Journal Of Applied Economics and Policy

VOLUME TWENTY FIVE, NUMBER ONE 2006

2005 KEA Best Faculty Paper

2005 KEA Best Student Paper

Refereed Conference Papers

Journal of Applied Economics and Policy

VOLUME 25, NUMBER 1

2006

Published by the Kentucky Economic Association
At the College of Arts and Sciences
Eastern Kentucky University

The *Journal of Applied Economics and Policy* (formerly the *Kentucky Journal of Economics and Business*) is published by the Kentucky Economic Association at Eastern Kentucky University. All members of the Association receive the *Journal* electronically as a privilege of membership. All views expressed are those of the contributors and not those of either the Kentucky Economic Association or Eastern Kentucky University.

Correspondence regarding articles submitted for publication in the *Journal* should be sent to Thomas G. Watkins, Department of Economics, Eastern Kentucky University, 521 Lancaster Ave., Richmond, KY 40475. The submission fee is $20.00. A check should be made payable to the *Journal of Applied Economics and Policy*.

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Table of Contents

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Dannie Harrison	1978-79
James McCabe	1979-80
Bernard Davis	1980-81
Frank Slensick	1981-82
Lawrence K. Lynch	1982-83
Clyde Bates	1983-84
Richard Sims	1984-85
Frank Spreng	1985-86
William Baldwin	1986-87
Richard Crowe	1987-88
Richard Thalheimer	1988-89
Lou Noyd	1989-90
Gilbert Mathis	1990-91
Claude Vaughn	1991-92
L. Randolph McGee	1992-93
Paul Coomes	1993-94
James R. Ramsey	1994-95
Ginny Wilson	1995-96
Bruce Sauer	1996-97
James Payne	1997-98
Mark Berger	1998-99
Martin Milkman	1999-00
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The Impact of Trade Liberalization on Economic Growth in Sub-Saharan Africa

Seid Hassan*, Abdulhamid Sukar**, and Syed Ahmed***

Abstract:

In the early 1990s and after the collapse of communism, some economists and quite a few policy-makers expressed highly optimistic forecasts about the future economic growth of sub-Saharan Africa. Those euphoric expressions implied, directly or indirectly, that the (rather cosmetic) political regime changes also were accompanied with structural economic regime changes. In this paper, we hypothesize that as far as Sub-Saharan economies are concerned, there were no regime (structural) changes as alleged (or alluded) by some policymakers (economists). We also argue that the mantra for openness cannot be a substitute for economic growth that requires sound economic policies and major structural changes (economic as well as political). In addition, we argue that openness by itself is insufficient to serve as an "engine" of economic growth. We support our arguments through an extensive review of the theoretical and empirical literature. We use two empirical methods to refute the idea that openness has helped Sub-Saharan African countries achieve improved economic growth. Our graphical illustrations vividly indicate that it is not apparent that these countries were either completely open or gained extra benefits from the presumed openness.

I. Introduction

In the early and mid 1990s, many people, including researchers at the World Bank and the International Monetary Fund, predicted that Sub-Saharan Africa would enjoy positive economic developments. For example, economists, such as Collier and Gunning (1999), suggested that some countries, such as "Uganda, Côte d'Ivoire, Ethiopia, and Mozambique started to grow fast, whereas others such as the Democratic Republic of the Congo and Sierra Leone descended into the social disorder" (p. 19). Another publication stated that "…whereas per capita real GDP increased in 16 [Sub-Saharan] countries in 1990-94, twice as many countries registered positive growth rates during 1995-97" (Basu et al., 2000, p. 4). During those days, it was not uncommon to hear or read phrases such as: with the new economic restructuring, Africa's better future is just around the corner; progress is underway; important changes have been made; Africa's new, young and courageous leaders are ready to bring new changes to the continent; the new poverty reduction plan is being implemented and will help; sustained development is achievable with the help of the New Partnership for Africa (NEPAD), etc. These unwarranted and heavily optimistic views can be found on the web sites of the IMF and the World Bank even though Sub-Saharan economies have been declining precipitously.

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Most of these researchers, implicitly and explicitly, attributed the positive gains to the liberalization of trade and increased exports. For example, Collier and Gunning state: "[s]ince these [restricted trade] policies have largely been reversed during the last decade, …Africa should be well-placed for continued growth." (1999, p. 19). There were two premises behind these optimistic conclusions. First, openness serves as an engine of economic growth; and second, these countries in fact were following open trade policies. That euphoria took place in the face of weak economic environments such as huge trade and budget deficits, piled up foreign debt, rigid financial policies, stiff tariffs, quotas, and other non-tariff barriers that were hampering trade. The unfortunate positive scenarios were painted with little or no regard to the negative economic impacts of corruption, ethnic turf wars, the lack of well-defined property rights, and a host of other mitigating factors.

Ten years later individual country-by-country investigations and cross-sectional calculations reveal that in Sub-Saharan Africa the terms of trade continue to deteriorate, exchange rates continue to be distorted, manufacturing exports continue to grow at the same rate, their share of manufactured exports as a share of their own total exports continue to deteriorate, and their share of world trade is not any better than it was before the early 1990s. Moreover, their foreign direct investment as a percentage of GDP is still low and has even precipitously declined for some countries. These countries still face huge external balance deficits. We trace these facts over time using Figures 1-8 below.

Country-by-country observations (not shown here) also indicate that most of the major structural problems that existed in the past still exist today. Most nations suffer from macroeconomic fluctuations and inflation. Financial repressions still exist and national saving rates are still low, thereby compelling these nations to borrow from abroad. The private sector is still curtailed and internal markets are stunted. Trade barriers are still in effect. Corruption is rampant, and political and ethnic conflicts thrive. Onerous and unfair tax systems are still intact. Even some of the positive developments that were perceived to exist in the early 1990s have either been reversed and/or abandoned altogether. Environmental degradation and HIV/AIDS continue. There were no sound fiscal and monetary policies then, nor do they exist today. Control of exchange rates may have been partially lifted but they were never eliminated. Tariffs and quantitative restrictions may have been partially lifted but they still exist today. Taxes on exports were somewhat lifted but they were never fully implemented. A substantial portion of these economies is still dominated by state monopolies and is mostly accompanied by price controls.[1] In short, most, if not all, of the fundamental factors that contributed to negative economic growth in the 1970s, 1980s and the early 1990s still exist today.

The purpose of this paper is to examine the effect of trade liberalization on economic growth of Sub-Saharan countries and evaluate the suggestions made by some economists, policy-makers and "experts". We begin by reviewing the theoretical controversies regarding the

[1] If these were the facts, and these facts were easily predictable to remain the same, one cannot stop asking the question: why then were important international institutions such as the World Bank and the IMF and some economists, especially those working at these institutions, so optimistic about the future economic growth in Sub-Saharan Africa? Part of it can be explained by their implicit or explicit assumption that trade is the engine of economic growth. There may be other factors but these are left for future research.

economic growth- trade nexus in part II. We review the literature in Part III. Part IV presents our empirical results using both statistical and graphical methods. We present our concluding summaries, comments and qualifications in Part V.

II. A Simple Theoretical Caricature on the Economic Growth-Trade Nexus

It was long ago acknowledged that trade in general, and exports in particular, contribute positively to economic growth. Attacking mercantilists successfully, Adam Smith laid out the basic theory that trade is a means of efficient resource reallocation. Following Smith, David Ricardo proved that comparative advantage leads to trade and this in turn leads to the reallocation of resources and the improvement of the standard of living of any nation, large or small. Modern trade theory, especially endogenous growth theory, also makes the case for exports and open trade as the causes for economic expansion. Open trade and exports foster competition through innovation and learning-by-doing, and they bring international best practices to the attention of domestic producers, and hence spur greater efficiency. Export expansion helps domestic producers to realize economies of scale when they attempt to produce for world markets rather than for their own, limited number of domestic consumers, and larger markets create incentives for firms to engage in R&Ds. Trade also allows countries to import important production inputs and foreign capital thereby minimizing the foreign exchange constraints, facilitates the transfer of technology, new ideas, and managerial skills, and stimulates the flow of international capital. Open trade and exports increase the demand for a country's output and hence contribute strongly to positive economic growth. Free trade improves consumer welfare by increasing the variety of goods and services consumed. Thus, from this standpoint, exports in particular, and openness to external trade in general contribute to economic growth.

Other economists are either skeptical or unyielding to this paradigm. In the traditional (neoclassical) growth theory "trade and other policies will affect the equilibrium *level* of aggregate output, but not the *rate of growth*" (Edwards, 1993, p. 1371). In the famous Harrod-Domar growth model, trade could be beneficial but only because labor remains slack throughout. The Solow growth model suggests free trade can raise income once but it cannot raise it on a sustained basis.[2] In the Bhagwati (1958, 1971) models, free trade can even reduce current and future incomes compared to autarky if market failures are present. Rodrick (1999) says that openness is not a reliable mechanism to generate sustained growth. In the growth accounting literature, the rate of output growth is composed of three components: the rate of growth of labor inputs, the rate of growth in capital inputs, and the rate of growth in total factor productivity (TFP). The last one is the rate of growth in productivity due to organizational and technological advances that allows an economy to produce more output from the same amount of resources. Even though the importance of TFP cannot be ignored, empirical evidence has shown that its contribution rises during and after industrialization. This leaves labor and capital as being the major sources of economic growth.

In our context, this means that Sub-Saharan countries would have to work hard to increase both the level and productivity rates of these resources. The accumulation of physical

[2] See R.G.D. Allen (1968) for a summary and a mathematical presentation of all neoclassical growth theories.

and financial capital requires increases in domestic savings rates, as domestic investment rates are strongly correlated with domestic saving. The increase in domestic saving necessitates not only the foregoing of present consumption but also the designing of clear macroeconomic policies that could stimulate them. To enhance the productivity of labor, Sub-Saharan countries would have to design educational policies that would increase their literacy rates. Without an adequate skilled labor force that can tackle sophisticated methods of production, it would be impossible to achieve the desired results of high economic growth. Of course, this may require an overhauling of the educational system. And this, in turn, may require an overhaul of the entire economic and political system. On the economic side, resources must be allowed to move freely. The movement of resources would be enhanced if adequate financial and material infrastructures exist. In short, both the internal and external sectors of the sub-Saharan economies must be open.

Furthermore, the use of exports as an *engine* of economic success depends on whether or not other nations, particularly industrialized nations, can absorb the exports of Sub-Saharan nations. Success also depends on whether or not the current IMF and WTO rules allow these nations to continue subsidizing their exports indefinitely. Even though poor nations are allowed to subsidize, it is unlikely that these countries would be allowed to subsidize their exporting firms indefinitely. Due to stiff trade restrictions imposed by developed nations, Sub-Saharan countries are even unable to market the goods they have a comparative advantages in, mainly agricultural and textile products.

The conflicting arguments illustrated in the previous paragraphs suggest that, even though one can find strong correlations between openness and growth, an *absolute* theoretical link between liberalized trade and improved economic growth has yet to be established.

III. A Brief Review of the Empirical Literature

Turning first to the empirical literature finding trade as an "engine" of economic growth, a plethora of research exists concerning the relationship between economic growth and external trade in general, and growth and exports in particular. Frankel and Romer (1999) find that a one percent increase in trade increases per capita income between one-half and two percentage points. They also find that within-country trade raises income per person. After running a regression of GDP growth against the growth rates of capital, labor, fuel exports, non-fuel primary products, consumption and government consumption, Okpolo (1994) concludes that low-income countries in Africa can use non-fuel primary products as the major engine of economic growth. Using cross-section data from developing countries, Tyler (1981) finds a positive correlation between export expansion and promotion with economic growth. He regressed the growth rate of GDP against the growth rates of manufacturing output, investment, exports, direct foreign investment, and the terms of trade. Chow (1987) conducts Granger and Sims causality tests and finds a bi-directional causality between growth in exports and industrial development of the eight newly industrialized countries in his study. The procedure followed by Bahmani-Oskooee, Mohtadi, & Shabsigh (1990) is the same as Jung and Marshal's (1985) and Chow's (1987), except that they adjust for the optimal lag lengths. They find some support in favor of the export-led growth hypothesis. Their twenty country study indicates that the evidence obtained is either inconclusive in evaluating competing hypotheses (whether GDP growth causes

export growth or vice versa), or in some cases, the causation from exports to GDP is negative. Bahmani-Oskooee and Alse (1990, 1993) use co-integration and error correction methods and find bi-directional causality between exports and real output for nine countries. Ram (1987) uses both cross-section and times series methods and finds evidence for the hypothesis of the export-growth linkage. Rodriguez and Rodrik (1999) and Rodrik (1999) have questioned the impact of open trade on economic growth on both theoretical and empirical grounds.

In 1999, Collier and Gunning, Deaton, Ndulu and O'Connell, Schultz, and Sender presented a series of studies on the economic conditions of sub-Saharan Africa. Their works are published in a symposium at the *Journal of Economic Perspectives.* Economic growth in Sub-Saharan Africa lacks predictability for numerous reasons. To begin with, Sub-Saharan Africa is plagued with intrinsic problems such as ethno-linguistic fractionalization, high population growth accompanied with high mortality rates, volatility in and declining terms of trade, insufficient private savings, dominance of the government sector which is unresponsive to market and economic changes, lack of political pluralism and stability, and lack of adequate investment in health and education. These authors suggest that, among other things, Africa's slow growth has been due to policies of reduced openness. These countries began experiencing positive growth rates in the 1990s because of the reversal of their closed policies. In their view, the improved economic growth rates of some Sub-Saharan countries of the 1990s are good testimonies of the importance of democracy, economic liberalization, and international support (Ndulu and O'Connell, 1999), even though these changes are extremely inadequate. Deaton (1999) argues that the roots of Africa's poor economic performance lie not on the volatility in the prices of their primary commodities but in poor investment and bad governance.

It is important to note that the theoretical implications and empirical results obtained by researchers depend on the existence of good and stable macroeconomic environments, which most researchers assume to exist. In addition to the ones mentioned above by Collier and Gunning, Deaton, Ndulu and O'Connell, Schultz, and Sender the conditions are perfectly mobile resources, little or no corruption and uncertainties, few market distortions, and national trade benefits.

