electronic goods to the EU and the rest of the world”. (The website [www.chinarohs.com](http://www.chinarohs.com) lists the differences between the Chinese version of the RoHS and the one set by the European Union.)

#### 3.3.3 India

India set regulations in this issue like the ‘Hazardous Waste Management and Handling Rules’ of December 1989 that “prohibit the import of hazardous waste to and from India for dumping or disposal” (Central Chronicle, 2006). But as the author of the article claims, the government is not enforcing those rules strictly enough; thus India is still fighting with the tons of e-waste that come into the country each year.

## 4.0 Discussion of Current Practices

The previous chapter shows that governments around the world are trying to establish standards regarding the proper treatment of e-waste. Often, manufacturers have to take their products back and are responsible for proper treatment of them. But as can be seen, not every company is adhering to the laws. And in countries where there is no corresponding legislation in practice yet, organizations can do as they please and will usually take the easiest (and cheapest) way.

#### 4.1 Landfills in Asia and Africa

On their website, Greenpeace claims that a lot of e-waste is exported to Asia, more specifically to China and India where people are discarding the products by hand, getting in close touch with toxic and harmful substances (Greenpeace Online (b), 2006). The group explains that even though Mainland China tried to fight against the incoming e-waste, a lot is still arriving in Guangdong (Greenpeace Online (c), 2007). On the same website they claim that in several large Indian city areas, e-waste dumping is becoming a growing problem. The Indian problem is also addressed in the earlier mentioned article by the Central Chronicle (2006).

Another US environmentalist group is based in Seattle and specifically fighting against the shipping of toxic materials to developing countries: BAN (Basel Action Network). One of their current campaigns is the *E-Waste Stewardship Project*, that is a “program to ensure that exports of hazardous electronic waste (Particularly from the USA) to developing countries, exposed by BAN, are eliminated and replaced with producer responsibility and green design programs/legislation” (BAN online (a), 2006). The organization published a report in October 2005 that revealed that a huge amount of used cell phones, computers and other electronic equipment is shipped from the USA to Africa where the items pile up along roadsides or get burned, thus “creating serious health and environmental contamination from the toxic leachate and smoke” (BAN online (b), 2006).

So it seems that a lot of companies see developing countries in Asia and Africa as the optimal place to dump their unwanted products. But can this be ethical right? Can poorer nations be used as a landfill for things the wealthier nations don't want anymore? Are consumers aware of those practices? Different mindsets of consumers have to be taken into account here as well, as people from different nation will view the issue differently.

#### 4.2 Mindset of Consumers

There are countries where environmental issues and protection of nature and natural resources have been on the agenda for decades and take a higher ranking, like for example in Germany. Sometimes called the “master of recycling”, German consumers – and the author being one of them – do care a lot about the environment. This was also encouraged by some laws that the government passed regarding environmental protection and conservation, like the extra tax on gasoline, high fees for garbage collection to force people to separate their waste, implementation of a complicated money deposit system for bottles, jars and cans, etc. Kids in kindergarten are already taught about the environment and the damages humans are causing it. Kids can join clubs like ‘Greenpeace at school’, ‘Biology excursion’, ‘Kids group of the NABU’, etc. that teach environmental issues in a child-friendly easy understandable way and include activities what the kids themselves can do to help. One of those activities is going out in the forests and open areas and collect the garbage people are throwing out of car windows or during walks and put an article about it in the paper about what they found, how much it weight, what damage it did, etc. to show people that such behavior is unacceptable.

In addition, in Germany almost every middle-sized city has a municipal waste collection center. People separate their different garbage at home in different categories like plastic, paper/cardboard, glass, garden waste, electronics & batteries, etc. and then bring it to the center and distribute it to the corresponding containers. This is free of charge and there are employees helping people if they are unsure where to put it and controlling whether everything is distributed correctly.

In other EU member states like Belgium, Netherlands, and Sweden national collective systems are running that are responsible for collecting and proper disposal of e-waste in their countries. “They are generally non-governmental, not-for-profit companies which are set up and owned by one or more trade associations” (IPTS, 2006). Such schemes “are considered by many stakeholders as providing the simplest and most effective route to collecting and recycling WEEE” when properly managed (IPTS, 2006). For quite some years now, Switzerland and Norway also have WEEE take-back and recycling schemes.

In some countries in South East Asia, recycling and nature preservation is not regarded as a main issue in consumer's daily lives. In Singapore, all trash goes together in one large bin, no matter whether it is paper, glass, plastic, or something else. In Indonesia people often just throw their garbage in the streets, alongside roads, or wherever they stand; similar behavior can be found in Thailand. A connection can be seen between the level of economic development and environmental concerns. In less-developed countries the awareness and concern about protecting the environment are less than in developed countries. Eisner (2004, p.147) confirms this by saying that “reflecting differences in levels of economic development, many nations [...] have weak environmental regimes and thus create opportunities for firms to produce without having to make investments in pollution control”.

### 4.3 International Treaties

In 1997 several states agreed on the Kyoto Protocol to enforce international protection of the climate. It lists goals and tools for a global initiative to save and protect the climate and the environment. The EU and its member states ratified it in late May 2002 (Europe online, 2006). The USA has signed the protocol but not ratified it yet. The Basel Convention (short for: Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal) tries to reduce waste and encourages a more responsible treatment with waste and the environment. It was enacted in 1992, the EU made it law for all member states in 1993 (Basel Convention online, 2006). 168 parties signed the Convention, the United States is one of them but again has not yet ratified it (Basel Convention status, 2006). Organizations like Greenpeace and BAN have continuously denounced the US behavior in this case.

The US governments attitude towards international treaties like the Basel Convention and the Kyoto-Protocol did and do not cast a favorable light on the USA. Media reports about it also led to damage in the USA's reputation among foreign countries, not only on the government level but also with the citizens: for example a lot of Germans could not understand why the US was not ratifying the Kyoto protocol although they are one of the main producers of greenhouse gases. Being one of the world's largest countries their behavior greatly influences the global climate and it was seen as their duty to agree to the treaty and help improve the overall situation. And also within the USA is resistance: KyotoUSA is a volunteer group trying to promote the issue, raise awareness for global warming and get the Protocol signed by the US government (KyotoUSA, 2006). Groups like them or BAN show that some American consumers do care about environmental issues and not agree with the governmental actions in this regard. Al Gore is probably one of the more famous and popular representatives and speaker for environmental issues in the US. Thousands of people have seen his movie "An inconvenient truth" about global warming and are coming to his shows all over the world.

### 5.0 Conclusion

Overall, the author thinks that within the European Union there is a higher awareness of environmental issues than in the United States or Asia. The author has lived and worked in Singapore, traveled extensively through Asia, and has lived, studied, and traveled in the United States, thus had the chance to make first-hand experiences and observations. The facts show that Europeans have worked on the issue for a long time and that the US governments and others should catch up now.

The problem with e-waste is a global one and no single country alone can deal with it. It needs the cooperation of governments over borders, especially from developed countries/industrial nations, the USA being one of the leading ones, as e-waste is mainly generated by them. Thus they carry a social responsibility for it and the well-being of their citizens as well as the environment. The US government is kind of going their own way in environmental issues and should now work on these issues on two levels, national and global.

National laws should be passed. This should not only be done in order to improve the overall environmental situation but also to prevent potential business losses for US companies. If they are trading with companies in the European Union member states, problems can arise when US products contain materials that are restricted under EU law. European companies might look for different supplier sources then in order to comply with EU law. This could have dramatic consequences for US exporters. So there is not only an ethical issue involved here but also a business one. California can be a role model here as it already has implemented some laws. It is interesting to note here that the Californian governor Arnold Schwarzenegger is from Europe, more specifically from Austria, and while he is in office, environmental issues got a higher priority on the agenda.

On a global level, the USA is taking on a rather isolated position in the international comparison with their negative attitude towards international treaties. They should finally ratify both treaties and stand to their commitment. It would show the government's awareness of the issue and taking over responsibility for what they are doing and pursuing with their policies. Furthermore, the USA would improve their reputation abroad.

Asian governments should also rethink their attitude towards environmental issues. Especially developed countries like Japan (that already passed some legislation) or Singapore should lead by example. India did pass legislation regarding the dumping but it is not yet enforced strongly enough. An aspect that could be further investigated here is what are the reasons for this (inexperience, bribery, corruption, lack of administrative support, etc). China is another 'big player', the country uses a lot of natural resources in order to be able to meet its needs. Environmental concerns have not played a big role over decades but now with the Olympic Games coming in 2008, China is trying to improve its image as a 'world polluter'. It is crucial, that countries of such a size educate their population about environmental issues and what each and everybody can do to support a 'healthy' environment. The introduction of an RoHS formed after the EU Directive is a good start but it needs to be ensured that it is strictly implemented and enforced.