The literature also provides empirical support for viewing trade as a “handmaiden” rather than as an engine of growth. It can be argued that export expansion may follow domestic economic growth rather than the other way round. It may be that domestic growth causes trade growth or that there may be a bi-directional causality between export expansion and the domestic economic activity[3]. As the 1991 American Economic Association Distinguished Fellow, Irving Kravis aptly put it, growth is mainly a result of "favorable internal factors…" (Kravis, 1970, p. 850). More recent empirical research also reveals that the link between exports (especially between exports in primary products) and GDP growth is rather weak (Jung and Marshal, 1985). Fosu (1990) finds no significant relationship between the growth rate of GDP and the growth rate of exports. He concludes that the primary sector exhibits little effect on GDP growth in LDCs. Using cross sectional studies, Sharma and Dhakal (1994) and Bahmani-Oskooee et al.

[3] If there is a bi-directional causality, exports and the rest of the domestic economic activity may depend on each other for creating the means (resources) for increased employment. On the question of bi-directional causality, see the synthesis by Edwards (1993).

(1991) find no causal links between trade and exports for many developing countries. Al-Yousif (1997) also finds no causal relationship between exports and economic growth for the Arab Gulf states. Jung and Marshal (1985) perform causality tests between exports and growth for 37 countries and doubt the validity of the export promotion hypothesis.

Most of these researchers use GDP (or its growth rate) as the dependent variable. The export variables enter either as one of the independent variables in the production function or as one of the components of the GDP identities. Sheehey (1993) argues that the results obtained by those who used the export variable in the production function are biased because of the inherent relationship between exports and GDP. He runs a regression with the non-export production components entering as independent variables and finds similar results as when the export component is the independent variable. He concludes that "[p]roductivity, however, cannot be higher in both exports and non-exports" (Sheehey, 1993, p. 157). Sheehey's criticism of biased regressions may fit the results obtained using cointegration methods in this particular paper. Ahmad and Harnhirun (1996) used bivariate causality tests between exports and GDP growth. They find support for a one-way causality, from GDP to exports, for Indonesia, Malaysia, the Philippines, and Singapore.[4]

Whether trade is an *engine* of growth depends, of course, on the assumptions and the theoretical and/or empirical settings of that specific theory or model. Our position is that free trade creates opportunities for foreign direct investment (FDI), and FDI can help countries create capital formation, acquire transfers of technology, increase their entrepreneurial skills, enhance competition, and create access to markets. But these gains may not be sufficient to serve as engines of economic growth because of the constraints we mentioned above. Van den Berg agrees with us and aptly puts it: "[e]stimates of the gains from trade based on the standard partial and general equilibrium models are on the order of one percent of GDP. Even when additional gains from liberalizing trade are factored in, such as variety, increasing returns to scale, increased x-efficiency, and less discrimination, estimated gains from free trade seldom exceed a few percent of GDP" (2001, p. 143).

Finding a positive relationship between trade and income is insufficient for a number of reasons. To begin with, as one of the components of GDP, the external sector should, in principle, be positively related to GDP.[5] However, as Frankel and Romer note (1999), the positive relationship may not even reflect the effect of trade on income, as trade may be endogenous (p. 379). Even a strong correlation between growth and openness does not imply that

[4] Geoffrey Garret (2004) from the University of California doubts the positive impact of globalization and argues that "… eastern Asian countries cannot be held up as paragons of virtuous globalization. During the Cold War, *because of security imperatives*, the United States nonetheless allowed these countries unfettered access to U.S. markets. It was only in the mid-1980s, when Asian competition came to be seen as a threat to the U.S. economy that Washington pushed hard for reciprocal access to eastern Asian markets."[p. 91, emphasis ours]

[5] The question, therefore, should not be about the existence of a positive correlation between the growth rate of GDP and that of trade in general, and that of exports in particular, as this should be expected to take place. In fact, if the growth rate of trade exceeds the growth rate of GDP and there is no take-off by the economy, then trade cannot be the engine of economic growth, for, if it was, it should have increased GDP and its other components in a multiplicative way. On the other hand, if the external sector is relatively a small portion of the entire economy over time, its effects would be minimal as it would be unable to push the economy to the desired level.

the latter causes the former. Moreover, an undue focus on the external sector in general, and on exports in particular, may not add to economic growth if this undue focus crowds-out the goods and services produced for domestic consumption. Indeed, given the extremely scarce resources in the Sub-Saharan region, devoting a larger proportion of the same resources to the external sector would mean that fewer and fewer resources would be available for the remaining components of the general economic activity. If in fact crowding-out exists, higher unemployment may result, ultimately offsetting the gains from liberalizing the external sector of the economy. This is so because, in general, the contributions of the other components of aggregate demand (that is, domestic consumption, investment and government spending) are greater than the external sector of the economy.

Furthermore, trade liberalization may be accompanied by a strong temptation to enhance export promotion strategies, increase industrial targeting, and grant unwarranted subsidies, which ultimately increase monopolistic practices and rent-seeking behaviors. If these happen, they stifle competition. It is also important to note that even the aforementioned benefits from trade may be realized only if a substantial proportion of the traded goods are manufactured goods. However, Sub-Saharan trade is predominantly focused on primary products. Therefore, the gains from technological transfers, competition, and learning-by-doing would be very limited. Since the terms of trade in these products have deteriorated over time, the gains from economies of scale from selling primary products are also limited.[6]

Most importantly, one should recognize that the benefits of trade liberalization are best achieved when the internal sector is liberalized as well. This is because, as Frankel and Romer (1999) note, a country's income may be influenced not only by the amount a country's citizens trade with foreigners but also by the amount they trade amongst themselves. Economic development may be impossible to achieve and nations may be unable to get any benefits from liberalizing their trade policies if internal markets are imperfect. Even the highly desired foreign capital may not be obtained with imperfect internal capital markets. Neither would foreign capital be attracted without an adequate infrastructure.

This paper tests several hypotheses. As far as Sub-Saharan economies are concerned, there were no regime (structural) changes as alleged (or alluded) by some policymakers (economists). Even though some Sub-Saharan countries might have experienced positive gains in economic growth in the early 1990s, these gains were short-term at best. We show this by using the "before-and –after the change" method for two periods, 1961-2002 and 1992-2002. Our maintained hypothesis is that the two periods are identical.

[6] Moreover, exports in primary products are notoriously very volatile. This is so because exports primarily depend on, among other things: foreign nations' incomes; the demand for the primary products by trading partners; the policies of trading partners; the stability of exchange rates; the business cycle of trading partners; internal rigidities of resources; political and social conditions of the exporting countries themselves; supply shifts due to weather conditions, etc. Since Sub-Saharan nations, as exporters of mainly primary products, do not have full control over these variables, the volatility in the growth rate of the external sector could lead to the volatility in the growth rates of GDP.

Drawing from our results and the literature we reviewed, we first conclude that the mantra for openness cannot be a substitute for economic growth based on sound economic policies and internal transformation of the economy. Second, the blind association of a temporal partially liberalized trade with long-term economic growth may even be very dangerous and gives hollow promises. It diverts a poor nation's meager resources (human and non-human resources, administrative focus, health, education, the building of infrastructures, and the political and social reforms) away from their important uses and leads to unrealistic priorities. Third, trade and openness not only cannot serve as a shortcut for economic growth, but also require complete overhaul of the industrial, administrative, political, and social structures. According to Rodrick (2001), an undue emphasis on external trade crowds out serious thinking and efforts.

IV. The Empirical Results of This Study

The empirical results are based on the average values of real GDP (gdp), exports (x), and imports (m) of 41 Sub-Saharan countries. We calculated two openness indices as $openness_t = \frac{(x_t + m_t)}{gdp_t}$ and $\frac{x_t}{(gdp_t - x_t)}$.[7] We then run a fixed effects regression in order to account for the "before and after the change." The fixed effects approach allows us to capture both country and period specific effects. This fixed effects procedure is based on the model given by :

$$Y_{it} = \beta_0 + \delta_s + \gamma_t + \sum_{i=1}^{k}(\beta_i X_{it}) + \sum_{i=1}^{n-1}\eta_i T_i + \varepsilon_{it}$$

where δ_s represents the state fixed effect and γ_t represents year fixed effects, T_i's represent the period-specific dummies (1992-2002), and the X_i's are the regressors. This is similar to the famous differential intercept and differential slope dummy variable approach. In both methods, the restricted model excludes the year dummy variables for 1992-2002. The Chow test is calculated using:

$$F\{(T-1),(N-1)(T-1)-K\} = \frac{(RSS_R - RSS_U)/(T-1)}{RSS_U/\{(N-1)(T-1)-K\}}$$ [8]

where RSS_R is the restricted sum of squares obtained without the 1992-2002 year dummy variables or period effects, RSS_U is the unrestricted sum of squares with the year dummy variables, (T-1) is the number of restrictions, N is the numbers of observations, T is the number of time periods and K is the number of regressors. Our results can be found in Table 1.[9]

Since the calculated values of the F-statistics are less than the tabulated ones for both models, we fail to reject the null hypothesis that the two periods are identical. The statistical analysis clearly shows that the Sub-Saharan economies are not any different from what they were before.

[7] Since we reached with the same conclusions using both calculations, we show our empirical results based on the first openness index.

[8] See Baltagi, p. 29 and Greene, p. 292, for example.

[9] A lagged dependent variable was added due to the presence of autocorrelation.

Using graphic methods, we attempt to show that the allegedly open Sub-Saharan economies were not open at all, and that the euphoria was premature and unrealistic. In particular, we show these by using two openness indicators, an average measure of foreign direct investment (FDI), the weighted average of the terms of trade over time, the weighted average of the growth in manufacturing exports, manufactured exports as percent of total exports, Sub-Sahara's share of world trade, the external balance as a percentage of GDP, and the average of both per capita GDP and GDP growth rates. The empirical analysis presented in this paper uses the latest data available from the International Monetary Fund's (IMF) *International Financial Statistics*, (2002, 2003, 2004), the World Bank's CD-ROM version of World Development Indicators (2002 and 2004), and Africa Data Base (2000 and 2004).

First, we calculated the two openness indicators: x/(gdp-x) and (x+m)/gdp. We then plotted the average of these openness indicators for individual countries against time.[10] These results are presented in Figures 1 and 2. These two figures clearly reveal that, even though the openness indicators rose in the early to mid 1990s, the indicators fell in the latter part of the same decade.[11] In other words, these economies, as a group, were not open at all (especially when we include the period these countries were expected to be more open than in previous years.)

Next, we consider another openness indicator, namely the growth rate of foreign direct investment (FDI) as a percentage of GDP. Foreign direct investments are real investments in factories, capital goods, land ownership, resource extraction, services, etc. and they are there to stay for many years since they are mostly illiquid. Developing nations could enhance their productivities by supplementing (and not substituting) their own saving by borrowing from abroad. FDI allows the transfer of highly desired technology that would otherwise be impossible to obtain domestically. It may create access to foreign markets. To begin with, foreign capital can only be attracted if the returns to investments in Sub-Saharan countries are expected to be higher than in the countries where the FDI originates. The returns from FDI in Sub-Saharan Africa would also have to be expected to be higher than other in other countries competing for the same funds. Be that as it may, we can ask the question: Have the Sub-Saharan economies been more open in recent years than in the previous decades using FDI as a measure of openness? Figure 3 reveals that, even though FDI as a percentage of GDP rose relatively quickly from 1992 to about 1996 for all countries as a group, it subsequently and dramatically fell from there on. This result is consistent with the ones shown in Figures 1 and 2.

We now ask the question: Have Sub-Saharan countries, as a group, benefited from open trade? We attempt to answer this question by exploring six other indicators over time: the terms of trade (TT), the average growth rates of manufacturing exports, the percentage of total exports that are manufacturing exports, Sub-Sahara's share of world trade, the condition of their external balance, and the per capita incomes and growth rates of GDP.

[10] We also calculated the openness indicators over time for each individual country. Except for five countries, Cote d'Ivoire, Ethiopia, Mauritius, Seychelles, and Togo, that showed increased openness until the early part of the late 1990s, all of the remaining Sub-Saharan countries (that is, for more than 85% of them) indicated qualitatively similar results as presented in Figures 1 and 2.

[11] See the Appendix for the list of the countries included in the calculation.

If these nations benefited more from trade because of their increased openness (assuming that the increased openness existed on a sustained basis), their terms of trade must have improved or at least not deteriorated compared to what they were before the early 1990s. The terms of trade, TT, reflects the prices that a nation receives for its exports relative to the prices it pays for its imports. Here again, we gathered and calculated the average terms of trade (TT) for 41 countries. This result is presented in Figure 4. Figure 4 reveals that the terms of trade (based on 1995 prices) for these countries deteriorated during the 1990s. The decline in TT is both in terms of price and volume. We understand that our use of the terms of trade is limited since the number of years under consideration is very few. However, the terms-of-trade is one more useful indicator revealing the limited fortunes that Sub-Saharan countries could garner from their promotion of trade and their use of world markets. Since import prices are in general higher than export prices, the terms-of-trade reveals the fact that exports earn fewer units of imports over time.

The growth-trade or growth-exports nexus described at the beginning of this paper is based mainly on their ability to sell manufactured goods in the world market, not from the sale of primary products. The dynamics of learning-by-doing, enhanced competition, transfers of technology, and the application of international best practices of doing business are mainly attributable to the domestic production and exchange of manufactured goods. In this light, we can ask the question: have Sub-Saharan manufactured exports as a ratio of GDP improved during the decade of the 1990s? To shed some light on this question, we plotted the average growth rates of manufacturing exports in Figure 5 and manufactured exports as percent of total exports in Figure 6. Figure 5 reveals that there was a sharp rise in the average growth rates of manufacturing exports. However, this rise in growth rate of manufacturing exports was only for a very brief period. Just like the other indicators, this indicator also dropped to its original level by the end of 1998.

Industrialization is crucial to economic development. The extent of industrialization and its potential benefits can also be measured by the growth rates in manufactured exports and their importance relative to total real GDP over time. Looking at Figure 6, manufactured exports as percentage of total exports rose consistently from mid 1980s to mid 1990s. Not only did manufactured exports as percentage of total exports drop by mid 1990s, but the level also remained below previous periods. At best, Figure 6 suggests that partially targeting a specific sector like exports in particular, and the external sector in general, maybe futile in terms of achieving the desired and sustainable economic growth.

Sub-Saharan Africa's shares of world trade as well as its external balance as a percentage of GDP are shown in Figures 7 and 8, respectively. Figure 7 reveals that Sub-Saharan Africa is, in fact, marginalized from, not integrated into, world trade. The deterioration in the external balance (which is the combined effect of the current, capital and financial accounts) has also continued unabatedly, as shown in Figure 8. Even though the causes of the external balance are complex, persistent imbalances in the external sector of the economy should be a serious

concern.[12] Among other things, these imbalances indicate that Sub-Saharan Africa, as a group, experienced persistent capital account deficits, decreases in domestic investment, and an accumulation of foreign assets, which may potentially lead to an inability to repay foreign debt. These persistent imbalances in the external sector may undermine foreign investors' confidence and even may lead to financial crises as well.

We plotted the average annual GDP growth rates and per capita growth rates in Figure 9. This figure shows that even though the incomes of these countries grew sharply for about 3 to 4 years in the early to mid 1990s, the situation reversed itself right away. Five-year average values involving major macroeconomic variables used in the figures are presented in Table 2.

V. Summary, Conclusions and Discussions

In this paper, we have attempted to garner evidence about the claims and optimistic forecasts made concerning the contribution of exports to economic growth in Sub-Saharan Africa. We used the Intrilligator, Bodkin, and Hsiao (1996) and the fixed effects method to refute the (optimistically) forecasts that were made in the early 1990s. The graphs we used illustrate our points and support our statistical findings.

Surely, our skeptical observations at the time and our current investigations indicate that Sub-Saharan countries attempted to liberalize their exchange rates. Devaluations were made without dismantling the barriers of capital, trade and exchange controls. Indeed, some countries had positive growth rates in GDP for a limited number of years. But those achievements were probably due to the easing of the existing bottlenecks and absurdly suppressed resources. Based on our analysis, we can conclude that complete liberalizations never took place, never existed and even those limited liberalization measures were subsequently reversed.

External trade, indeed, could be beneficial to economic growth if certain conditions preexist. This paper, therefore, does not advocate isolationism, for such policies are extremely harmful to the countries themselves. In fact, recent history is replete with empirical evidence demonstrating that the isolationist polices of those countries effectively shielded local manufacturing sectors from international competition. As a result, policies of restricted trade made those countries totally dependent on their primary commodity markets which were susceptible to market fluctuations.

However, even though trade and openness could be one of the important ingredients for economic success, simple dismantling of old trade barriers and investment, without an overall development strategy or supportive macroeconomic policies, cannot be the panacea for economic stagnation, for economic development requires comprehensive institutional reforms. The impact of trade on economic growth depends on in large part, and in addition to the ones we mentioned in the body of this paper, the following conditions: implementing structural and institutional reforms such as the elimination of government regulations; eliminating rigidities in labor and

[12] We acknowledge and understand, as one of the referees alluded, that deterioration in the trade balance does not necessarily imply decreased trade or decreased benefits from trade. One of our main objectives in this paper, however, is to show that these counties have not faired better than what they were before the early 1990s.

financial markets; defining property rights; passing legislation to enhance competition; decontrolling wholesale and retail trade; creating an efficient infrastructure; designing an educational system that enhances productivity; creating a system of democracy with full participation of all citizens; and legislating land reform.

Overemphasis on export-led growth can even be counter-productive for countries striving for sustained economic growth. Export led growth strategies not only disregard internally existing market distortions but also exacerbate problems by creating more conflicts between the external and internal sectors of the national economies. This overemphasis may also lead to neglect of internal sectors (domestic consumption and investment, and government spending), which are the *major sources* of the supply capabilities. The effectiveness of trade also depends on how the trade revenues are used. For instance, these revenues should not be used for acquisition of military weapons, which are ultimately used to protect the interests of the privileged few and a few dictators who expropriate meager resources to send them abroad.

Furthermore, the economic and political constraints peculiar to this region put extra limitations on how much exports could be used as catalysts of economic growth. For example, most of these countries are ridden with corruption and there is a great potential for exports to be used as a means of looting the meager resources of these countries. Markets cannot function well if there is rampant corruption and significant rent-seeking behaviors by the ruling group. They cannot function at all if a large portion of the society is disenfranchised and cannot participate in the economy. The institutions cannot function properly in the absence of sound educational and healthcare systems.

Thus, even though reforming the external sector, as manifested mainly by decontrol of their exchange rates and increased openness, could be a good start, it is argued in this paper that the practice of targeting the external sector alone would not be the vehicle for *long-term* economic growth.

The results shown in this paper indicate that the euphoria was premature and the gains were short-term at most. The message, therefore, is loud and clear. To achieve high and sustained economic growth, policies must be geared not only towards the opening up of the external sector but those policies must also be accompanied with complete structural reforms. Opening up the external sector without allowing free trade of goods and services among the citizens themselves and without the free movement of resources within each country itself is a futile exercise. It is also about time to recognize and acknowledge without delay that the appearance of reform isn't indeed a true reform. Limited economic liberalizations are not enough to achieve the desired and sustained economic growth without complete structural reforms.

Table 1: Statistical Results		
Variable	Restricted	Unrestricted
Constant	2.15(4.166)	2.83(3.47)
Openness	1.46 (1.77)*	1.50(1.82)
$Growth_{t-1}$	0.132(5.00)*	0.13(4.96)*
$Year\ Dummy_{1991-2002}$		-2.43(1.07)
R^2	0.161350	0.162037
F-Statistic	3.335	3.309
Log-Likelihood	-4804.346	-4803.737
SSE	55944.27	55898.44
DW	2.06	2.054
Obs./total pool	1486	1486
SSE	59407.64	56305.85
Chow Test	$\frac{(55944.27 - 55898.44)/41}{55898.44/(1636-4)} = 0.03$	
Other coefficients	A set of Fixed cross effects	A set of Fixed cross and period effects
Notes: 1) Absolute t-values are in parenthesis; 2) (*) indicates significance at the 5% level; 3) the results were calculated using Eviews 5.		

Table 2: 5-year Average of the Variables shown in the Graphs									
Variable	1960-64	1965-69	1970-74	1975-79	1980-84	1985-89	1990-94	1995-99	00-02
Openness	0.3957	0.39356	0.54072	0.600488	0.53485	0.56361	0.51171	0.5521	0.69941
Ex. Balance	-3.8784	-3.8829	-6.4357	-11.2754	-12.797	-9.4132	-11.689	-10.936	-9.0205
gdp(%Δ)	4.0923	4.16523	5.63576	3.846348	2.43780	3.64284	1.32284	4.7819	3.64699
gdp/capita(%Δ)	1.7009	1.63372	2.87378	0.997998	-0.3520	0.81449	-1.1973	2.0744	1.316861
FDI	NA	5.30430	3.25301	4.7562	3.98842	7.41443	10.8502	16.148	14.6545
TT	NA	133.208	131.299	126.243	129.221	119.521	103.991	98.913	92.381
Manuf. Exports (% of total exports)	NA	7.5868	21.1193	21.354	15.3345	13.3581	15.1153	16.735	16.967

Table 3. Country Data Used In the Analysis			
Country	Restricted Model	Country	Restricted Model
Benin	Congo, Republic	Malawi	Seychelles
Botswana	Equatorial Guinea	Mali	Sierra Lion
Burkina Faso	Ethiopia	Mauritania	South Africa
Burundi	Gabon	Mauritius	Sudan
Cameroon	Gambia	Mozambique	Swaziland
Cape Verde	Ghana	Namibia	Tanzania
Central Africa	Guinea	Niger	Togo
Chad	Guinea Bissau	Nigeria	Uganda
Comoros	Kenya	Rwanda	Zambia
Congo, Democratic rep.	Lesotho	Senegal	Zimbabwe
	Madagascar		

Figure 1: Openness1- as measured by x/(gdp-x)

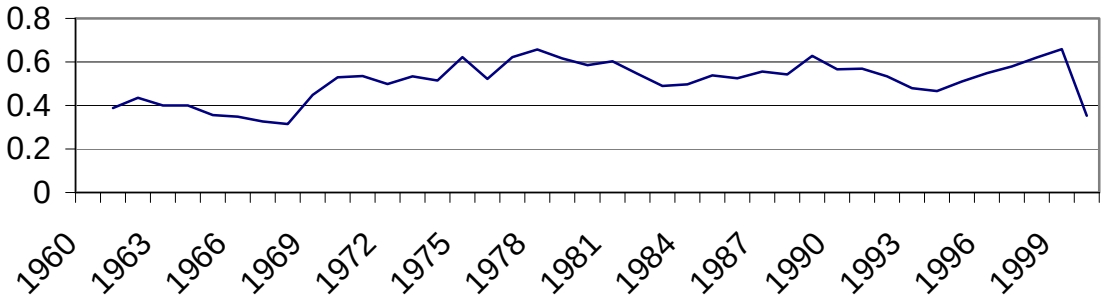


Figure 2: Openness2-as measured by (x+m)/gdp

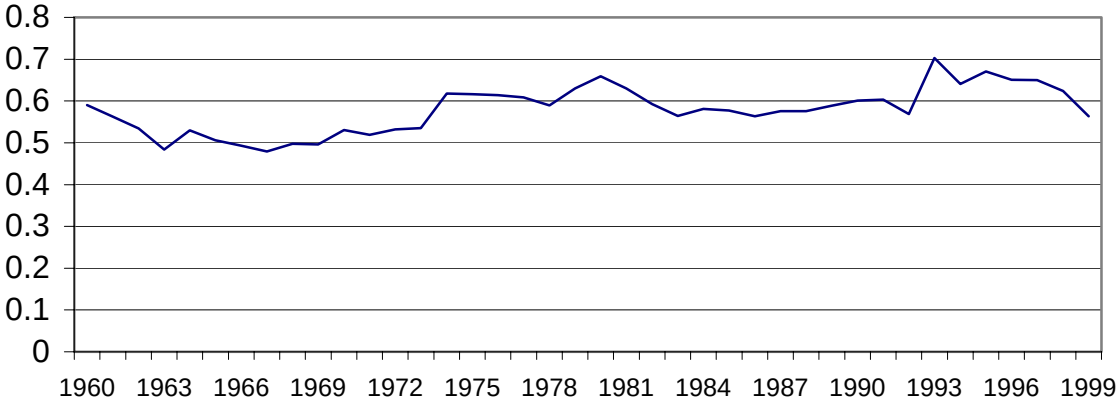
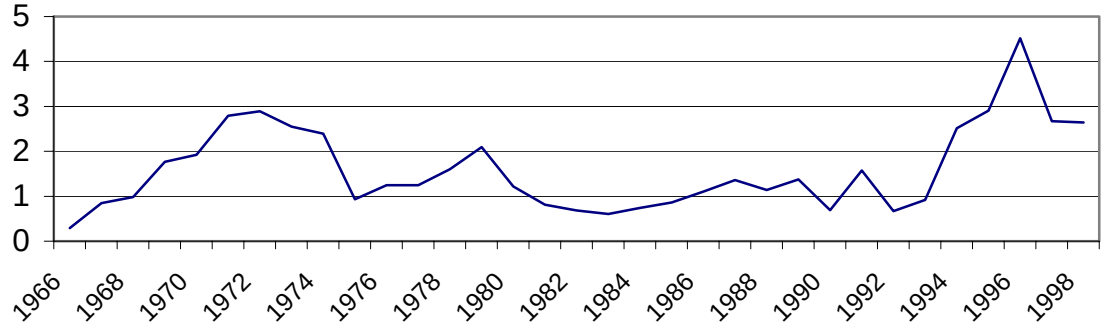


Figure 3: FDI as % of GDP



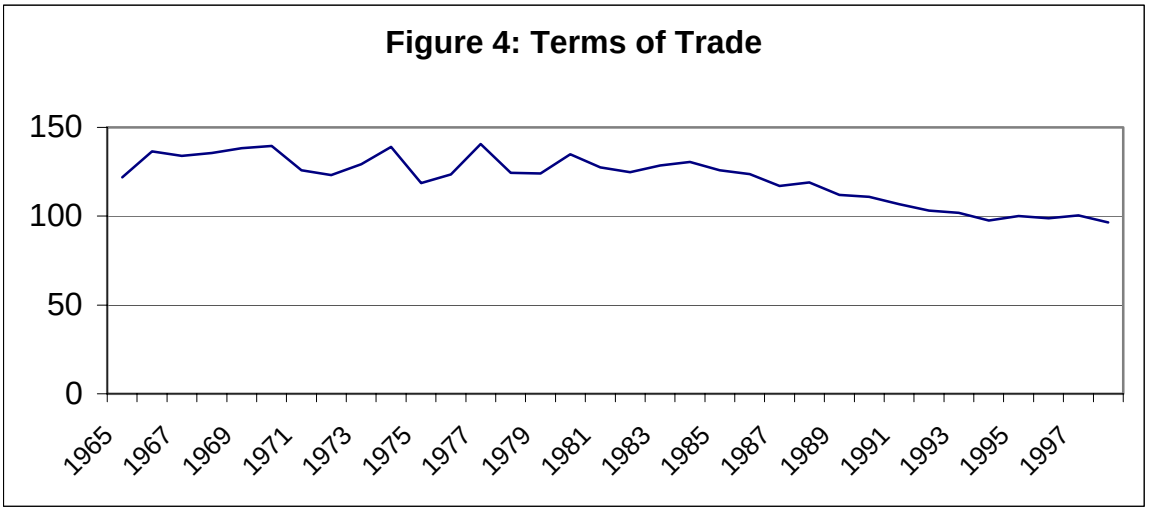


Figure 4: Terms of Trade
150
100
50
0
1965
1967
1969
1971
1973
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
1995
1997