The Directives passed by the EU as well as practices used in member states like Germany, Belgium, Netherlands, or Sweden could be adopted by other nations to raise and increase the awareness of the issues among their population, to set rules and standards regarding the treatment of e-waste, and to enforce them in order to improve the current situation and show responsibility. The author believes that this is an issue people need to be aware of as she regards it unethical to ship e-waste to less developed nations in order to get rid of responsibilities and just use the 'simplest' way out.

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# JUDICIAL INTERPRETATION OF RESTRICTIVE COVENANTS IN A KNOWLEDGE ECONOMY

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## ABSTRACT

*It has been said that "knowledge is power." Today, it is more accurate to say that knowledge is value—economic value. Possession of individual knowledge, expertise and skill are assets representing the primary sources of institutional and individual advancement and competitive economic advantage. Conflicting perspectives of employees and employers about the ownership of this human capital have generated an increasing number of legal disputes. More and more, employers are requiring employees to sign covenants not to compete and covenants not to disclose confidential information at the outset of an employment relationship. Increasingly, employers are suing their former employees at the end of an employment relationship, seeking to enjoin them from taking knowledge acquired on the job for use on behalf of a competitor. In the past decade, there has been an exponential increase in the volume of lawsuits between employers and former employees involving covenants not to compete and the ownership of information and knowledge.*

*Conflicts that arise over restrictive covenants involve three sets of competing interests:*

- 1. Employers view post-employment non-competition covenants as their best hope for protecting valuable confidential information from misuse by former employees. Without this type of protection, employers feel they cannot invest optimally in product development or in their employees. Also, the covenants tend to promote freedom of communication within a company, a conduit for optimal efficiency.*
- 2. Non-compete covenants, on the other hand, force employees to relinquish freedom to use information, customer contacts, and generalized skills they have acquired. The enforcement of non-compete covenants prohibits employees from using such skills and information to pursue a livelihood in a particular market, thus restraining the economic mobility and personal freedom of employees.*
- 3. Non-competition covenants restrain the free flow of ideas and information. From a societal perspective, enforcement of these covenants may be injurious to the general public by rendering employee skills developed during employment unavailable.*

*This paper explores the history and current state of the law of post-employment restraints as it impacts evolving employment relationships. It discusses the evolution of these restraints with specific focus on covenants not to compete. It also addresses issues related to resolving disputes involving trade secrets and confidential information in a "knowledge economy" where intellectual assets are the most valuable resources for economic advantage.*

## INTRODUCTION

The American economy has transitioned from a manufacturing-based economy to an information-based economy, and human capital has become increasingly more important to the success of most business enterprises. The value of many companies is no longer concentrated in their tangible assets; rather it is in the intangible assets, the knowledge, experience and creativity of their employees. It is the employees, not the machinery, equipment or facilities, who provide the most significant competitive advantage for many businesses (Drucker, 1998; Manville & Ober, 2003). In the current technology driven economy, technical knowledge and information, along with the ability to creatively use such knowledge, form the basis of innovation, increasing the company's ability to compete in the marketplace. In the words of Fortune magazine editor, Thomas Stewart, "Information and knowledge are the thermonuclear competitive weapons of our time" (1999).

Thus, obtaining and retaining key employees has taken on heightened importance for companies who must compete fiercely to recruit the best applicants. Learning opportunities, performance incentive compensation and life style perks have become common recruitment tools. In addition, firms are permitting valued employees to customize their jobs to suit their own ambitions and lifestyles as well as select their own work tasks, work location and schedules (Tulgan, 2001; Kanter, 2001).

In addition to altering recruitment practices, firms are actively reorganizing their human resource practices in order to utilize and enhance the talents and intellectual capacities of their employees. Firms have departed from the labor relations practices of the past, and have constructed a radically new type of workplace, one that is dedicated to expanding and deploying the knowledge and skills of their employees rather than to maintaining hierarchy and control. In their quest for quality and flexibility, employers no longer value long-term attachment. Thus, they have replaced their former implicit promises of long-

term job security and hierarchical progression through identifiable job ladders with promises of training, “up-skilling,” and networking opportunities (Pfeffer, 1998; Capelli, 1999).

Inevitably, as employers and employees have come to recognize the enormous value of the knowledge and skills of employees, disputes over ownership of this human capital have increased. Employees, who bring knowledge and capabilities to their jobs, expect that their jobs will further increase their human capital, whether by providing experience and learning on the job, or by providing more formal training opportunities. Employees see the growth of their human capital and the enhancement of their labor market opportunities as one of the benefits of the job. Jobs are often evaluated and selected on the basis of whether and how much, opportunity for learning and skill enhancement is provided. Accordingly, employees assume that the skills and knowledge they acquire on a particular job “belong” to them in the sense that they take these with them when they depart (Stone, 2002).

Employers, on the other hand, believe that if they have provided valuable training and imparted skills or knowledge to their employees, they should “own” that human capital and appurtenant intellectual assets in the sense of being able to ensure that it is utilized on their firm's behalf. While they cannot compel an employee to remain with their firm, employers can, and do, attempt to prevent former employees from using knowledge obtained in their employ on behalf of a competitor. Thus, employers increasingly seek to impose and enforce post-employment restraints. When employees depart, employers often seek judicial enforcement of covenants not to compete or judicial protection for their trade secrets (Vanko, 2002; Gillian, 2002).

The conflicting perspectives of employees and employers about the ownership of human capital have generated an increasing number of legal disputes. Employers are requiring employees to sign covenants not to compete and covenants not to disclose confidential information at the outset of an employment relationship (Closius & Schaffer, 1984). Increasingly, employers are suing their former employees at the end of an employment relationship, seeking to enjoin them from taking knowledge acquired on the job that the employers consider to be for use on behalf of a competitor. In the past decade, there has been an exponential increase in the volume of lawsuits between employers and former employees involving covenants not to compete and the ownership of information and knowledge (Staidl, 1998). Disputes over ownership of human capital are becoming some of the most important and frequently litigated issues in the employment law field (Lowrey, 1988). This paper explores the history and current state of the law of post-employment restraints as it impacts evolving employment relationships. It discusses the evolution of these restraints with specific focus on covenants not to compete in a knowledge economy.

## **RESTRICTIVE COVENANTS -HISTORICAL OVERVIEW**

It has been over five hundred years since employers first attempted to restrain departing employees from using confidential knowledge or customer-targeted influence developed during the period of employment. Today, many employers ask employees to sign various types of non-compete and confidentiality agreements. These covenants are currently used in virtually every industry and through every level of employment. This section of the paper provides a historical overview of the evolution of these restrictive covenants in employment from the middle Ages through the American Revolution to the present.

### **Public Policy of Employee Protection: Apprentices System in England**

Employers began utilizing restrictive covenants in England as early as the fifteenth century. During this era, the craft guilds were the prevalent means of entering a trade and earning employment (Blake, 1960). The guilds were a form of economic organization for their communities and also embodied “a whole social system’ sanctioned by the force of public opinion and the pressure of moral and social conventions” (Blake, 1960, p. 296).

The classes of members that constituted the guild system included masters, journeymen, and apprentices. Apprentices learned their trade by indenturing themselves to master craftsmen for a period of years. Upon completion of this tenure for nominal or no wages, the apprentice would be free to practice his trade for hire until he could gain entry to the elite group of craftsmen. For safety and social reasons, master craftsmen usually set up their businesses in the same town in which they had served as an apprentice (Blake, 1960).

Because of the significant entry barriers to employment, the difficulty of relocating geographically and lack of flexibility in changing trades, the labor market became increasingly competitive during the late medieval period. As a result, master craftsmen devised strategies to delay the members of the two lower classes from advancing to the next level of the hierarchy. One such stratagem used by enterprising masters was to bind apprentices to longer than customary periods of servitude. This tactic was, in effect, a self-enforced covenant not to compete. Whether to alter the erosion of traditional practices or to protect

the apprentice from unethical masters engaging in anticompetitive activity, courts held that the longer periods of indenture were illegal per se (Blake, 1960).

### **Development of a “Rule of Reason”: Industrial Revolution**

Over the course of the next three hundred years, the British economy began its transition to free market capitalism in the wake of colonial expansion and the industrial revolution. With the changed industrial scene, the widespread reliance on the guild system of the late medieval period dissipated. Indentures binding apprentices to longer than customary periods of servitude were replaced with contracts limiting future competition by former employees (Blake, 1960).

The prevalence of factory work lowered entry barriers to particular career paths as aspiring workers traded years of service through the apprenticeship system for minimal training in specialized factory jobs. The physical dangers and economic risks of travel lessened so that individuals in search of work were able to pursue greater geographic mobility. Because of the breadth and scope of factory operations, however, personal relationships between master and servant weakened. Without the long-standing social bond, workers became more dependent than ever on their chosen occupations (Butler, 1960).

It is against this laissez-faire economic background that the black letter law declaring all personal restraints of trade void as against public policy was transformed to a doctrine of reasonableness. (Butler, 1960; *Mitchel v. Reynolds*, 1711). In applying this new standard, English judges balanced the interests of the employer, employee, and society on a case-by-case basis (Mitchel, 1711, p.350). Essentially, the courts examined the reasonableness of the restraint in terms of time and scope in relation to the employer's purpose for requiring the covenants (Butler, 1960). The articulation of the reasonableness doctrine eventually came to be known as the "rule of reason." (*Davies v. Davies*, 1887; *Standard Oil Co. v. United States*, 1911).

In comparing the benefit to the employer against the burden to the employee within the context of the existing social and economic system, judges were no longer reacting with the same degree of paternalism once exhibited toward apprentices in the guild system. Rather, courts in the industrial age adapted the rule of reason to modern conditions and the philosophical ideas of economic liberalism (Sterk, 1993). Consequently, when employees bound themselves to contracts that limited their economic liberty, the courts were faced with the need to balance the preeminent societal values of freedom of the market against freedom of contract (Butler, 1960).

### **Adoption of the Rule of Reason: Restrictive Covenants on America**

The British approach to enforceability of restrictive covenants was ultimately adopted in the United States after the Revolutionary War (Butler, 1960). As the U.S. economy shifted from agrarian to industrial, evolving American legal principles reflected the increasing importance of economic liberty (Sunstein, 1987). Nevertheless, the reigning freedom of contract philosophy did not fully dominate the specialized area of restrictive employment covenants and the reasonableness test stood as a counter-weight to unfettered freedom of contract (Kales, 1917). In applying the standard to covenants against competition, American courts were more sensitive than those in England to the burdens placed on employees (Blake, 1960).

American courts, however, did acknowledge that the altered labor market following industrialization eliminated many objections to enforcing restrictive covenants of employment (Kales, 1917). Despite the decline in employee bargaining power due to the demise of the craft unions and their monopoly on skilled labor, (Stone, 2001) judges examining the validity of post-employment restraints frequently noted the ease of changing careers, the shortage of labor, and the expanding opportunities to engage in commercial activities. Thus, even prior to New Deal legislation that ameliorated the burdens of individual workers, cases upholding covenants not to compete were becoming more common (Kales, 1917).

The pendulum began to swing in favor of workers during the decade of the Great Depression. The rise of the industrial organization led to a concentration in the ownership of productive property and greater inequalities in private economic power (Corwin, 1948). An increasing number of individuals without significant productive property became dependent on industrial employment (Drucker, 1995). Management of these large-scale companies had seized control of the production processes and redesigned them in an attempt to eliminate the problems of unskilled labor and diminished loyalty (Stone, 2001). As public confidence in business collapsed with the stock market crash of 1929, the application of the rule of reason was marked by greater caution and more careful scrutiny of restrictive covenants (Ingram, 2002).

Following the depression, a human resource approach known as “scientific management” became popular (Stone, 2001). It was characterized by defined job duties, promotion and retention policies, and longevity-linked benefit packages. It is interesting to note that even with the prevalence of lifetime tenure at most major companies by mid-century, the existence and enforcement of covenants not to compete was a matter of public concern. While continuing to engage in a balancing

analysis under the rule of reason, many courts were still rooted in notions of worker protection (*Welcome Wagon v. Morris*, 1955; *Bennett v. Storz Broad Co.*, 1965).

During the hundred year history of the application of the rule of reason in the United States, the doctrine was refined from random interest balancing to a more structured "ends-means" analysis. As an initial matter, courts assessed the purpose for which the employer sought protection from competition by its former employees (Schulman, 1992). Only if the employer was deemed to have a protected interest that the law acknowledged would the court then proceed to evaluate the content of restrictions for their reasonableness (Blake, 1960).

The courts soon established that employers had essentially two interests worthy of protection in the context of a covenant not to compete in an employment situation (Kitch, 1980). First, courts held that an employer had a legitimate interest in retaining its customer base (*Mertz v. Pharmacists Mutual Ins. Co.*, 2001; *BDO Seidman v. Hirshberg*, 1999). A company was entitled to the protection of its customer base in industries characterized by indistinguishable products, competitive prices, and heavy reliance on personal selling (*Kelite Products v. Brandt*, 1956). Second, courts repeatedly ruled that an employer had a legitimate interest in restraining the dissemination of its trade secrets and other confidential information (Cunduff, 1992; Unikel, 1998). Covenants with conditions that extended beyond the use of such knowledge and client influence were not enforced.

### **Recent Developments**

The economic output of the United States shifted from manufacturing products to providing services during the final quarter of the last century. At the same time, the United States entered what has since been deemed the "information age." (Carnevale & Desrochers, 1999). Unlike the prior transformation from agrarian to manufacturing, where business relied primarily on physical labor and workers moved from farms to factories, the new knowledge-based economy utilizes mental labor and creativity as the primary sources of production (Thomas, 2002).

In order to keep pace with growing competition from abroad and the speed of technological change, the scientific management structures of the large manufacturing firms have begun to be dismantled (Stone, 2001). Limited positions of entry, hierarchical job ladders, and long-term employment have increasingly been replaced with short-term employment, lateral mobility, general training, and skill development (Drucker, 1995). Organizational behavior theories such as "competency-based organizations" and "total quality management" have been espoused to replace "scientific management." Company strategies emphasize organizational flexibility, product quality, speedy delivery of goods and services, and adaptability to customer desires (Lawler, 1994; Anshcutz, 1995). This shift in the nature of production has been described as the "new workplace" involving "just-in-time production, just-in-time product design, and just-in-time workers." (Anderson & Schalk, 1998).

The recognition of individual skills and knowledge as a source of competitive advantage has made it difficult to distinguish between the employee and his or her work product. Technological advances and remote computer networking additionally provide increased geographic flexibility as individuals pursue "boundaryless" careers. This dynamic environment has changed the employment relationship not only physically, but also psychologically. An emerging "social" or "psychological" contract of employment has been used to describe modern employment relationships (Stone, 2002). Employers are recruiting employees by offering human capital development. Employees, in turn, increasingly measure the value of employment in terms of the market value of human capital development being offered and not by the older notion of job security (Anderson & Schalk, 1998). Notwithstanding these changing attitudes and conditions in the labor market, the English rule of reason remains the doctrinal scheme in a majority of states in this country (Anenson, 2005).

### **LAW OF POST-EMPLOYMENT RESTRICTIONS**

The law of post-employment restrictions is a hybrid of contract, tort and intellectual property law. The disputes that arise when an employee leaves one employer for another are about ownership and control of human capital. Much of the litigation relates to preliminary injunctive relief, as the former employer seeks to prevent the employee from working for the new employer, or starting a business arguing that irreparable harm would result if the employee were permitted to violate non-competition or nondisclosure agreements or to disclose trade secrets to the new employer. As a legal matter, the dispute might arise in one of several ways, under statutory or common law. Under a statutory framework, the employer might claim that the employee misappropriated a trade secret, which is secret information that grants the possessor a competitive advantage (Bone, 1998; Wilf, 2002). Most trade secret cases involve technological trade secrets. Although the law varies by state, a trade secret claim generally requires the employer to show that the employee "acquired, used or disclosed the [trade secret] in breach of confidence or by other improper means." (Bone, 1998). Trade secret law seeks to enable businesses to protect their "investments in research and development" without unduly restraining employee mobility and competition

(Pasqualone, 2002, p.252).

Common law claims also exist to enforce agreements between the employee and the employer. The agreements can take the form of a confidentiality agreement in which the employee agrees not to disclose particular information, generally trade secrets, or a covenant not to compete in which the employee agrees not to compete with the employer (Ingram, 2002). Covenants not to compete occupy a peculiar legal place between contract and tort, in which party consent and externally imposed obligation are intimately and complexly intertwined. When an employment relationship includes a covenant not to compete or not to disclose specific information, it is reasonable to assume that the employee has consented to restrictions on his or her post-employment activities. Accordingly, there is a strong argument for courts to enforce the covenant, perhaps with some scrutiny to ensure that the agreement was the product of actual consent and that the terms were disclosed.