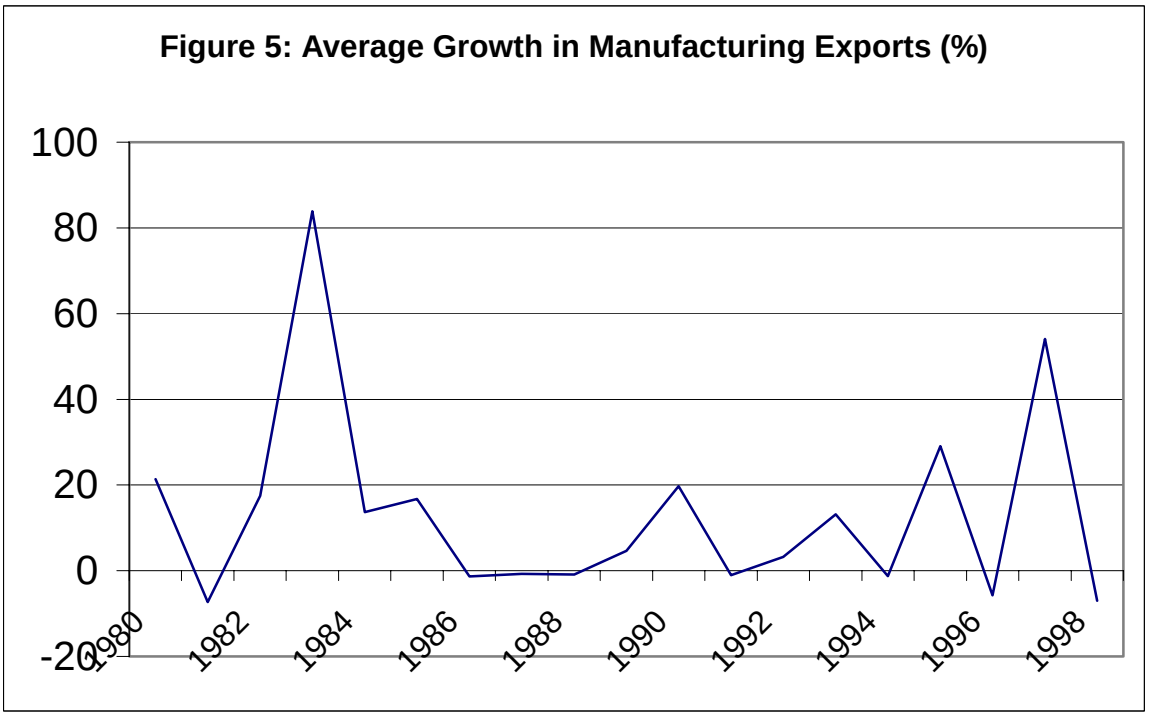


Figure 5: Average Growth in Manufacturing Exports (%)
100
80
60
40
20
0
-20
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998

Fig. 6. Manufacturing Exports as a % of Total Exports

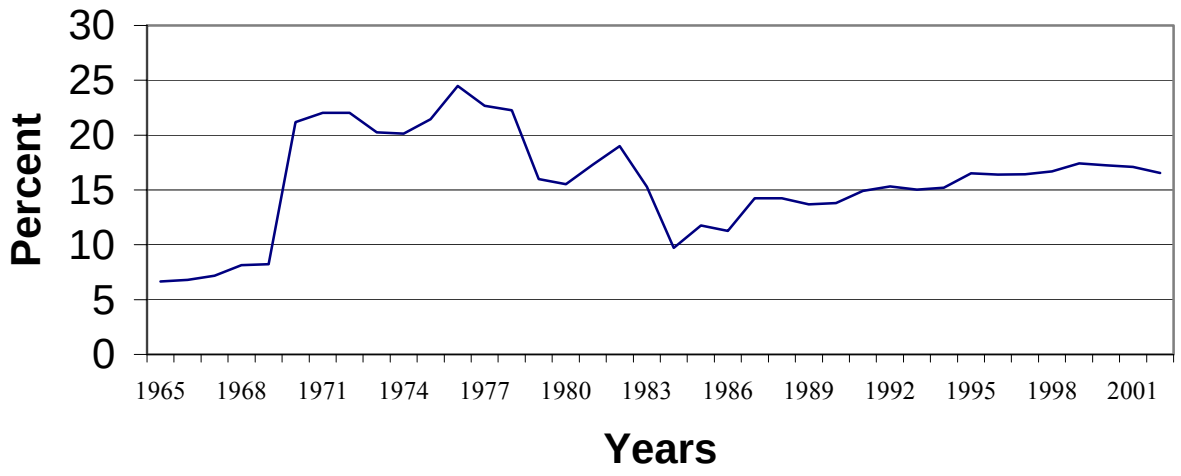
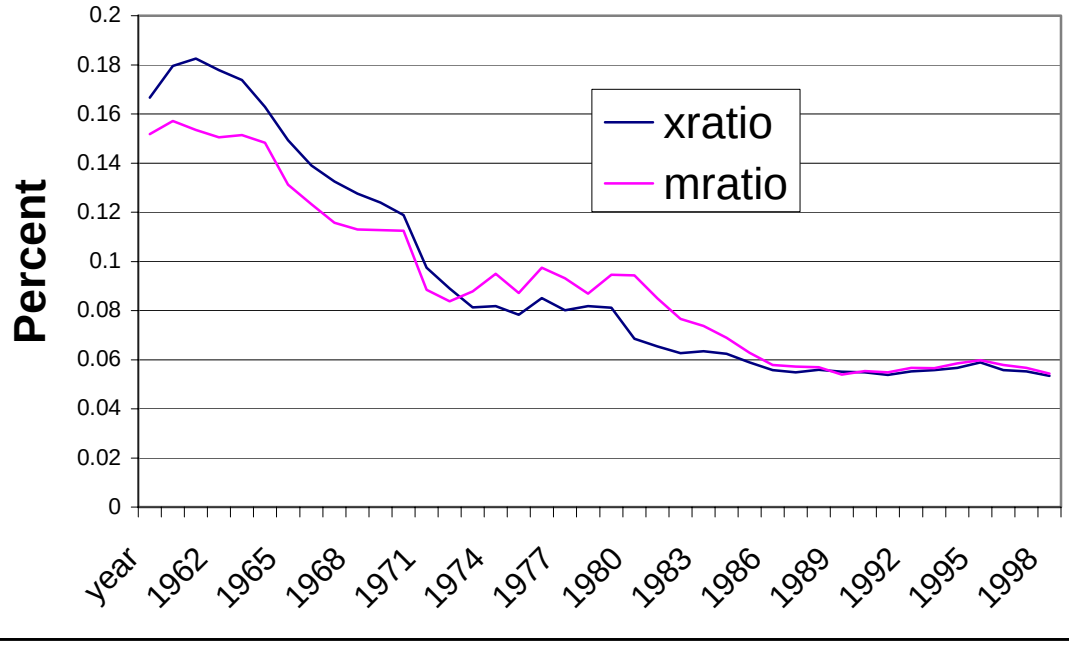


Figure 7: Africa's Share of World Trade



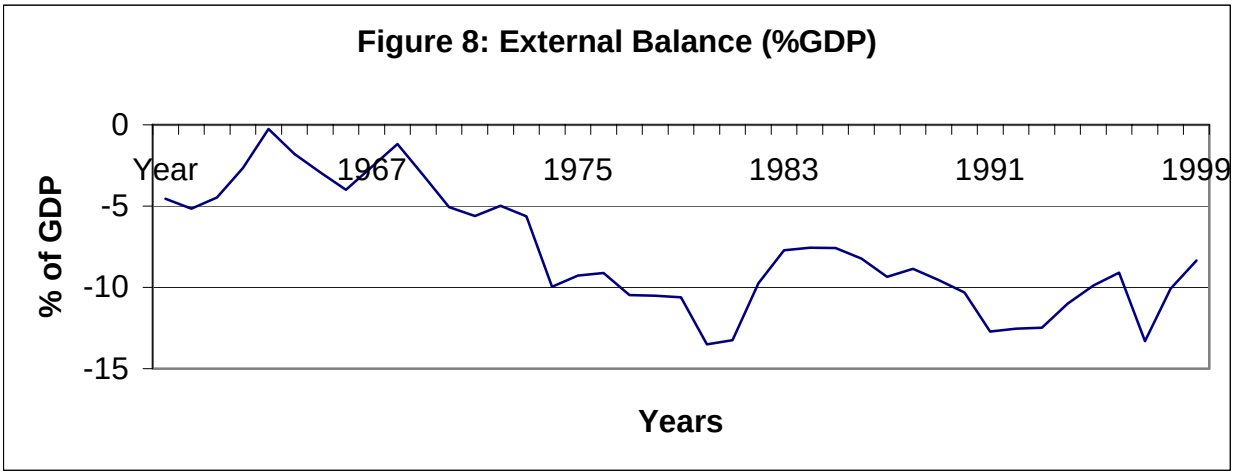


Figure 8: External Balance (%GDP)
0
-5
-10
-15
% of GDP
Year
1967
1975
1983
1991
1999
Years

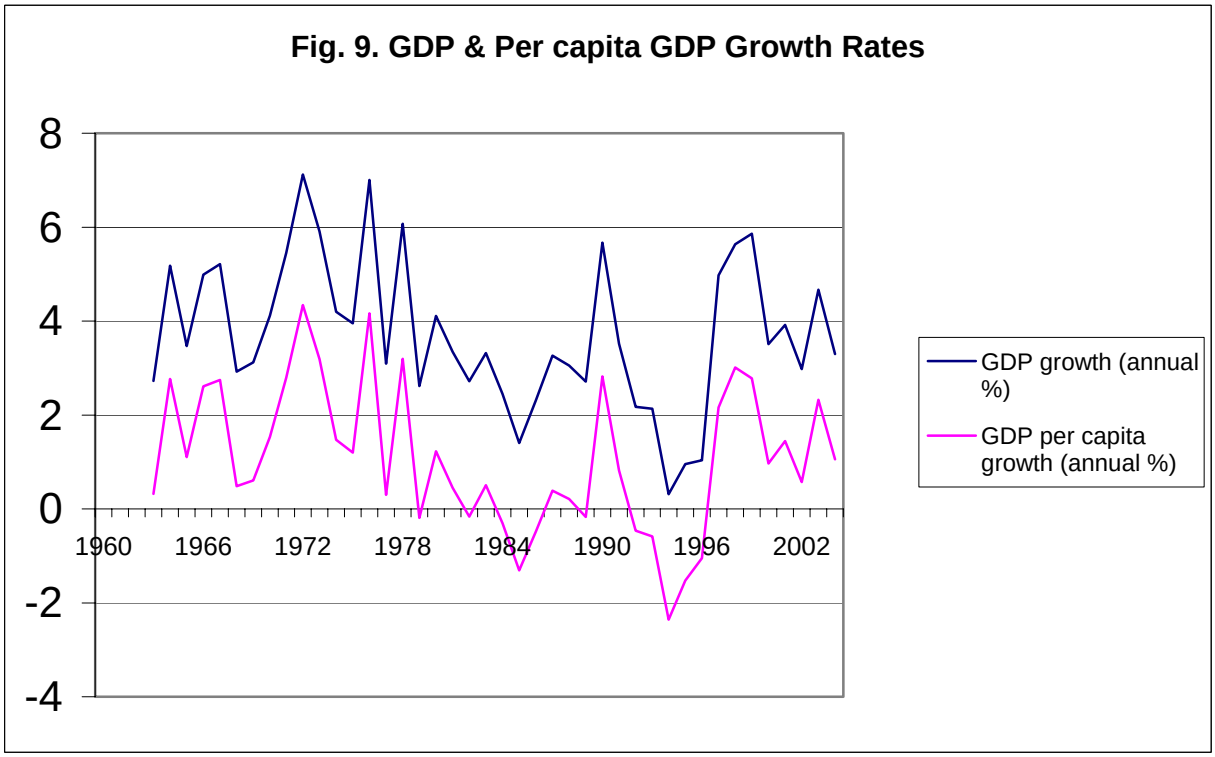


Fig. 9. GDP & Per capita GDP Growth Rates
8
6
4
2
0
-2
-4
1960
1966
1972
1978
1984
1990
1996
2002
GDP growth (annual %)
GDP per capita growth (annual %)

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And the Oscar Goes to…
A Logistic Regression Model for Predicting Academy Award Results

David Kaplan*

Abstract

The Academy Awards present a unique opportunity to explore voter preferences. Every year the Academy of Motion Picture Arts and Sciences vote for the Best Picture of the Year. There are many influences to their decision. This study seeks to survey and weigh these influences. This paper analyzes the previous forty years of Best Picture nominations for characterizations including personnel, genre, marketing and records in other award competitions. Using a logistic regression model, each variable's effect on the odds of a given film winning the Best Picture Award is estimated. This paper also calculates the odds for previous nominees and compares those odds to the films' actual record at the Oscars.

I. Introduction

The Academy of Motion Picture Arts and Sciences annually presents awards for excellence to the previous year's films, filmmakers, actors, artists and technicians. The Academy has presented these awards since 1929, and so the awards carry a long history of tradition. An Academy Award, also known as an Oscar, is a mark of distinguished accomplishment. It comes with instant recognition for the recipient who in turn reaps the immediate rewards of publicity, fanfare, and an increase in demand for one's ability or product. The following study attempts to create a model for predicting the winner of the Academy Award for Best Picture.

The Academy of Motion Picture Arts and Sciences consists of 6,000 motion picture professionals. In January, members nominate five individuals or films in every category with which they are concerned. For example, only directors nominate individuals for Best Director. All members nominate for the Best Picture award. After the Academy announces the five leading candidates in each category, the Academy sends final ballots to all Academy members, who must view every film and vote in every category. The winners are announced at the Award Ceremony, which has become one of the most watched television events in the world. (Academy of Motion Picture Arts and Sciences, 2003)

The Oscar for Best Picture is the crown-jewel of the Academy Awards. A list of previous winners is a roll call of the greatest films ever made. Thirty-three of the films on

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the American Film Institute's 100 Greatest Films were Academy Award Best Picture Winners. Seventy-five of the films were Academy Award Best Picture Nominees. (American Film Institute, June, 1998) Even though a Hollywood cliché says 'it's an honor just to be nominated,' the prestige and financial rewards of winning the Best Picture award motivate film producers to create the highest quality work. Producers can hire the best and most important directors. They can hire the most accomplished and talented actors. They can choose which types of films to make by genre, style and scope. They can market the film to emphasize its Oscar-worthiness. Through appropriate choices, producers can make optimally competitive films in the hope that they will win a Best Picture nomination and award. The goal of this study is to identify the important factors that influence the Academy's selection using a logistic regression model. With that knowledge filmmakers can tailor their work to increase the probability that their film will win the Oscar, and casual viewers of the award ceremony can predict the winner.