A covenant not to compete is "an agreement, generally part of a contract of employment or a contract to sell a business, in which the covenantor agrees for a specific period of time and within a particular area to refrain from competition with the covenantee." (Black, 1990). As discussed previously, at common law, contracts restricting an employee's post-employment mobility were generally deemed void and unenforceable as a matter of public policy (Gillian, 2001). This policy was founded on the basic assumptions that restrictive covenants undermined the free flow of human capital in the marketplace and were the product of unequal bargaining power between employer and employee. In the employment field, the common law established certain substantive criteria a covenant not to compete had to meet to be valid and enforceable (Benedict, et al., 1997). First, the covenant must always be reasonably limited in time, geographical extent, and scope of activity restrained (Carlson, 1996). In addition, most courts also require such covenants to be supported by consideration and to not be unreasonably detrimental to either the employee or the general public (Calaimari & Perillo, 1998). Finally, because these covenants curtail free enterprise in the market and mobility in society, all restrictions must be narrowly drawn to safeguard some legally protectable interest of the employer, not simply the employer's competitive position (Driscoll, 2004).

### **Judicial Analysis of the Enforceability of Covenants Not to Compete**

Although current judicial analysis of the enforceability of post employment restraints will vary from jurisdiction to jurisdiction, many courts have relied on the Restatement (Second) of Contracts (1981) as a guide, or at least have utilized similar terminology to that contained in the treatise:

1. A promise to refrain from competition that imposes a restraint that is ancillary to an otherwise valid transaction or relationship is unreasonably in restraint of trade if
  - (a) the restraint than is needed to protect the promisee's legitimate interest, or
  - (b) the promisee's need is outweighed by the hardship to the promisor and the likely injury to the public (p.102)
2. Promises imposing restraints that are ancillary to a valid transaction or relationship include the following...
  - (a) a promise by an employee or other agent not to compete with his employer or other principal (p.103).

Therefore, relying on this language, there are two basic requirements for a covenant not to compete to be enforceable;

- The covenant must be ancillary to or part of an otherwise enforceable agreement, and
- The covenant must contain limitations as to time, geographical area, and scope of activity to be restrained that are reasonable and do not impose a greater restraint than is necessary to protect the goodwill or other business interest of the promise (see e.g. Texas Business & Commerce Code, §15.50 et. Seq.)

### **Consideration**

In some jurisdictions, a covenant is ancillary only when executed prior to or contemporaneously with commencement of at-will employment (Milner v. Woods, 1993; Geisinger Clinic v. DiCuccio, 1992; Kistler v. O'Brien, 1975). According to this approach, an ancillary covenant passes the threshold validity test because the covenant is exchanged for a promise of initial employment. On the other hand, if the covenant is entered into after the first day of work, there is no similar exchange for employment because employment has already begun. In order for a non-ancillary covenant to be enforceable, it must be supported by separate consideration. However, many jurisdictions have recognized that the essential question should not be whether a covenant is ancillary or subordinate to the employment agreement, because the courts are actually considering whether there is adequate consideration to support a noncompetition agreement in an at-will employment relationship. Accordingly, the majority of courts hold that a covenant signed prior to, contemporaneously with, or any time during employment is ancillary. In addition, some courts are beginning to simply dispense with the need to determine whether a covenant is "ancillary" and instead analyze only whether there is independent consideration to support the covenant (Clark v.

Liberty National Life Insurance Co., 1992; *Criss v. Davis*, Presser & Lafaye, 1986; *Phone Connection, Inc. v. Harbst*, 1992).

As the above discussion illustrates, restrictive covenants involving at-will employees are particularly problematic and sometimes receive additional scrutiny. An at-will employee is one who can be fired for a good reason, a bad reason, or no reason at all. 7 If an at-will employee is fired without cause, she has no redress for her unjust dismissal; yet, if there is a covenant in effect, she can be prevented from performing another job. Because courts usually enforce noncompete covenants with injunctions, an at-will employee who has been fired unfairly can be barred from accepting all subsequent employment in the type of work that she is best able to perform. That is, an employee subject to a restrictive covenant, who is fired unfairly, is left without a job and is unable to take another one in her specific area of expertise (*Lofton v. TLC Laser Eye Centers, Inc.*, 2001; *Wright & Seaton, Inc. v. Prescott*, 1982).

Therefore, courts are divided over what suffices as adequate consideration to support a noncompetition agreement in an at-will employment relationship. One category of courts find that continued employment, beyond the day of signing the covenant, provides sufficient consideration (*Copeco, Inc. v. Caley*, 1992). However, other courts, recognizing the illusory nature of a promise of employment beyond the day the covenant is signed, require that the employment actually continue for a "substantial" or "reasonable" period for it to suffice as adequate consideration for a noncompetition covenant (*Zellner v. Conrad*, 1992). Some courts hold that continued employment in and of itself is insufficient consideration to enforce a noncompetition agreement. Instead, they require a promise that additional benefits will be conferred upon the employee in exchange for signing the agreement. Although the promise of additional benefits appears to be a more substantial exchange than mere continued employment, unless the employee is given the opportunity to receive and realize the fruits of such promises through continued employment, the employer's promise remains illusory at its inception. The exchange will be complete only through optional performance on the part of the employer, who must confer the benefits in addition to continuing employment. Thus, an employer's mere promise of benefits does not create an enforceable exchange at the time the covenant is signed (*Rogers v. Runfola & Assoc., Inc.*, 1991; *Chrysalis Health Care, Inc. v. Brooks*, 1994). Recognizing the problems associated with this reasoning, other courts find that additional benefits, other than continued employment, must in fact be conferred upon the employee in exchange for the signing of the noncompete agreement (*Sanborn Mfg. Co. v. Currie*, 1993).

## **Reformation**

Where the non-competition covenant is ancillary to an otherwise enforceable agreement or adequate separate consideration is found (see previous discussion), but the agreement is unreasonable or overbroad as to time, geographical area, or scope of the activity to be restrained, the court may reform the covenant to make the limitations "reasonable." In *John R. Ray Sons, Inc. v. Stroman* (1996), the court struck down a noncompetition provision that had no time limit. The court refused to reform the agreement because the plaintiff had made no showing as to what lesser time limit would be reasonable. However, courts have found that restrictions of between two and one half and five years are reasonable (*Stone v. Griffin Communications & Security Systems, Inc.*, 2001).

What a court considers to be reasonable duration and geographic scope varies from state to state and from case to case. Some courts have upheld extremely broad covenants while some have struck down very narrow ones. Recently, some courts have upheld covenants that are wider in geographic scope than those they would have affirmed in the past on the grounds that the firm seeking to enforce the covenant competes in a nationwide or worldwide market (*Ackerman v. Kimball Int'l, Inc.*, 1995). However, some courts have restricted the time of an allowable covenant on the grounds that in today's fast-moving and competitive environment, an employee's knowledge loses its value quickly (*EarthWeb, Inc. v. Schlack*, 1999). Generally, however, a reasonable geographic area of restraint consists only of the territory in which the employee worked while employed by the employer (*Evans World Travel Inc. v. Adams*, 1998). If requested and supported by the evidence, courts may reform an overbroad geographic restriction and enforce the agreement as reformed (*Butler v. Arrow Mirror & Glass, Inc.*, 2001). However, based on court opinions, generally, the total failure to limit geographic scope is fatal (*Zep Manufacturing Co. v. Heartlock*, 1992). Courts usually require that restrictions of the scope of activities post employment have a strong relationship to the employee's activities while employed (*Peat Marwick Main and Co. v. Haas*, 1990). Courts have also looked favorably on restrictions of solicitation of former customers, however, many courts have held that a covenant must be limited to those customers with whom the employee actually dealt while employed (*John Ray and Sons*, 1996).

## **Recognized Employer Interests**

Another area in which judicial enforcement of noncompete covenants has changed is the conception of what constitutes a legitimate protectable employer interest. A court will not enforce a covenant if it is solely a means to restrain trade. Rather, the long-standing view has been that to be enforceable, a covenant not to compete must protect an employer's interest in a

trade secret or in other "confidential information" (Stone, 2002).