II. Winning the Award

This paper employs three categories of variables that influence a film's likelihood of winning the Best Picture award: Personnel, Genre, and Marketing. Personnel decisions include which director and actors to hire. Genre decisions include which style movie to make. Marketing decisions include length of movie, source of material and release date.

Making a film is an exercise in both business and artistry. A quality product depends on critical decisions as related to the creative team employed. Emanuel Levy (1987), renowned film critic and writer, emphasizes the role of the director in his book And the Winner Is...: The History and Politics of the Oscar Awards. The producers of a film charge the director with the duty of crafting a film from his or her vision. This charge includes creative controls relating to casting, hiring a technical crew, finalizing a script, choosing film locations, and editing. Because of Levy's emphasis, this paper measures a director's capability, experience and craftsmanship by his or her lifetime record in previous Academy Award ceremonies.

The actors are the face of a film. Since voters view all the films, actors influence voters through the power of their performance. Some actors are capable of giving award-winning performances, and have done so repeatedly. Actors bring with them their experiences, previous roles, and motivation to a film. In a similar way, audiences and critics carry a connection to certain actors. Drew Casper at the University of Southern California[1] argues that actors play an important role in filmmaking. For this reason, this paper measures an actor's accomplishments and talent by his or her lifetime record in previous Academy Award ceremonies.

The genre of a film dictates the story, style and scope. The selection of a genre is a determined process, rooted in an understanding of cinematic and narrative traditions. When one makes a comedy, science fiction, or horror movie, certain specific elements are

[1] The author attended the film school at U.S.C where Dr. Casper chairs the critical studies department.

expected. The Academy traditionally responds to certain types of films. In his paper An Index of Oscar-Worthiness, Professor Andrew Bernard (2005) discusses the significance of a comedy designation for a film. His prediction model suggests that a comedy is less likely to win an Academy Award.[2] The model used in this paper has been expanded to include categories for musicals, epic films, and biographic pictures. Emanuel Levy describes the importance of "high production value, visual style, and epic vision" (1987, p. 176) to the Academy, which is why epic films are designated. Musicals are categorized to distinguish between comedies and musicals that the Golden Globes include in the same category. Biographic films were included to test the researcher's own hypothesis. Epic and biographic classifications will be explained in more depth later in the paper.

The marketing of a film for Oscar success often involves creating interest, building momentum, and generating both critical and box office success as the Academy fills the ballots. Many Hollywood producers will save their potential Oscar candidates for release in the fourth quarter. Voters then see the films in theatres right before the ballots arrive in order to build support and recognition. I include fourth quarter release to determine if this strategy is successful. Another marketing choice is the length of the film. This choice can be purely artistic, but can also be influenced by executive screenings and pre-release audience screenings, in which audiences can rate the film as being too long or too short. Considering that "the running time of over half of the winners have been over the average [of all released films] of 100 minutes," (Levy, 1987, p. 176) this paper includes length of the film in the model. Another useful marketing tool is making a film based on previously released work, like books and plays, especially successful and recognizable material. This paper categorizes the films on whether they were adapted works or not.

Another important variable in the prediction model is the film's success at previous award ceremonies. Although the Academy Awards are the most important and prestigious awards, films earn recognition by winning other awards, such as the Golden Globes or the Director's Guild of America (DGA) Award. The results of these other ceremonies help measure the popular and critical approval of a film and the quality of performance by filmmakers and actors. Professor Bernard's model (2005) uses results from the Golden Globes, which are presented by the Hollywood Foreign Press Association, a Southern California journalist organization. The Director's Guild of America Awards are presented by an organization of over 12,000 film directors, and the bases for including this award are Levy's emphasis on directors and Bernard's emphasis on previous award results.

III. Data Collection and Methodology

Cross-sectional data to estimate the model were collected through two film databases: Videohound's Golden Movie Retriever, edited by Jim Craddock, and the Internet Movie Database (IMDB). The data contain observations for the 200 films

[2] Bernard's data was based on film descriptions from Netflix® an online rental service. My data is based on the Golden Globe's designation between drama and comedy.

nominated for the Best Picture Oscar from 1965 to 2004. For each film the independent variables collected from these sources include the number of nominations at the Oscars, the results from the Golden Globes and DGA Awards, the directors' and actors' respective records at previous Oscars, the length of the film, the film's first release date in the US, the film's genre designation, and whether the film was adapted from a previous work.

The directors' and actors' records of previous awards involved reviewing the credits for each film in the Videohound guide and then comparing the director and cast members from each nominated film to the historical record of the Academy Awards[3]. The historical record also provided the data on each film's Oscar nominations. The Videohound guide provided the data on whether a film was an adapted work or not.

The web pages for each of the films on the Internet Movie Database contained the data for length of film and release dates. The film was classified as Postmodern if the film's release date was 1977 or later.

This paper designates the genre for each film using specific criteria. To be classified as a comedy or a musical, the Golden Globes had to nominate the film in a Comedy/Musical category. If that was true and the film had musical numbers that forwarded the narrative, then the film was a musical. If a film had no musical numbers that forwarded the narrative, then the firm was a comedy. If the Golden Globes nominated a film in a drama category, it was a non-comedy, non-musical. If the Golden Globes did not nominate the film, film descriptions on IMDB and in the Videohound guide were used as the secondary method.

To be classified as an epic film, the film had to have large scope, a sophisticated visual style that included set locations and costumes, and a hero. When in doubt, I checked the descriptions on IMDB or in the Videohound guide for the word 'epic', and used that as the final judgment. This variable obviously reflects the researcher's own subjective evaluation. To test for potential bias, the epic variable was not included in Model 4.

To be classified as a biographic film, the narrative had to be based, in some part, on a true story. This designation did not include fantasy movies about actual people, like Shakespeare in Love or fictionalized stories based on true events, like Platoon. This classification included films that glamorize and stylize real stories, like Gladiator. I used the descriptions of the films and the source of the adapted work, where applicable, as my guide. Since this variable also reflects the researcher's own subjective evaluation, the biographic variable was not included in Model 4 to test for potential bias.

In many of the personnel categories this paper attempts to measure the importance of competition. After all, it is called 'The Oscar Race.' Each film was compared with the

[3] The historical record of Academy Awards found in the appendix of the Videohound Guide

other films in its nomination group. Films were designated for having the most nominations, the most previous director nominations, the most previous director wins, the most previous actor wins, and for being the longest movie. When there was a tie, both films were designated as having the most or being the longest.

IV. Specification

Since this paper attempts to estimate the probability of that a film wins the Oscar for Best Picture, the dependent variable is binary and the relationship between the independent and dependent variables is non-linear. In a linear probability model the probability results are not bounded between 0 and 1. Also, a linear probability model has inherent heteroskedasticity and tends to produce low R^2 results. A logistic regression model is preferred because it solves the boundlessness problem. Table 1 defines each variable and provides descriptive statistics.

Although there have been other Oscar prediction models that recommend the inclusion of independent variables, the literature was often less persuasive in assigning expected signs. All of the variables therefore have an ambiguous expected sign. The statistical significance of parameter estimates was tested using two-sided tests.

Table 2 shows the expected signs and results of several different estimates of the model. Using SAS, the logistic regression model was initially estimated using all independent variables, and these results are known as Model 1. Mathematically, Model 1 is:

$$\text{Ln}\,(BESTPIC_i/[1+ BESTPIC_i]) = \beta_0 + \beta_1 TOTALNOM_i + \beta_2 MOSTNOM_i + \beta_3 GGWINCOM_i + \beta_4 GGWINDRAMA_i + \beta_5 MUSICAL_i + \beta_6 COMEDY_i + \beta_7 EPIC_i + \beta_8 BIOP_i + \beta_9 EPICBIOP_i + \beta_{10} PREVDIRWINS_i + \beta_{11} MOSTPREVDIRWINS_i + \beta_{12} PREVDIRNOMS_i + \beta_{13} MOSTPREVDIRNOMS_i + \beta_{14} GGDIRWIN_i + \beta_{15} DGAWIN_i + \beta_{16} PREVACTWIN_i + \beta_{17} CURACTNOMS_i + \beta_{18} GGACTWINS_i + \beta_{19} RELEASE_i + \beta_{20} TIME_i + \beta_{21} LONGEST + \beta_{22} ADAPTi + \varepsilon_i$$

To test for specification error Model 1 (results not shown in Table 2) was also estimated using the square of the $TIME_i$ variable. Model 2 removes all of the potentially insignificant variables from Model 1 in order to run a χ^2 test. Model 3 includes $GGWINCOM_i$ in order test for significance after having removed the other insignificant variables. Based on the literature review, $GGWINCOM_i$ should be significant. Model 4 removes the variables $EPIC_i$, $BIOP_i$, and $EPICBIOP_i$. Model 5 estimates the relationship using ordinary least squares in order to test the logistic model for multicollinearity. This model is not to be used for accurate prediction. Model 6 (results not shown in Table 2) uses a Hausman test to check for changes in the parameter estimates during the post modern era. All of the explanatory variables from Model 3 are included, along with a dummy variable $POSTMODERN_i$ and the products of the explanatory variables with $POSTMODERN_i$,.

V. Results

As shown in Table 2, Model 1 included all independent variables in the model, but only eight of the 22 independent variables were significantly different from zero. The results suggest that a film is more likely to win if the film received the most nominations, if the film won the Golden Globe Award for Best Picture in the Drama category, if the film was an epic and a biography, and if the film's director won the DGA award. A film was less likely to win if the film was a biography, if the film's director won the most previous Best Director awards, and if film's director won the Golden Globe for Best Director. Also, a film is less likely to win as the number of Best Director awards for the film's director increase. The model's percent of concordance is 98.5 and the maximum rescaled R^2 is .8373. The Hosmer and Lemeshow Test's Wald Chi-Square statistic probability is .9979. Small p-values indicate inadequate fit (University of Kentucky, 3/3/05).

My first concern was that Model 1 might be specified incorrectly. $TIME_i$ might need to be specified with a polynomial function. Historically, a short film has been less likely to win than a longer film. The likelihood of winning might also decrease if the film is too long. To test this theory Model 1 was re-estimated with $TIME_i$ and $TIME_i^2$, the square of length of film in minutes. Both were insignificant, with chi-square probability values of .82 and .64, respectively.

My second concern was that the model suffers from imperfect multicollinearity, which increases estimated standard errors, decreases t-statistics, and increases the likelihood of a Type II error. The method of checking for multicollinearity involved two steps. Correlation coefficients were reviewed to detect high correlation between two independent variables. Variance inflation factors (VIF) were estimated to measure the severity of any multicollinearity. If an independent variable was highly correlated with another variable, had a high VIF score, and had a low t-score, then that variable was judged to be multicollinear with another variable.

Pearson correlation coefficients suggested three sets of partially correlated variables. The correlation coefficient was .72 between $TOTALNOM_i$ and $MOSTNOM_i$, .86 between $PREVDIRWINS_i$ and $MOSTPREVDIRWINS_i$, and .67 between $PREVDIRWINS_i$ and $PREVDIRNOMS_i$. The first two problematic correlation coefficients are between variables that are combinations of each other. The higher the amount of total nominations that $FILM_i$ has, the more likely $FILM_i$ will have the most nominations. A similar relationship exists between $PREVDIRWINS_i$ and $MOSTPREVDIRWINS_i$.

VIF scores were calculated by running an OLS regression using all explanatory variables (Model 5). The VIF scores highlight one potential problem. $PREVDIRWINS_i$ has a VIF of 6.11. This variable is significant in the linear probability model, but insignificant in the logistic regression model. I believe that PREVDIRWINSi does suffer from multicollinearity. But dropping $MOSTPREVDIRWINS_i$ from Model 1 does not

make $PREVDIRWINS_i$ significant. Considering that $PREVDIRWINS_i$ and $MOSTPREVDIRWINS_i$ are both insignificant, they will be included in the joint hypothesis test for significance to be discussed later. $TOTALNOM_i$, $MOSTNOM_i$ and $PREVDIRNOMS_i$ all have acceptable VIF scores, and so multicollinearity did not have adverse effects on their t-statistics.

Model 1 seems to be specified correctly. The variables are not severely affected by multicollinearity. The strongest and simplest explanation for the low t-scores and low chi-square scores on 14 explanatory variables is that the parameter estimates are insignificant. The joint hypothesis that these variables are zero could not be rejected using an F-test (Wald Chi-Square Statistic: 9.8324; Pr > ChiSq: .7743).

Model 2 removes those insignificant variables and re-estimates new parameters. All explanatory variables continue to have the same sign as in Model 1 and all are significant. Model 2 neither fits as well as Model 1, nor predicts results as accurately. The maximum rescaled R^2 value decreased to .7854, the percent of concordance decreased to 97.4 and the Hosmer and Lemeshow Test's Wald Chi-Square statistic probability decreased to .937. Since the literature suggests that genre designation for comedy and the results of the Golden Globes are important and both variables have been removed from Model 2, I believe that Model 2 is less accurate due to omitted variable bias.

To address this issue, Model 3 includes $GGWINCOM_i$ with the rest of Model 2's specification. $GGWINCOM_i$ and $GGWINDRAMA_i$ take into account the full results of the best picture awards at the Golden Globes, and so they both need to be included. Five out of the forty Oscar winners won the Best Picture-Comedy award at the Golden Globes and twenty-two out of the forty Oscar winners won the Best Picture-Drama award at the Golden Globes. All nine explanatory variables in this model are statistically significant. Including both variables in Model 3 alleviated omitted variable bias on $GGWINDRAMA_i$. The coefficient on $GGWINDRAMA_i$ increased from 2.7471 to 3.6073 when $GGWINCOM_i$ was included and its t-statistic also increased. Including $GGWINCOM_i$ also partially accounts for the comedy genre designation. The benefit of including $GGWINCOM_i$ in Model 3 is a better goodness-of-fit. Model 3 has an increased maximum rescaled R^2 of .8007, an increased percent of concordance of 97.7, and an increased Hosmer and Lemeshow Test's Wald Chi-Square statistic probability of .9903. Because of its significance and accuracy, Model 3 will be used to determine the probabilities of $FILM_i$ winning the Best Picture Academy Award.

The parameter estimates of Model 3 are difficult to interpret out of context. A positive parameter estimate means that an increase in that variable will lead to an increased probability of winning a Best Picture award, ceteris paribus. To quantify that increase, the parameter estimate must be transformed using an antilog function. This output, called the odds ratio, shows the effects of each variable on the odds of winning ceteris paribus and is shown in Table 3. If $FILM_i$ earns the most nominations, its odds of

winning increase by a multiple of 15.78, ceteris paribus.[4] So if $FILM_i$ originally has a 1/100 (1%) chance of winning, by earning the most nominations, $FILM_i$ will then have a 15/100 (15%) chance. Or if $FILM_i$ hires Director A with 3 previous Best Director nominations, rather than Director B with 2, its odds of winning decrease by a multiple of .36, ceteris paribus. So if $FILM_i$ originally has a 1/10 (10%) chance of winning with Director B, by hiring Director A instead $FILM_i$ will then have a 3.6/100 chance (3.6%).

The parameter estimates of Model 3 yield the following equation for the fitted value of the natural log of the odds of winning the Oscar:

$$\ln (BESTPIC_i/[1-BESTPIC_i]) = -4.2836 + 2.7589(MOSTNOM_i) + 1.962(GGWINCOM_i) + 3.6073(GGWINDRAMA_i) + -1.7059(GGDIRWIN) + -4.0916(BIOP_i) + 6.4702(EPICBIOP_i) + -1.0221(PREVDIRNOMS_i) + 5.7281(DGAWIN_i) + -1.1888(PREVACTNOM_{i)}.$$

By substituting specific values for the explanatory variables, the equation yields the fitted index value representing the natural log of the odds. This index can then be transformed into the probability of winning, where the probability is equal to $1/(1+ e^{-INDEX})$. Columns A – G of Table 4 shows estimated probabilities of winning the Academy Award for Best Picture for films having seven different sets of values for the explanatory variables.

Column A illustrates a hypothetical $FILM_i$ that has the most nominations, wins the Best Picture-Drama Golden Globe award, has a director with two previous Best Director nominations, and has a cast with two previous Best Actor Nominations. This movie has an 8.8% probability of winning the Academy Award.

Column B illustrates a similar case but the director also wins the DGA Award; this film now has a 96.7% probability of winning the Academy Award. The film is now 10.98 times more likely to win. This transformation shows the importance of winning the DGA Award. The DGA follows a procedure similar to that of the Academy, and the two groups share many of the same voters. Its voting process precedes the Oscar voting process by a week. Since the DGA is an organization of professional directors, members most likely make their selection based on artistry and craft rather than a marketing campaign. Based on the results of winning the DGA award, producers who want to win the Best Picture should always choose directors capable of creating a film of high quality. And viewers who want to predict the winner of the Best Picture should have a very good reason to not select the film whose director won the DGA award.

Column C illustrates hypothetical $FILM_i$ that has the most nominations, wins the Golden Globe Best Picture-Drama award, has a director with two previous Best Director nominations, has a cast with two previous Best Actor nominations, is a biographic film, and has a lead actor with 3 previous Best Actor nominations. The probability of winning

[4] This model is restricted by conditional probability. The data is only collected for films nominated for the Best Picture. So where Director B may have less of a chance than Director A does of winning, Director B may have a greater chance of being nominated than Director A. Further analysis into the nomination process would be necessary to clarify this condition.

decreases to 0.05%, and this film is now 19.24 times less likely to win. Column D illustrates the case where the producer also takes on the financial burden of producing an epic biographic film. The probability increases to 24.06%.

Column E illustrates the case where the producers decide to hire an unknown cast rather than big name stars for their epic biographic film. The probability increases to 91.8%. Historically, many acclaimed actors have repeatedly been nominated for Best Actor awards, even though their past films have not won Best Picture awards. Meryl Streep, for example, has been nominated thirteen times, but none of her films have won the Best Picture award since *Out of Africa* in 1985. This suggests that acclaimed actors are less important than the director in identifying the Best Picture.

Column F illustrates the case where the producers also realize they cannot afford a quality technical crew to edit, light, design the sound, do the make-up and design costumes, which in turn deceases the total number of nominations for the film. The probability decreases to 41.5%, which shows the importance of hiring a quality film crew.

And finally, in Column G, if the producer chooses to hire a quality crew that gets many technical nominations and a quality director who goes on to win the DGA award for making an epic biographic film with a big name star, then this film has a 99.7% chance of winning the Best Picture Oscar. In this situation, changing the amount of previous Best Actor nominations has minimal effect on the probability. It would take a cast with six previous nominations to lower the probability to below 90%. And this same film with a cast that has zero previous nominations has a probability of 99.97%.

The data for this model span the modern and postmodern eras in Hollywood. The modern era from 1960 to 1977 is characterized by an emphasis on certain dramatic genres, more realistic character portrayals, and the birth of a modern class of directors and actors. The post-modern era began in 1977 with the release of Star Wars, which changed Hollywood into an event culture. Post-modern films are characterized as having been made by directors, cast and crew members who have been influenced so strongly by films of previous eras that the new films begin to look like films that have already been made. The Academy, a stronghold of tradition, may have been able to withstand this transformation and continue to award the same kinds of films. Or maybe the Academy has also been influenced by the post-modern era and now awards films with different criteria. A Hausman test is required to measure any change in the parameter estimates that may occur as a result of this transition. Model 3 was re-estimated using additional explanatory variables. Included were $POSTMODERN_i$ a dummy variable that equals 1 if the film was released after 1977 and zero otherwise, and the product of $POSTMODERN_i$ and each of the remaining explanatory variables. The joint null hypothesis that $POSTMODERN_i$ and the interaction variables are zero could not be rejected. There is no evidence in this model that the parameters change between the modern and postmodern eras of Hollywood.

One final concern I would like to address is omitted variable bias. Originally I wanted to specify the model with variables representing $FILM_i$'s budget and $FILM_i$'s box office success. Budget might be significant for representing size and scope of $FILM_i$. Box office success might be significant for representing the popularity of $FILM_i$. These data observations were mostly unavailable. In addition, film budgets have changed drastically over the past 40 years due to advances in technology, increases in marketing and advertising costs, and the destruction of the studio system which suppressed actor wages. In the current labor system actor salaries are a much bigger percent of the budget. $FILM_i$ made in the 1960s would be much less expensive to make then in the 1990s due to all of these rising costs. Box office success is not a fair assessment of popularity because of varying film release dates. A film released in January has an entire year to earn revenue, while a film released in December only has a few weeks. Opening weekend revenues are difficult to use and potentially inaccurate. Opening weekend revenue statistics have only recently been collected, making it nearly impossible to find them for earlier films. Also some films' revenue streams begin slowly but thanks to word-of-mouth reviews and media support, they become "Oscar Darlings," a phenomenon seen most recently in *Million Dollar Baby*'s upset over *The Aviator.* The omission of these variables may cause bias if the Academy does in fact rely on these variables for their decisions.

VI. The Historical Record

Model 3 has a percent of concordance of 97.7%. To determine the percent of concordance, SAS analyzes all of the calculated probability values. If $FILM_i$ has a probability value over 50% and wins the Best Picture, $FILM_i$ is concordant. If $FILM_j$ has a probability value under 50% and does not win the Best Picture, $FILM_J$ is also concordant. If $FILM_i$ has a probability value over 50% and does not win the Best Picture, $FILM_i$ is discordant. If $FILM_i$ has a probability value under 50% and wins the Best Picture, $FILM_i$ is discordant. And if $FILM_i$ has a probability value of 50%, it is a tie.

While this statistic measures the accuracy of the model, it is also important to ask how well the model predicted the actual results. For each nomination group, the probability values were compared to see whether the film with the highest probability value won the award. Model 3 accurately predicted thirty-four out of forty Best Picture winners, giving it a success rate of 85%. The six incorrect predictions were for films regarded as upsets. *Million Dollar Baby* and *Shakespeare in Love* were both small independent films that won over big epic biographic films. *Chariots of Fire* defeated *Reds* and *Out of* Africa defeated *The Color Purple* even though *Reds* and *The Color Purple* had the most nominations respectively. A full list of upsets, false positives, false negatives, and close races can be found in Appendix I.

I would like to briefly discuss another model. Although it may suffer from potential calculation problems, this model managed to be more significant and produce more accurate results than Model 3. During my research I noticed that every Best Picture winner was nominated for the Best Director award. Every year there are Best Picture nominees that are not nominated for the Best Director and no such film has ever won

Best Picture. By including $CURDIRNOM_i$ in Model 1, the model can distinguish whether $FILM_i$'s director is nominated for Best Director. This final specification removed the insignificant variables after running a joint hypothesis test on the whole model. The model's percent of concordance is 98.3, the maximum rescaled R^2 is .8642 and the Hosmer and Lemeshow Test's Wald Chi Square statistic probability is .9983. The model correctly predicted thirty six out of the forty Best Picture winners for a success rate of 90%. No film has ever won the Best Picture award if it was not also nominated for Best Director. This creates a mathematical predicament for this model since it cannot account for a scenario in which a Best Picture winner is not nominated for Best Director award. Although it has never happened, perhaps there is a theoretical chance that it could. To fix the model, a selection model could be built which would quantify the process for nominating the Best Director awards. Then the results from that selection model could be included along with $CURDIRNOM_i$ to fully account for the effects of the Best Director nomination.

VII. The Envelope Please

Much like the accountants at Price-Waterhouse-Cooper, who painstakingly calculate and tally the Academy votes, this paper has calculated the most important variables for winning an Academy Award for Best Picture. And the winners are: $EPICBIOP_i$, and $DGAWIN_i$. With either of these characteristics, $FILM_i$'s odds of winning increase by a multiple of 645.612 and 307.38 respectively. $MOSTNOM_i$ and $GGWINDRAMA_i$ should be honored to be nominated because they also strongly affect the selection but not with the same magnitude as $EPICBIOP_i$, and $DGAWIN_i$.

There are significant financial benefits from winning a Best Picture award. Chris Hewitt of the film magazine Empire says "If a film gets two or three of the big Oscars - such as best film, best actor and best director - it can go on and really clean up at the box office…Success at the Oscars gives a film a second wind at the box office." (BBC News, *Cashing in at the Oscars*, 2/20/04) For example American Beauty earned an estimated seventy million dollars at the domestic box office before the award show. After winning Best Picture, American Beauty earned another sixty million domestically. A Best Picture winner has a longer shelf life in the theatres and a higher demand for rentals and DVD sales. There are also benefits for the director and actors involved who can ask for higher wages afterwards, demand more creative control, and choose their own projects.

The directors should also take note of this prediction model. During contract negotiations, a director can show his or her significance in winning a Best Picture award. Directors should use this information to demand more money, specifically by negotiating performance bonuses for winning the Best Picture award, being nominated for the Best Director award and winning the DGA award. Continued research in this field could lead to a prediction model for the DGA awards and for the Academy nomination process. By knowing the important factors for winning the DGA award and tailoring $FILM_i$ to those criteria, a director could have an even greater impact on the probability of winning the Best Picture Academy Award.

This prediction model will be most useful though for the viewers of the Academy Awards. Because of conditional probability, this model represents the odds of already nominated films winning the Best Picture Award. So at the beginning of each New Year when the Academy presents its nominees, viewers at home who use this prediction model will have a more accurate forecast of the winner.

A Disclaimer: Betting on the Academy Awards is illegal in the United States, even Las Vegas. This prediction model should only be used to obtain bragging rights, to impress friends and family, or to win money from British bookies, who can take bets on award shows.

Table 1. Variable Definitions and Descriptive Statistics.

Variable	Mean	Min.	Max.	Description
$BESTPIC_i$	.2	0	1	Dummy variable equal to 1 if $FILM_i$ won Best Picture, 0 otherwise.
$TOTALNOM_i$	7.36	2	14	Number of nominations received by $FILM_i$.
$MOSTNOM_i$	.28	0	1	Dummy variable equal to 1 if $FILM_i$ received the most nominations, 0 otherwise.
$GGWINCOM_i$	.13	0	1	Dummy variable equal to 1 if $FILM_i$ won the Golden Globe Best Picture-Musical/Comedy award, 0 otherwise.
$GGWINDRAMA_i$	.2	0	1	Dummy variable equal to 1 if $FILM_i$ won the Golden Globe Best Picture-Drama award, 0 otherwise.
$GGWINCOM_i$	.33	0	1	Dummy variable equal to 1 if $FILM_i$ won either Golden Globe Best Picture award, 0 otherwise.
$MUSICAL_i$	.05	0	1	Dummy variable equal to 1 if $FILM_i$ was a musical, 0 otherwise.
$COMEDY_i$	.165	0	1	Dummy variable equal to 1 if $FILM_i$ was a comedy, 0 otherwise.
$EPIC_i$	.21	0	1	Dummy variable equal to 1 if $FILM_i$ was an epic, 0 otherwise.
$BIOP_i$	.255	0	1	Dummy variable equal to 1 if $FILM_i$ is a biographic film, 0 otherwise.
$EPICBIOP_i$	.09	0	1	Dummy variable equal to 1 if $FILM_i$ was both an epic and a biographic film, 0 otherwise.
$PREVDIRWINS_i$	.165	0	3	Number of Best Director awards that director of $FILM_i$ has won.
$MOSTPREVDIRWINS_i$	.105	0	1	Dummy variable equal to 1 if $FILM_i$'s director won the most previous Best Director awards, 0 otherwise.
$PREVDIRNOMS_i$	.785	0	12	Number of Best Director awards for which the director of $FILM_i$ was been nominated.
$MOSTPREVDIRNOMS_i$	.205	0	1	Dummy variable equal to 1 if $FILM_i$'s director was nominated for the most previous Best Director awards, 0 otherwise.

$GGDIRWIN_i$	.185	0	1	Dummy variable equal to 1 if $FILM_i$'s director won the Golden Globe Best Director award for directing $FILM_i$, 0 otherwise.
$DGAWIN_i$	.195	0	1	Dummy variable equal to 1 if $FILM_i$'s director won the DGA award for directing $FILM_i$, 0 otherwise.
$PREVACTWIN_i$	.71	0	6	Number of Best Actor awards that the cast of $FILM_i$ has previously won.
$CURACTNOMS_i$	1.695	0	5	Number of Best Actor awards for which $FILM_i$'s cast was currently nominated.
$GGACTWINS_i$	.55	0	3	Number of Golden Globe Best Actor awards the cast of $FILM_i$ won for performances in $FILM_i$.
$RELEASE_i$	.44	0	1	Dummy variable equal to 1 if $FILM_i$ was first released in the US during the fourth quarter, 0 otherwise.
$TIME_i$	132.35	84	201	The length in minutes of $FILM_i$.
$LONGEST_i$	.2	0	1	Dummy variable equal to 1 if $FILM_i$ was the longest in its nomination group, 0 otherwise.
$ADAPT_i$	.565	0	1	Dummy variable equal to 1 if $FILM_i$ was adapted from a previously released work, 0 otherwise.
$POSTMODERN_i$	.675	0	1	Dummy variable equal to 1 if $FILM_i$ was released after 1977, 0 otherwise.
$CURDIRNOM_i$	.71	0	1	Dummy variable equal to 1 if $FILM_i$'s director was nominated for Best Director , 0 otherwise.