Courts have recently expanded the types of employer interests that they consider legitimate subjects of noncompete covenants beyond the narrow trade secret rationale. Many courts no longer require that there be a trade secret involved at all (Reardigan v. Shaw Indus., Inc., 1999). For example, courts have enforced covenants when a manicurist left to work for another nail salon (Nail Boutique, Inc. v. Church, 1988), a carpet salesman took a job with another carpet retailer (Reardigan v. Shaw Indus., Inc., 1999) and a liquor deliveryman went to work for another distributor (E. Distrib. Co., Inc. v. Flynn, 1977). In doing so, the courts have expanded the set of interests they consider legitimate to protect with a noncompete covenant. Two factors cited with increasing frequency as being legitimate employer interests are: (1) contact with customers, and (2) employer provision of training (Closius & Schaffer, 1984; Aero Kool Corp. v. Oosthuizen, 1999). Courts use the presence of either of these factors as evidence from which to infer that a covenant has a legitimate, rather than an anticompetitive, purpose (Wolf v. Colonial Life and Accident Ins. Co., 1992).

### **Public Policy Considerations**

Public policy considerations have led to divergent opinions regarding the degree to which a noncompete clause between an employer and an employee should be upheld. Some courts have found that freedom of contract principles support enforcing all contracts made between competent parties, so long as those contracts are neither illegal nor unconscionable (UniCredito Italiano SPA v. JPMorgan Chase Bank, 2003). Advocates of noncompete agreements also argue that restrictions are necessary to subvert attempts by rogue employees to poach trade secrets and customer lists, which could be used to gain advantage over former employers (Water Services, Inc. v. Tesco Chems., Inc., 1969). Some proponents of strict enforcement argue that an employer should have a right to use noncompetes to protect any investment in its business, including employee training. Recognizing the significant outlay in training costs, those proponents support the protection of training investment should the beneficiary of the training terminate employment (Blake, 1960).

On the other hand, those who argue against the enforcement of employment noncompetes generally advance four policy rationales. First, some scholars have expressed concern that restrictive covenants are anticompetitive (Callahan, 1985). If employees are hindered from moving laterally between companies, firms can tie up valuable human capital and create a monopoly on market talent. According to Blake (1960, p. 627), noncompetes "diminish competition by intimidating potential competitors and by slowing down the dissemination of ideas, processes, and methods."

Second, opponents have criticized noncompetes for hindering a worker's ability to earn a living. Geographic and durational noncompetes, if enforced, could limit an employee's ability to take advantage of her talents and provide sustenance for her family (All-Pak, Inc. v. Johnston, 1997). To the same extent that an employer might be reluctant to invest in employee training if employment noncompetes were unenforceable, an employee who values job transferability might be ambivalent to general job training if a restrictive covenant obstructed that employee from utilizing the newly acquired knowledge outside of her current employment. Such a result could stunt the development of the American workforce (Stone, 2001).

The final two primary policy considerations are invoked less frequently. Some courts have rejected noncompetes that allow employers to take advantage of superior bargaining positions to the detriment of their employees (Arthur Murray Dance Studios v. Witter, 1952). Assuming a paternalistic role, courts that cite this rationale when striking down restrictions assume that employers, given their in-house legal resources and experience, are more sophisticated bargainers and likely to induce employees into unnecessarily restrictive covenants. Lastly, some courts are reluctant to enforce noncompetes that deprive the public of an employee's effort and productivity; described by one commentator as the "loss-to-society" rationale (Callahan, 1985), this line of reasoning is rare in today's jurisprudence.

### **CONCLUSION**

The increased number of disputes over post-employment restraints is the result of two developments: (1) the recognition of the central value of employee human capital in the workplace, and (2) the fact that changing work practices have caused a decline in job security and a corresponding increase in employee mobility. Both of these developments are functions of new human resource practices that are spreading through the U.S. economy. These practices embody new sets of expectations and understandings about the employment relationship that are relevant to a court's evaluation of post-employment restraints. This review of the history and current state of the law of restrictive covenants in employment underscores the dilemma of applying legal constructs that have been utilized for several hundred years in an employment environment that has changed substantially. Courts are struggling with the question, "Who owns employee human capital?" in an attempt to determine the efficacy of these restrictive covenants.

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# A Threshold Cointegration Test of the Fisher Hypothesis: A Study across Alternative Inflation Measures

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## **Abstract:**

A perennial favorite among monetary and financial economists is the super neutrality hypothesis, which translates to an acceptance/rejection of the Fisher equation, conceptualizing the relationship between nominal interest rates ( $R_t$ ) and inflation ( $\pi_t$ ). The empirical evidence is far from unanimous. This failure contributed to the fact that previous studies have ignored the stochastic features of these variables, which have resulted in only a partial adjustment (temporal co-movement) between the variables, and that too only when they cross some threshold.

To model the true dynamics of " $R_t$ " and " $\pi_t$ ", we now have an appropriate and powerful metric in the form of the "threshold cointegration" methodology, developed over the last decade. We propose to apply the recently available Hansen - Seo (2002) technique to revisit this unsettled question, using three alternative inflation measures (CPI, PCE and the Survey of Professional Forecasters survey of inflation expectations). The results will determine the true dynamics of how consistently and efficiently inflation (including inflation surveys) is incorporated into the nominal interest rate process, keeping real interest rates stationary.

## **1. Introduction**

A common topic of research among monetary and financial economists is the "Fisher equation," which conceptualizes the degree (and extent) to which nominal interest rates incorporate changes in expected inflation, thus keeping the real interest rate unaffected. The validity or otherwise of this hypothesis has fundamental ramifications for both theory and policy. As an example, this hypothesis upholds the super-neutrality of money and justifies using nominal interest rates as a good predictor of future inflation.

Two things seem to stand out in the literature. One is the conflicting results regarding its existence / non-existence in an absolute sense. Mishkin (1992) examines the hypothesis for postwar USA, and finds evidence in support (and against) it over different periods of time. Secondly, when nominal interest and inflation do co-move, it's a case of partial co-movement and not a one-to-one correspondence in the long run. One reason forwarded for this "on again off again" relationship between the two variables is their inherent nonlinearity, resulting only in partial adjustment when their difference reaches some threshold. This has been examined by Evans and Lewis (1995), Garcia and Perron (1996) and Bierens (2000).

Here we apply the recently available Hansen-Seo (2002) test of bivariate threshold cointegration, which has (through Monte Carlo simulation) been proven to be a powerful test. Its strongest feature is its ability to model the true dynamics of the interest and inflation series, where proactive policy results in "mean reversion" only when the difference between the variables reach some threshold or "tolerance band." We will apply this procedure to three different inflation measures: (a) Inflation calculated using the Consumer Price Index (CPI), (b) Inflation calculated using Personal Consumption Expenditures (PCE), and (c) the forecasted value of inflation (Survey of Professional Forecasters). All three measures are for the United States, with monthly data on the CPI (for the inflation rate) and the 3 month treasury certificate rates (for the short term interest rate) ranging from 1947 to 2005.

In section 2 we do a brief review of the literature on this topic, followed by a brief description of the data set in section 3. Section 4 encompasses the basics of the Hansen-Seo (2002) test, (with a demonstration of their methodology in the appendix) and results followed by our concluding remarks in section 5.

## 2. Literature Review

The concept originated in Fisher (1896) and was extended in 1930. According to him nominal interest responds to the changing inflation rate by smaller amounts and with a time lag. The justification is the presence of “money illusion,” which implies the inability of people to distinguish between nominal and real variables, at least in the short run. A practical manifestation of the presence of money illusion would be that lending institutions would not fully transmit their expected change in the inflation rate to the nominal interest rate, even if they do correctly estimate the expected inflation ( $r_t^e$ ). The concern with testing the Fisher hypothesis is that it is a long run phenomenon and more and more evidence is coming to the fore that economic / financial variables undergo structural changes (regime shifts) over time due to policy changes and / or business cycle fluctuations. But the early empirical studies using cointegration, have not included the presence of structural shifts.

The rationale provided for the failure of the Fisher hypothesis extends from money illusion to the negative effect of inflation on money demand to the negative correlation between inflation and real interest rates. This study proposes a technical (econometric) reason for the failure of the hypothesis, in terms of the stochastic properties of the variables under consideration. It is also propounded as the reason for the partial acceptance of the Fisher hypothesis, i.e., why it held over some periods and not over others.

To model the true dynamics of interest and inflation over time, the most recent contribution has been in the area of threshold cointegration. Davutyan and Pippenger (1990) and Balke and Fomby (1997), amongst others, have used it to examine the purchasing power parity hypothesis. They contend that due to the presence of transaction costs agents do not adjust continuously, but rather discretely adjust once the price differential is greater than the transaction cost. This is a step function in the sense of zero market activity before the bound or threshold has been reached, and complete action once it has been crossed. In the cointegration sense, the error correction mechanism is inactive inside the boundary, but kicks in once the threshold has been crossed. Thus the equilibrium error is modeled as a threshold autoregression in the sense of mean reversion only from outside the band, i.e. the variables are nonstationary (have unit roots) inside the band.

In the context of the Fisher correlation hypothesis, both nominal interest and inflation are nonstationary (and do not trend together under normal circumstances), but once the limits of social / political comfort are reached, proactive policy (for example contractionary / expansionary monetary policy) will kick in and the some combination of the variables will become “mean reverting,” and hence start behaving like stationary entities. Their actual behavior depends on the width of the “tolerance band,” say for example the differential between the higher (H) and lower (L) bounds as  $(T_H - T_L)$ . Mean reversion or tendency towards forming a cointegrating vector will be evident only at the limits and / or outside the band. Conventional estimates of this long run relationship has always assumed a “constant difference” and thus resulted in biased estimates.

## 3. Data Description

Forecasts are the backbone of the decision making process. They are decisions made under uncertainty, and hence provide at best a guiding light towards the future economic tract. Here we use the three most extensively used data sources on inflation, namely the consumer price index (henceforth the CPI), the Personal consumption expenditure (henceforth the PCE) and the Survey of Professional Forecasters.

Inflation is the change in the general price level over time. This price level is the average price of all goods and services, and the relevant time frame is month-to-month or quarter-to-quarter. There are different measures of inflation since it would be prohibitively expensive and logistically untenable to include every price change. Moreover including the price of every conceivable commodity in one index would reduce its relevance (due to a multitude of statistical weights) to specific policy prescriptions. Hence we have specific price indexes geared to measure price changes in specific sectors of the economy. The oldest index is the producer price index (PPI) (first used in 1902), to measure the price of economic input, geared towards the goods producing sector only. This makes it of limited usage in assessing general economy wide inflation. On the other extreme is the broadest measure of inflation, called the “GDP deflator,” which accounts for all goods and services, in the most comprehensive manner possible. But it is at the same time too generic for specific policy application. This leaves the two most closely followed indices, namely the CPI and the PCE.

The Consumer Price Index (CPI) is a major inflation measure used as an economic input in the policy making process. It is used to index for example, social security payments (though it is not without its own share of controversy) and also innumerable private (future) contracts are indexed to the CPI. It is the price statistic most closely followed by the policy makers. Each month the Bureau of labor statistics (BLS) collects 100,000 plus price quotes from retailers, sellers (for goods prices) and offices (Doctors for service prices). Then the data is aggregated by weighting them according to their respective share in the expenditure basket of the everyday Joe and Jane. The CPI is the most widely used major price indexes published by the federal government. It measures the average change over time in the prices paid by *urban* consumers for a specific

basket of goods and services (the basket of goods consumed by a typical consumer in the base year). Since the base year is not changed frequently, the basket of goods used to calculate the CPI may become outdated and can overstate the actual rate of inflation. This will have a significant impact on government spending since items like social security spending are indexed to the inflation rate.

The Personal Consumption Expenditure (PCE) deflator is comprised of entities from both the CPI and the PPI. The PCE accounts for the prices paid by consumers for goods and services, used at both urban and rural centers. The PCE also accounts for the continuous shifts in the individuals spending patterns. The other measure of inflation used is the Personal Consumption Expenditure (PCE) deflator. This uses components of both the CPI and the Producer Price Index (PPI). This is representative of prices paid by both urban and rural consumers. The PCE deflator uses information on both current spending patterns and past spending patterns to weight the prices when the index numbers are calculated, and therefore avoids the overestimating the inflation (like the CPI does).<sup>(1)</sup> The major difference between CPI and PCE is that while the CPI is an urban consumer based assessment, the PCE includes both urban and rural consumers. Along with that is the fact that the PCE is based on a continuously changing spending pattern, but the CPI relies on prices which are a few years old. The contention here is that historical prices tend to understate inflation. One recommendation for this is the use of an average of past and current spending patterns, as done in the PCE. This begs the answer to the question, why use both? It is mainly because both measure core inflation in the best possible manner. This “core inflation” is the measure used by policy makers. The most prominent example is the food and energy measure which basically excludes (by assigning zero weights) the price of food and energy as a way to exclude temporary “price shocks.” Once these extremes (statistical outliers) are excluded, we get a good realistic measure of the underlying fundamental inflation level. But this method has its detractors too. The problem is that by assigning zero weights we are averaging out dynamic price movements (albeit temporary ones), and the result is a sanitized picture of the economy. Hence another prescription is to use the median CPI, which excludes price spikes, but not price shifts and movements.

The data for the consumer price index (CPI) and the personal consumption expenditure (PCE) is has been obtained from the Bureau of Labor Statistics. Both series are quarterly data for the period 1947 quarter 1 to 2005, quarter 3. The CPI was originally obtained at monthly frequency but was converted to a quarterly frequency by taking end of the period values.

The third measure of inflation (in this case expected inflation) is the Survey of Professional Forecasters survey of expert’s forecasts, maintained today by the Philadelphia Federal Reserve Bank. It started in 1968, with the collaboration between the American Statistical Association (ASA) and the National Bureau of Economic Research (NBER). It is a survey of major macroeconomic variable forecasts, done by the experts. Various professionals are surveyed about their expectations about various macroeconomic variables including the CPI. This, therefore, represents actual forecasts of professionals rather than an estimate. Each quarter the survey asks professional forecasters from the academic, government and the private sector, to forecast a variety of macroeconomic aggregates, ranging from consumer prices to corporate profits to aggregate investment to real output. It is the most extensive and largest data set available. This survey is the oldest quarterly survey of macroeconomic forecasts in the USA. It began as the ASA-NBER economic outlook survey in 1968, with forecasts from 50 participants. With time the number of surveyors went down (to around 20 in 1988) and was discontinued in 1990. At that point the Philadelphia FED picked it up, doing the same with around 30 forecasters. The surveys are mailed out and collected with great consistency, and in case of some variables even long term forecasts are required.<sup>(2)</sup> It is anonymous and so the surveyor’s true projections are recorded. On a comparison with other surveys, like the Livingston survey, Blue Chip economic indicators and the NABE, this survey hold up very well in terms of depth and latitude. Hence it is extensively used in academic research. The survey data was obtained from the web site of the Philadelphia Federal Reserve Bank, and is from 1981, quarter 3 to 2005 quarter 3.

#### 4. Hansen – Seo Threshold Cointegration Model

Threshold cointegration introduced by Balke and Fomby (henceforth BF1997) combines nonlinearity and cointegration by allowing for nonlinear adjustments over the long run. It begins by testing for the presence of a bound or threshold where the null hypothesis is of linearity. Hansen –Seo (2002) extend the BF and the Lo and Zivot (2001) test to examine for the presence of an unknown cointegrating vector. Under the null hypothesis of no threshold it reduces to a linear VECM. They apply the Lagrange multiplier (LM) test for threshold cointegration and calculate the p-values. Simulation evidence is provided to justify the size and the power of the tests. The basic model is:

$x_t$  is a p-dimensional I(1) time series which is cointegrated with one  $p \times 1$  cointegrating vector  $\beta$ .  $w_t(\beta) = \beta' x_t$  is the I(0) error-correction term We can write a linear VECM as

$$\Delta x_t = A' X_{t-1}(\beta) + u_t$$

where

$$X_{t-1}(\beta) = \begin{pmatrix} 1 \\ w_{t-1}(\beta) \\ \Delta x_{t-1} \\ \vdots \\ \Delta x_{t-l} \end{pmatrix}$$

$A$  is  $k \times p$ , where  $k = pl + 2$ . The error  $u_t$  is assumed to be a vector martingale series with finite covariance matrix  $\Sigma = E[uu']$ . At the true value of  $\beta$  both the left and the right side of the equation is  $I(0)$ . A two regime threshold model takes the following form

$$\Delta x_t = \begin{cases} A'_1 X_{t-1}(\beta) + u_t & \text{if } w_{t-1}(\beta) \leq \gamma \\ A'_2 X_{t-1}(\beta) + u_t & \text{if } w_{t-1}(\beta) > \gamma \end{cases}$$

The regime is determined by the size of the error correction term. We could also write this as

$$\Delta x_t = A'_1 X_{t-1}(\beta) d_{1t}(\beta, \gamma) + A'_2 X_{t-1}(\beta) d_{2t}(\beta, \gamma) + u_t$$

where

$$d_{1t}(\beta, \gamma) = 1(w_{t-1}(\beta) \leq \gamma)$$

$$d_{2t}(\beta, \gamma) = 1(w_{t-1}(\beta) > \gamma)$$

are indicator functions. They undertake a grid search based on a prior linear and consistent estimate of the cointegrating vector  $\beta$ . The search is conducted for the values of  $[\beta, \gamma]$  over the range  $[\beta_L \text{ and } \beta_U]$  and  $[\gamma_L \text{ and } \gamma_U]$ . The threshold test is for  $H_0$  (null hypothesis of linear cointegration) versus  $H_1$  (alternative hypothesis of threshold cointegration).<sup>(3)</sup>

First we run the conventional Engle-Granger (1987) test of bivariate cointegration (to reject the null hypothesis of no cointegration). Then based on these results we test for threshold cointegration between the nominal interest rate and the inflation rate. For all three inflation measures, the test rejects the null hypothesis of no cointegration. We then proceed to test for the existence of threshold cointegration.