Table 2. Parameter estimates for four logistic models and one OLS model. (Standard errors in parentheses. Levels of significance for a two sided test are given for each parameter estimate: *** 1% ** 5% * 10%).

Variable (Expected Sign)	Model 1	Model 2	Model 3	Model 4	Model 5	Model 5 VIF Scores
INTERCEPT significance	0.6390	-3.532	-4.2836	-1.0126	.1448	
$TOTALNOM_i$ (+/-)	-0.0193 (.3158)			0.1851 (0.2236)	-0.004 (0.012)	3.201
$MOSTNOM_i$ (+/-)	4.1699** (1.671)	2.7793*** (0.752)	2.7589*** (0.7638)	2.8462)** (1.2197)	0.2346*** (0.061)	2.428
$GGWINCOM_i$ (+/-)	3.54 (2.836)		1.962** (1.0656)	1.0617 (1.6576)	0.0491 (0.078)	2.217
$GGWINDRAMA_i$ (+/-)	4.0416** (1.831)	2.7471 (0.939)***	3.6073*** (1.206)	1.4481 (0.8821)	0.128** (0.058)	1.745
$MUSICAL_i$ (+/-)	-0.3359 (2.6687)			0.267 (1.796)	0.026 (0.097)	1.426
$COMEDY_i$ (+/-)	-3.0598 (2.579)			-1.2127 (1.6199)	-0.018 (0.07)	2.146
$EPIC_i$ (+/-)	0.1103 (1.704)				0.048 (0.073)	2.815
$BIOP_i$ (+/-)	-6.4779** (2.836)	-3.5872** (1.572)	-4.0916** (1.7858)		-0.063 (0.052)	1.631
$EPICBIOP_i$ (+/-)	10.1763*** (3.885)	5.3425*** (1.867)	6.4702*** (2.279)		0.173* (0.095)	2.384
$PREVDIRWINS_i$ (+/-)	3.8916 (2.58)			1.0939 (1.6691)	0.038 (0.094)	6.112
$MOSTPREVDIRWINS_i$ (+/-)	-1.6516 (2.619)			-2.6324 (2.5481)	-0.122 (0.128)	4.942
$PREVDIRNOMS_i$ (+/-)	-1.6213** (0.651)	-0.8274** (0.361)	-1.0221** (0.41)	-0.2749 (0.4517)	-.013 (0.022)	3.118
$MOSTPREVDIRNOMS_i$ (+/-)	-1.029* (1.816)			-0.4214 (1.4601)	-0.0001 (0.06)	2.291
$GGDIRWIN_i$ (+/-)	-2.8864*** (1.563)	-1.6245* (0.905)	-1.7059* (.9914)	-0.9229 (0.9905)	-0.071 (0.06)	1.75
$DGAWIN_i$ (+)	7.835*** (2.06)	5.0864*** (1.016)	5.7281*** (1.232)	4.9839*** (1.0671)	0.568*** (0.058)	1.713
$PREVACTWIN_i$ (+/-)	-1.529 (0.779)	-1.0206** (0.481)	-1.1888** (0.5466)	-0.6209 (0.4658)	-0.02 (0.019)	1.203
$CURACTNOMS_i$ (+/-)	-0.357 (0.507)			-0.3087 (0.3552)	-0.005 (0.02)	1.72
$GGACTWINS_i$ (+/-)	1.0412 (1.003)			0.8499 (0.631)	0.043 (0.032)	1.493
$RELEASE_i$ (+/-)	0.378 (0.973)			0.6439 (0.7806)	0.016 (0.04)	1.272
$TIME_i$ (+/-)	-0.0437 (0.037)			-0.0379 (0.0287)	-0.0009 (0.001)	2.883
$LONGEST_i$ (+/-)	1.401 (2.078)			1.8982 (1.573)	0.037 (0.068)	2.345
$ADAPT_i$	-0.1108			-0.0247	-0.0017	1.174

(+/-)	(0.955)			(0.8228)	(0.039)	
R^2	0.5295	0.4967	0.5064	0.4868	.6551	
Max Rescaled R^2/ Adjusted R_2	0.8373	0.7854	0.8007	0.7698	.6122	
Percent Concordant	98.5	97.4	97.7	96.8		
Wald Chi Square Statistic (Probability Value)/ F-test Statistic (Probability Value	1.0513 (.9979)	2.9571 (0.937)	1.2257 (0.9903)	4.2314 (0.8357)	15.28 (.0001)	

Table 3. Odds Ratio for Model 3.

Variable	Parameter Estimate	Odds Ratio: $e^{(\text{Parameter estimate})}$
$MOSTNOM_i$	2.7589	15.782473
$GGWINCOM_i$	1.962	7.1135399
$GGWINDRAMA_i$	3.6073	36.866379
$GGDIRWIN_i$	-1.7059	0.1816089
$BIOP_i$	-4.0916	0.0167125
$EPICBIOP_i$	6.4702	645.61284
$PREVDIRNOMS_i$	-1.0221	0.3598385
$DGAWIN_i$	5.7281	307.38468
PREVACTNOM	-1.1888	0.3045865

Table 4. Estimated Probabilities of Winning the Best Film Academy Award.

Variables	Parameter Estimates	$Film_i$'s Values (A)	$Film_i$'s Values (B)	$Film_i$'s Values (C)	$Film_i$'s Values (D)	$Film_i$'s Values (E)	$Film_i$'s Values (F)	$Film_i$'s Values (G)
INTERCEPT	-4.2836	1	1	1	1	1	1	1
$MOSTNOM_i$	2.7589	1	1	1	1	1	0	1
$GGWINCOM_i$	1.962	0	0	0	0	0	0	0
$GGWINDRAMA_i$	3.6073	1	1	1	1	1	1	1
$GGDIRWIN_i$	-1.7059	0	0	0	0	0	0	0
$BIOP_i$	-4.0916	0	0	1	1	1	1	1
$EPICBIOP_i$	6.4702	0	0	0	1	1	1	1
$PREVDIRNOMS_i$	-1.0221	2	2	2	2	2	2	2
$DGAWIN_i$	5.7281	0	1	0	0	0	0	1
$PREVACTNOM_i$	-1.1888	2	2	3	3	0	0	2
Fitted Index Value		-2.3392	3.2889	-7.6196	-1.1494	2.417	-0.3419	5.7675
Probability		.088	.967	.0005	.241	.918	.415	.997

Appendix I

Upsets: Using Model 3's probability figures, an upset occurs when the film that won Best Picture did not have the highest probability.
2004 Million Dollar Baby .0985 over The Aviator .40
1998 Shakespeare in Love .269 over Saving Private Ryan .447
1995 Braveheart .6 over Apollo 13 .644
1985 Out of Africa .316 over The Color Purple .59
1981 Chariots of Fire .1211 over Reds .89
1967 In the Heat of the Night .08 over The Graduate .613

False Positive: When a film has a probability figure higher than .5 and did not win Best Picture
2000 Crouching Tiger, Hidden Dragon .657
1995 Apollo 13 .645
1985 The Color Purple .59
1981 Reds .89
1973 The Exorcist .5439
1967 The Graduate .613

False Negative: When a film has a probability figure lower than .5 and did win Best Picture
2004 Million Dollar Baby .098
1998 Shakespeare in Love .269
1991 Silence of the Lambs .39
1985 Out of Africa .316
1983 Terms of Endearment .496
1981 Chariots of Fire .121
1969 Midnight Cowboy .44
1968 Oliver .15
1967 In the Heat of the Night .08
1966 A Man for All Seasons .495

Close Races:
1995 Braveheart .6 vs. Apollo 13 .644
1973 The Sting .896 vs. The Exorcist .5439
1968 Oliver .155 vs. The Lion in the Winter .111

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Divorce Probability and the "Preference" for Sons

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Abstract

The introduction of new and relatively inexpensive technology for determining and controlling the gender of future children has prompted researchers to examine if a preference for male children exists in the United States. Several studies have found evidence that such a preference could in fact exist and might lead couples with daughters to experience a higher divorce rate than those with only sons. If such a preference does in fact exist, then gender balance consequences could be substantial.

Much of the prior research in this area has neglected to control for documented correlates of divorce. While controlling for these correlates of divorce, this paper uses the National Longitudinal Survey of Youth to examine if divorce likelihood differs for couples with no male children versus those with only male children or those with both sons and daughters. Our study reveals that while generally couples with a higher percentage of male children have lower divorce probabilities, those with a firstborn daughter experience lower divorce rates than those with a firstborn son. The marginal effect of a second child is a lower divorce rate, while the marginal effect of a third child is a higher rate of divorce. Fourth and subsequent children do not significantly affect the divorce likelihood.

I. Introduction

In countries such as India and China, the preference for male children is widely acknowledged. Such preference has led to a grave imbalance in the number of males to females. China has an imbalance of approximately 120 males for every 100 females, while a recent study demonstrated that an area of New Delhi contained only 762 female children for every 1000 male births in 2004 (Goldberg 2005). This is despite regulations designed to prevent sex selection in these areas. Recently, researchers have begun to question whether a similar preference exists in the United States. In this vein, our study examines the impact of children's gender composition on parents' divorce probabilities.

This issue is particularly relevant given the recent controversy that has erupted surrounding the use of sperm sorting and other technologies to determine a child's gender. Such practices are currently in use by fertility clinics such as the Genetics and IVF Institute, who use the technology Microsort to sort sperm and implant women with fetuses of a specific gender.

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For an extra fee, potential parents can select the gender of their future child with an accuracy rate of 74-91%, depending on gender preference (Matken, Karabinus, Horton, Stern, and Blauer 2003). An even more controversial technology in use that carries a higher success rate involves discarding embryos of the unwanted gender after in-vitro fertilization has already taken place.

A new test introduced to the US in June of 2004, the Baby Gender Mentor, allows parents to learn the gender of a 5 week old fetus for a fee of $275 (Goldberg 2005). The arrival of such technologies has prompted many to examine the ethical impact of determining child gender or learning it at such an early stage in pregnancy, when abortions are still a legal option.

Consistent with concerns expressed by the President's Commission for the Study of Ethical Problems in Medicine and Biomedical and Behavior Research, The United Nations, the International Federation of Gynecology and Obstetrics, and the ACOG Committee on Ethics rejected the use of sex selection for non-medical purposes "because this position may reflect and encourage sex discrimination" (2004, 39). Although such practices are banned in Great Britain, Canada, Australia, and much of Europe when used for nonmedical reasons, there are currently no similar restrictions in place in the United States (Kalb 2004).

Recently, researchers have begun to examine if such a preference for male children exists in the United States so as to determine if new technologies for gender selection might potentially lead to an imbalanced gender ratio in the US. Also of interest is whether a possible preference might lead to differential rates of investments into male and female children or a difference in the established consequences of parental divorce for male and female children. Further, such a preference may have implications for the gender wage gap.

One way in which researchers have examined gender preference is by studying the correlation between divorce probability and the gender of children in the household (Spanier and Glick 1981, Morgan, et al. 1988, Morgan and Pollard 2002, Lundberg and Rose 2002, Diekmann and Schmidheiny 2004, Dahl and Moretti 2004). The majority of these prior studies examining child gender and divorce probability have found that the presence of male children decreases the likelihood of divorce (Spanier and Glick 1981, Morgan, Lye, and Condron 1988, Morgan and Pollard 2002, Lundberg and Rose 2002, Dahl and Moretti 2004). While insightful, these studies have based their results primarily on first marriages and often have failed to control for known correlates of divorce. We extend this research area by examining divorce data from the National Longitudinal Survey of Youth and examining not only divorce likelihood, but also the total number of divorces experienced by an individual.

Our findings confirm that the percentage of male children is a positive and significant correlate to not only the number of divorces an individual has but also to the probability that he or she is ever divorces. Further, we find that while having a second child decreases the probability of divorce, giving birth to a third child increases the risk, and bearing a fourth child or subsequent children has no significant effect on divorce risk. Our study suggests that the lowest divorce risk occurs for two child families of mixed gender. Interestingly, we find that couples who give birth to a daughter first have a lower probability of divorce than those whose firstborn is male. As this is contradictory to the hypothesis that having more male children

decreases the likelihood of divorce, our findings suggest that perhaps something is occurring other than just a stronger preference for more male children.

II. Prior Research

Several studies have examined the relationship between the gender makeup of the household and the likelihood of divorce, the marriage probability of unwed mothers, and the probability of remarriage following divorce. Spanier and Glick first examined these issues using 1960 and 1970 CPS data (1981). They found that couples with no male children were more likely to divorce than those with all sons, while those marriages with both male and female children were the least likely to end. The larger the family size, the lower was the likelihood of divorce.

Morgan et al. (1988) supported the findings of Spanier and Glick using 1980 census data. They found that couples with male children exhibited slightly lower risk of divorce in first marriages, regardless of the total number of children. Couples with no children were most likely to divorce. Couples with only male children were the least likely to divorce, followed by those with both male and female children. In contrast, Diekmann and Shmidheiny found no statistically significant relationship between the number of male children and the probability of divorce in the United States (2004).

Morgan and Pollard (2002) reexamined the Morgan et al. (1988) study using more recent data from the 1985, 1990, and 1995 CPS. The latter study confirmed many of the earlier study's findings. However, for more recent years, they found that the number of daughters did not increase the likelihood of divorce. In fact, the lowest divorce rates in their study occurred in families with children of all the same sex.

In a similar vein, Lundberg and Rose documented that single mothers with sons entered their first marriage more quickly than single mothers with daughters and were more likely to marry the child's biological father (2002). However, the first marriage and remarriage rates to non-biological fathers in their study were virtually identical. These findings are consistent with the hypothesis that biological fathers have a preference for sons over daughters.