**Table 1**  
**Nominal interest rates and inflation: tests for threshold cointegration**

Nominal Interest rates and inflation: tests for Threshold Cointegration (p-values)

	Bivariate		Univariate	
	$\beta=1$	$\beta$ estimated	$\beta=1$	$\beta$ estimated
Survey of Professional Forecasters	0.2922	0.3846	0.4310	0.4388
CPI	0.4794	0.6822	0.3626	0.6896
PCE	0.3538	0.8532	0.4442	0.4488

**NOTE:** In testing for threshold cointegration, we use the SupLM test (estimated cointegration vector) and SupLM<sup>0</sup> test (cointegration coefficient = 1), with p-values calculated by bootstrap. For comparison, we also calculated the univariate Hansen (1996) TAR test to the error correction term. All univariate and multivariate tests indicate the absence of threshold cointegration for all measures of inflation during our sample period for the United States. This is consistent with results from an earlier paper by the authors.

We use the SupLM test (estimated cointegration vector) and SupLM<sup>0</sup> test (cointegration coefficient is constrained to be equal to 1), with p-values calculated by bootstrap (5000 replications). For comparison, we also calculated the univariate Hansen (1996) threshold autoregression (TAR) test to the error correction term. All univariate and multivariate tests indicate the absence of threshold cointegration for all three measures of inflation during our sample period for the United States.

## 5. Conclusion

We find evidence in favor of linear cointegration (from the Engle Granger tests), but no evidence in favor of threshold cointegration (from the Hansen-Seo results). This is in line with the results of Jumah and Kunst (2002) who state that “.....the threshold models fail to offer much advantage over error-correction models without thresholds.” This implies that the Fisher equation is a linear relation for the United States for all three measures of inflation used in this paper. This is not surprising for the survey data, since it is from 1981 – 2005, and the anti-inflationary policies of the Federal Reserve started under Paul Volcker from 1979. The long period of data (for the CPI and the PCE) does not seem to exhibit any nonlinearities. This is surprising as the Federal Reserve’s reputation for fighting inflation has really been earned only after Paul Volcker came into office in 1979, and therefore we would expect a regime change (threshold effect) around this time. This would seem to imply that nominal interest rates and inflation track each other even in the absence of any policy changes designed to achieve this. This is perhaps not surprising as we have used short term interest rates in this paper, and these rates are typically sensitive to market changes.

However before we can conclude that there is linear cointegration (long run co movement) between nominal interest rates and inflation, further testing is necessary. One other possible explanation is the difference in characteristics of short-term and long term interest rates (since we use short run interest rates (3 month t-bill rate) in our econometric tests). As we have seen since the Fed started increasing interest rates in 2004, short term and long term interest rates have not moved together. The regime changes (threshold effect) may be more prevalent in long term interest rates. Further investigation is necessary.

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#### *Notes*

1. For a detailed discussion of the CPI and the PCE deflator, please see a presentation by Mark A. Wynne, available on the website of the Dallas Federal Reserve Bank.
2. For a list of the relevant variables, see Croushore, 1993. A specialized internet search on the ASA-NBER data resulted in many research and policy references, which could be used for more information on this survey.
3. In their 2002 article, Hansen-Seo test the term structure model of interest rates which suggests that the one period bond rate ( $r_t$ ) and the multi-period bond rate ( $R_t$ ) should be cointegrated with a unit cointegrating vector. A detailed description of the procedure is given in the appendix.

#### *Appendix*

Hansen (1996) introduces a testing methodology that can be used when we have a case of an unidentified nuisance parameter under the Null Hypothesis. This is typically the case when testing for regime-switching. Hansen and Seo (2002) extend the methodology to a case of non-linear threshold cointegration. In this appendix we first demonstrate the theory developed by Hansen (1996) for the univariate case, and then we examine the multivariate extension of Hansen and Seo (2002). Consider the following model:

$$y_t = \alpha_1 + \alpha_2 w_t + \alpha_3 z_t^\gamma + \varepsilon_t$$

Where  $\alpha_1, \alpha_2, \alpha_3 \in \mathfrak{R}$ ,  $\gamma \in \Gamma$ ,  $E[\varepsilon_t | \Omega_t] = 0$ , and  $E[\varepsilon_t^2 | \Omega_t] = \sigma_t^2$ . Now consider the null hypothesis  $\alpha_3 = 0$ . Under this null,  $z_t$  does not enter the equation, so the parameter  $\gamma$  is unidentified. If  $\gamma$  is unknown this can cause problems when trying to test the null, since the assumptions that allow us to use the usual testing statistics are violated. If  $\gamma$  is known, then

no problem exists. This is a standard testing problem for a linear regression model. The model can be expressed as  $\mathbf{y} = \mathbf{X}(\gamma)\alpha + \varepsilon$ , where

$$\begin{aligned}\mathbf{x}_t(\gamma) &= (1, w_t, z_t')' \\ \mathbf{X}(\gamma) &= [x_1(\gamma)x_2(\gamma)\dots x_n(\gamma)]' \\ \alpha &= (\alpha_1, \alpha_2, \alpha_3)' \\ \mathbf{y} &= (y_1, y_2, \dots, y_n)' \\ \varepsilon &= (\varepsilon_1, \varepsilon_2, \dots, \varepsilon_n)'\end{aligned}$$

The null hypothesis is  $H_0 : \mathbf{R}'\alpha = 0$ , where  $\mathbf{R}'$  is the selector matrix. In this example,  $\mathbf{R}' = (0, 0, 1)'$ . The test of the null hypothesis is based on the statistic  $\mathbf{R}'\hat{\alpha}(\gamma)$  which can be calculated as  $\mathbf{R}'\hat{\alpha}(\gamma) = \mathbf{R}'(\mathbf{X}(\gamma)'\mathbf{X}(\gamma))^{-1}\mathbf{X}(\gamma)'\mathbf{y}$ , using the Wald principle, or as  $\mathbf{R}'(\mathbf{X}(\gamma)'\mathbf{X}(\gamma))^{-1}\mathbf{X}(\gamma)'\tilde{\varepsilon}$ , using the Lagrange Multiplier principle. In the latter case  $\tilde{\varepsilon}$  are the estimates of the error term when the estimation is done with the null restrictions enforced. Under the null hypothesis,  $\mathbf{R}'\hat{\alpha}(\gamma) = \mathbf{R}'(\mathbf{X}(\gamma)'\mathbf{X}(\gamma))^{-1}\mathbf{X}(\gamma)'\varepsilon$ . Using the Lagrange Multiplier principle (estimation under the null) gives us two distinct advantages. A Wald or Likelihood ratio test would require a distributional theory for  $\hat{\gamma}$ , the estimate of  $\gamma$ , which is unidentified under the null hypothesis. Such a theory has not yet been developed. Also, the residuals from the estimation do not depend on  $\gamma$ . This is very helpful for simulation of the bootstrap later on. We will not have to re-estimate at each simulation.

**DISTRIBUTION OF THE TEST STATISTIC:**

$$\begin{aligned}\mathbf{R}'\hat{\alpha}(\gamma) &= \mathbf{R}'(\mathbf{X}(\gamma)'\mathbf{X}(\gamma))^{-1}\mathbf{X}(\gamma)'\varepsilon \\ &= \mathbf{R}'\left(\frac{1}{n}\sum_{t=1}^n \mathbf{x}_t(\gamma)\mathbf{x}_t(\gamma)'\right)^{-1}\left(\frac{1}{n}\sum_{t=1}^n \mathbf{x}_t(\gamma)\varepsilon_t\right)\end{aligned}$$

Under standard regularity conditions

$$\begin{aligned}\left(\frac{1}{n}\sum_{t=1}^n \mathbf{x}_t(\gamma)\mathbf{x}_t(\gamma)'\right) &\xrightarrow{P} \mathbf{M}(\gamma), \text{ and} \\ \left(\frac{1}{n}\sum_{t=1}^n \mathbf{E}[\mathbf{x}_t(\gamma)\mathbf{x}_t(\gamma)'\tilde{\varepsilon}_t^2]\right) &\xrightarrow{P} \mathbf{V}(\gamma) \\ \sqrt{n}\left(\frac{1}{n}\sum_{t=1}^n \mathbf{x}_t(\gamma)\tilde{\varepsilon}_t\right) &\xrightarrow{d} \mathbf{N}(0, \mathbf{V}(\gamma))\end{aligned}$$

Putting these results together, we get

$$\begin{aligned}\sqrt{n}\mathbf{R}'\hat{\alpha}(\gamma) &\xrightarrow{d} \mathbf{N}(0, \mathbf{R}'(\mathbf{M}(\gamma))^{-1}\mathbf{V}(\gamma)(\mathbf{M}(\gamma))^{-1}\mathbf{R}) \text{ and} \\ n\hat{\alpha}(\gamma)'\mathbf{R}[\mathbf{R}'(\mathbf{M}(\gamma))^{-1}\mathbf{V}(\gamma)(\mathbf{M}(\gamma))^{-1}\mathbf{R}]^{-1}\mathbf{R}'\hat{\alpha}(\gamma) &\xrightarrow{d} \chi_q^2\end{aligned}$$

where  $q$  = number of restrictions. Replacing  $\mathbf{M}(\gamma)$  and  $\mathbf{V}(\gamma)$  with their consistent estimates  $\mathbf{M}_n(\gamma)$  and  $\mathbf{V}_n(\gamma)$ , let  $T_n(\gamma) = n\hat{\alpha}(\gamma)'\mathbf{R}[\mathbf{R}'\mathbf{M}_n(\gamma)^{-1}\mathbf{V}_n(\gamma)\mathbf{M}_n(\gamma)^{-1}\mathbf{R}]^{-1}\mathbf{R}'\hat{\alpha}(\gamma)$ . Then,

$$T_n(\gamma) \xrightarrow{d} \chi_q^2$$

If  $\gamma$  is unknown, we run into a problem known in the literature as hypothesis testing when parameters are not identified under the null. Under the null of  $\alpha_3 = 0$ , the parameter  $\gamma$  is unidentified, and thus a standard likelihood ratio test will not have the usual chi-square distribution. Instead Davies (1987), Andrews and Ploberger (1994), and Hansen (1991, 1996) propose using a test that is a functional over the entire space  $\Gamma$ . Although we do not know  $\gamma$  we do know that the statistic  $T_n(\gamma)$  as developed above has a marginal  $\chi^2$  distribution. The idea is to use that fact to develop the distribution of a statistic based on  $T_n(\gamma)$  evaluated over  $\Gamma$ . For example Hansen suggests using the statistic

$$g_n = \sup_{\gamma \in \Gamma} T_n(\gamma),$$

which they call the sup LM statistic. Notice that  $g_n$  does not depend on any particular  $\gamma$  but is a function over the entire space  $\Gamma$ . Theorem 1 of Hansen (1996) gives the asymptotic distribution of the test statistic  $g_n$  and shows that it has non-trivial local power. Since the co-moments of  $T_n(\gamma_1)$ , and  $T_n(\gamma_2)$  depend on  $\Gamma$ , critical values cannot be tabulated, and must be constructed on a case by case basis. We do so by simulation. To find the p-values for this statistic we use a technique similar to the bootstrap. Let

$$\{\mathcal{E}_{ij}^*\}_{i=1}^n = \{\tilde{\mathcal{E}}_i \cdot v_{ij}\}_{i=1}^n$$

where  $v_{ij}$  is distributed iid  $N(0,1)$ , be sample  $j$  of simulated residuals. These simulated residuals will have the same properties of the actual residuals. With the simulated residuals in hand, we can create the function  $T_j^*(\gamma)$  for each simulation  $j$ , and find its supremum over  $\Gamma$ ,  $g_{n,j}^*$ . By taking the proportion of these simulated values that exceed the test statistic we can estimate the p-value. Theorem 2 of Hansen (1996) shows that the estimated p-value converges in probability to the actual p-value.

### THRESHOLD COINTEGRATION :

For the case of threshold cointegration there are two extensions that must be addressed. First, the cointegrating vector may be unknown, and second, the theory must be applied to a multivariate setting. If the cointegrating vector is known, we could use the Hansen(1996) univariate tests on the error correction term. This is the approach used by Balke and Fomby (1997). Hansen and Seo (2002) investigate the multivariate case. They derive an asymptotic null distribution of the sup LM test and find that it is identical to the theory above (Hansen (1996)) for threshold tests to stationary data. The asymptotic distribution depends on the covariance structure of the scores precluding tabulation. They suggest using the fixed regressor bootstrap algorithm to approximate the sampling distribution. The two regime threshold model takes the following form

$$\Delta x_t = A_1' X_{t-1}(\beta) d_{1t}(\beta, \gamma) + A_2' X_{t-1}(\beta) d_{2t}(\beta, \gamma) + u_t$$

where

$$d_{1t}(\beta, \gamma) = 1(w_{t-1}(\beta) \leq \gamma)$$

$$d_{2t}(\beta, \gamma) = 1(w_{t-1}(\beta) > \gamma)$$

are indicator functions. The null Hypothesis in this case is  $H_0 : \text{vec}((A_1) - (A_2)) = 0$ . As above the Lagrange Multiplier test is preferred because i) it only requires estimation under the null, and ii) the Likelihood ratio and Wald tests would require a distribution theory which is not available. As above, we can calculate the statistic by linear regression. The statistic is

$$LM(\beta, \gamma) = \text{vec}(\hat{A}_1(\beta, \gamma) - \hat{A}_2(\beta, \gamma))' (\hat{V}_1(\beta, \gamma) + \hat{V}_2(\beta, \gamma))^{-1} \\ \times \text{vec}(\hat{A}_1(\beta, \gamma) - \hat{A}_2(\beta, \gamma))$$

where

$$M_1(\beta, \gamma) = I_p \otimes X_1(\beta, \gamma)' X_1(\beta, \gamma)$$

$$M_2(\beta, \gamma) = I_p \otimes X_2(\beta, \gamma)' X_2(\beta, \gamma)$$

and

$$\Omega_1(\beta, \gamma) = I_p \otimes \xi_1(\beta, \gamma)' \xi_1(\beta, \gamma)$$

$$\Omega_2(\beta, \gamma) = I_p \otimes \xi_2(\beta, \gamma)' \xi_2(\beta, \gamma)$$

and

$$\hat{V}_1(\beta, \gamma) = M_1(\beta, \gamma)^{-1} \Omega_1(\beta, \gamma) M_1(\beta, \gamma)^{-1}$$

$$\hat{V}_2(\beta, \gamma) = M_2(\beta, \gamma)^{-1} \Omega_2(\beta, \gamma) M_2(\beta, \gamma)^{-1}$$

$X_1(\beta, \gamma)$  is the matrix of stacked rows  $X_{t-1}(\beta) d_{1t}(\beta, \gamma)$ , and

$X_2(\beta, \gamma)$  is the matrix of stacked rows  $X_{t-1}(\beta)d_{2t}(\beta, \gamma)$ .

$\xi_1(\beta, \gamma)$  is the matrix of stacked rows  $\tilde{u}_t \otimes d_{1t}(\beta, \gamma)$ , and

$\xi_2(\beta, \gamma)$  is the matrix of stacked rows  $\tilde{u}_t \otimes d_{2t}(\beta, \gamma)$ .

If  $\beta_0$ , the true value of  $\beta$ , is known then Theorem 1 of Hansen and Seo (2002) shows that the distribution of the sup LM statistic is identical to that derived in Theorem 1 of Hansen (1996). If  $\beta_0$  is not known then Theorem 2 of Hansen and Seo (2002) shows that  $LM(\hat{\beta})$  has the same asymptotic finite dimensional distributions as  $LM(\beta_0)$ .