Dahl and Moretti (2004) further tested this hypothesis using Census data from 1940 to 2000. Unlike prior studies, they controlled for a number of known correlates to divorce such as parental education, maternal age, race, and region of residence. Further, they distinguished between various gender combinations of families of four or fewer children. They found that in every decade since the 1940's, families with only male children exhibited a lower likelihood of divorce than those with no male children in the household. Further, two children families of all girls were more likely to give birth to a third child than those with male children in the household. Using the California Birth Statistical Master File from 1989-1994, they demonstrated that single mothers whose ultrasounds revealed male children were more likely to get married to the child's biological father than those pregnant with female children. Additionally, fathers of sons were 1-22% more likely to obtain custody following divorce, while mothers were 2-7% more likely to ever marry if they had no daughters. They argue that these findings demonstrate a prevailing

preference for male children. However, Dahl and Moretti (2004) do state, like Morgan and Pollard (2002) that the preference seems to be decreasing in recent years.

Earlier studies such as Spanier and Glick (1981) and Morgan et al (1988) used limited samples of first marriages of Caucasian women married prior to their 30th birthday. Many of these studies did not delineate among various combinations of male and female children. To the best of our knowledge, none identified the presence of adopted or stepchildren, despite findings that the presence of such children correlates with marital instability (White and Booth 1985). Further, many of the studies failed to control for family size (as is noted by Dahl and Moretti 2004).

While Dahl and Moretti improved upon many of these omissions, they still failed to control for several documented correlates of divorce. Race (Carter 1978, Sweet 1974, Furstenberg 1990), age at first marriage (Furstenberg 1990, Becker 1977), income (Carter 1976, Becker 1977), education (Spanier 1981, Furstenberg 1990), the number of kids (White 1990, Becker 1977, Bumpass 1972), the presence of non-biological children (White and Booth 1985), and a religious upbringing (Thorton 1978, Coombs 1970) have all been identified as factors contributing to divorce likelihood; however, no study has controlled for all of these variables. We include controls for the established correlates of divorce, control for family size, and document the presence of non-biological children in the household in order to further examine the extent to which a "preference" for male children exists in the United States. Finally, we further extend prior research by examining the link between divorce probability and specific child gender combinations and ordering.

III. Data Description

We use the National Longitudinal Survey of Youth (NLSY79) to examine the relationship between the gender of one's children and the probability of divorce. The NLSY79 is a survey begun in 1979 of 6,111 civilian US youths aged 14-21 as of Dec. 31, 1978. The survey is sponsored by the Bureau of Labor Statistics, U.S. Department of Labor. In the 2002 survey, there were 7724 individuals surveyed ranging in age from 37 to 45. The survey records any changes in marital status, changes in the number of biological and nonbiological children of the respondent, as well as the dates on which these changes occurred. The NLSY79 has abundant background information about factors related to divorce probability, which we include as controls (Center for Human Resource Research 2004).

Our sample includes males and females who have been married at least once and who have at least one biological child. We include variables for the respondent's race, religion, household income, highest level of education, number of kids, and age at first marriage to help control for other factors correlated with divorce. In order to control for and measure the impact of non-biological children, we include a dummy variable indicating whether or not any non-biological children are present in the household. We also measure the correlation of divorce

probability to the percentage of male children as well as the relationship between divorce probability and the firstborn child being female. Descriptive statistics are listed in Table 1.[1]

IV. Empirical Model and Results

We examine two different dependent variables to measure the preference for male children. In the first estimation we look at the relationship between child gender and the total number of divorces one has obtained. In the second, we examine the relationship between child gender and the probability of having divorced at least once, given that one has children in the household.

Using a tobit model, our first estimation is of the following:

$$\textbf{Number of divorces}_i = a + b_1\mathbf{X}_{i,} + b_2\mathbf{Y}_i + \boldsymbol{\varepsilon}_i,$$

where vector:

$$X = \begin{pmatrix} \textbf{Percent female} \text{ (percent of respondent's biological children that are female)} \\ \textbf{First child female} \text{ (a dummy variable equal to 1 if the firstborn is female)} \\ \textbf{Number of children} \text{ (the respondent's total number of biological children)} \\ \textbf{Nonbiological children} \text{ (a dummy variable equal to 1 if nonbiological children of the respondent are present in the household)} \end{pmatrix}$$

and where vector $Y_{i,}$ contains the following non-family composition independent variables: income, a dummy variable signifying that the respondent is not religious, four education dummy variables, the age of the respondent at her first marriage, and two race dummy variables. Our second estimation is identical except that it is a probit model with the dependent variable being the probability that an individual has experienced at least one divorce. Our findings for these first two models are reported in Tables 2-3.

In examining the number of divorces for an individual, we find that consistent with earlier findings, the percentage of female children is positively correlated with the number of divorces a correspondent has had. Interestingly, the firstborn child being female was significantly negatively correlated with the number of divorces of the respondent.

The probit model for the probability that the respondent has experienced at least one divorce exhibited the same properties. The percentage of children who were female is

[1] The main drawback to any study on divorce is that the decision to divorce is based on a continuous scale of factors rather than a discrete one. As our survey is ongoing, there are potentially divorces amongst our respondents that have not yet occurred. We cannot measure the extent to which child gender affects that likelihood for divorces (and childbearing) that will occur in the future. Another drawback is that in order to accurately examine the correlation for secondary or subsequent marriages, we must assume that the individual's children have an ongoing relationship with the individual in future marriages. While this is a reasonable assumption given current and prior custody practices, it still has the potential to slightly bias our results.

significantly and positively correlated to the probability of at least one divorce, while the firstborn being female is negatively correlated to this probability. Both of these estimations imply that generally, the presence of more male children does decrease divorce likelihood and frequency. In order to better understand how this result compares to the finding of a negative correlation with divorce and the firstborn being female, we further specified different gender combinations in subsequent regressions for the probability of experiencing at least one divorce.

We next estimated a probit model for the probability of divorce including more specified dummy variables. The first additional dummy we examined was equal to one if the household had only female children. We also included a dummy equal to one if the household had mixed gender children, with our omitted category being all male children families. To better specify differing family sizes, we included a dummy variable signifying a two children, three children, or four plus children family, with one child families being the omitted category. Table 4 reports the findings concerning the relationship between the divorce likelihood and the number of children.

In this better specified model, we find once again that having all female children increased the probability of divorce and the presence of a firstborn female decreased that probability. However, families with both male and female children did not significantly differ in divorce incidence from those with only male children. Further, families with two children, three children, or four or more children all exhibited lower divorce incidence. This reinforces the idea that having more than one child has a negative impact on divorce likelihood relative to one child families. So, having a female firstborn lowers divorce likelihood most when a subsequent child is born. However, fertility is likely endogenous to divorce incidence, and so this finding must be viewed with that fact in mind.

The fourth and final estimation is identical to the third, except we examine how each child (in terms of numerical order) affects divorce probability. We do this by changing the independent dummy variables for households with two children, three children, and four children to dummy variables for households with two or more children, three or more children, and four or more children. This allows us to see the marginal effect on divorce probability for each additional child. Table 5 reports the marginal effect of each additional child on divorce likelihood. Once again, all girl families are positively correlated with divorce likelihood while having a firstborn daughter is negatively correlated with divorce likelihood. Interestingly, we find that while the second child decreases divorce probability, the marginal effect of the third child is an increase in divorce probability. The fourth child, however, has no statistically significant impact on divorce probability.

This result sheds light as to a possible explanation why the first child being female decreases divorce probability while having a higher percentage of female children increases divorce probability. Relative to one-child families, the second child decreases the likelihood of divorce. This could mean that the ultimate "preference" in terms of children is having one male and one female child. A second preference that may not be quite as strong is the "preference" for male children.

Finally, our findings concerning other statistically significant independent variables are consistent with prior research. We find that age at first marriage and income are negatively correlated with divorce probability, while being African-American and not identifying with any religion are positively correlated to divorce probability. Individuals who are non-white/non-black are more likely to divorce than whites, while those earning an advanced degree are less likely to divorce than those who dropped out of high school. However, the presence of a non-biological child is not a statistically significant predictor of divorce.

V. Conclusion

Thus, households in which a larger percentage of the children are male have a lower probability of experiencing divorce. In addition, those with more male children have fewer divorces in their lifetimes. This trait holds true even once major factors of divorce were controlled. Interestingly, we find that couples with a firstborn daughter experience lower rates of divorce, perhaps due to couples having a stronger "preference" for having one female and one male child.

By examining differing family sizes, we demonstrate that having two, three, and four or more children all decrease divorce likelihood relative to one-child families. In addition, the second child decreases probability of divorce relative to the first child, the third child increases divorce likelihood relative to the second, and the fourth and subsequent child has no significant effect relative to the third. In all of these scenarios, having all female children increase the probability of ever being divorced.

While our finding that having a larger percentage of male children decreases the total number of lifetime divorces and individual divorce likelihood is consistent with earlier research, our discovery of the first child being female having the same effect introduces an interesting twist to the question of male children being "preferred". Our study seems to hint that a two children mixed gender family is the most likely to not divorce. This would suggest that in the long run, the demand for sons would not outweigh the demand for daughters. Thus, the emergence of effective sex selection technology may not lead to the drastic gender ratio consequences that have arisen in countries with more explicit preferences for male children.

However, future study should further examine why families with firstborn females have a lower likelihood of divorce. If there is another explanation, then the problems surrounding a stronger demand for sons may still exist. Further examination into potential differences between men and women for sons and daughters would also be enlightening. While our dataset did not allow for this consideration, future research should consider how the gender make-up of nonbiological children fit into these "preferences". It is important to examine these factors before sex selection becomes commonplace in American households so that we can avoid any potential problems that result from whatever preferences do in fact exist.

Table 1: Descriptive Statistics					
Variable	Obs	Mean	Std. Dev.	Min	Max
Everdivorced	5698	0.346086	0.475763	0	1
# Divorces	5698	0.423306	0.654307	0	6
Percentfemale	5698	0.487744	0.356925	0	1
Firstchildfemale	5698	0.493507	0.500002	0	1
Numberchildren	5698	2.387329	1.144023	1	9
Nonbioexists	5698	0.060372	0.238196	0	1
Income	4487	67897	64696.61	0	390662
HS	5698	0.209547	0.407021	0	1
Somecollege	5698	0.119691	0.324629	0	1
Collegegrad	5698	0.059144	0.235914	0	1
Advanceddegree	5698	0.023517	0.151552	0	1
Black	5698	0.248684	0.432288	0	1
Otherrace	5698	0.077922	0.268073	0	1
Agefirstmarriage	5097	23.35923	4.921544	13	44
Noreligion	5698	0.038786	0.1931	0	1

Table 2: Tobit for Number of Divorces		
	Coefficient	Std. Error
PercentFemale***	0.423075	0.10371
FirstChildFemale**	-0.18696	0.07402
Numkids***	-0.07155	0.02318
Nonbioexists	-0.07594	0.11498
Agefirstmarriage***	-0.1302	0.00655
Income***	-3.93E-06	4.62E-07
HS	-0.01079	0.06927
SomeCollege	0.00559	0.0849
CollegeDegree	-0.0329	0.12067
AdvancedDegree*	-0.32347	0.1815
Black***	0.282104	0.06195
Otherrace**	0.193626	0.09539
Noreligion***	0.373113	0.12416
Constant***	2.746192	0.17015
Pseudo R2 = 0.0705; n = 4386		
* statistically significant at the 90% level ** statistically significant at the 95% level *** statistically significant at the 99% level		

Table 3: Initial Probit for Ever Divorced		
	Coefficient	Std. Error
PercentFemale***	0.3275871	0.08261
FirstChildFemale**	-0.140865	0.05885
Numkids***	-0.053828	0.01863
Nonbioexists	-0.023308	0.09116
Agefirstmarriage***	-0.093611	0.00495
Income***	-3.05E-06	3.63E-07
HS	-0.011817	0.05534
SomeCollege	0.0106019	0.06771
CollegeDegree	0.0079277	0.09663
AdvancedDegree	-0.198021	0.14138
Black***	0.2464775	0.04944
Otherrace**	0.1533677	0.07645
Noreligion***	0.3410022	0.10192
Constant***	1.896006	0.13493
Pseudo R2 = 0.1003; n = 4386		
* statistically significant at the 90% level ** statistically significant at the 95% level *** statistically significant at the 99% level		

Table 4: Probit for Ever Divorced		
	Coefficient	Std. Error
AllGirls***	0.315937	0.082108
Mixed	0.057433	0.064761
FirstChildFemale**	-0.125376	0.056563
2Kids***	-0.345451	0.062395
3Kids***	-0.224963	0.073807
4+Kids**	-0.206257	0.08413
Nonbioexists	-0.039603	0.091458
Agefirstmarriage***	-0.096354	0.004988
Income***	-2.91E-06	3.64E-07
HS	-0.030607	0.055726
SomeCollege	-0.00688	0.068108
CollegeDegree	-2.28E-05	0.097695
AdvancedDegree*	-0.250454	0.142047
Black***	0.241067	0.049783
Otherrace**	0.176619	0.077085
Noreligion***	0.325942	0.102537
Constant***	2.104973	0.134645
Pseudo R2 = 0.1083; n = 4386		
* statistically significant at the 90% level ** statistically significant at the 95% level *** statistically significant at the 99% level		

Table 5: Probit for Ever Divorced with the Marginal Effect for Additional Kids		
	Coefficient	Std. Error
AllGirls***	0.315937	0.08211
Mixed	0.057433	0.06476
FirstChildfemale**	-0.12538	0.05656
2+kids***	-0.34545	0.06239
3+kids**	0.120488	0.05478
4+kids	0.018706	0.06861
Nonbioexists	-0.0396	0.09146
Agefirstmarriage***	-0.09635	0.00499
Income***	-2.91E-06	3.64E-07
HS	-0.03061	0.05573
SomeCollege	-0.00688	0.06811
CollegeDegree	-2.3E-05	0.0977
AdvancedDegree*	-0.25045	0.14205
Black***	0.241067	0.04978
Otherrace**	0.176619	0.07708
Noreligion***	0.325942	0.10254
Constant***	2.104973	0.13465
Pseudo R2=.1083; n=4386		
* statistically significant at the 90% level ** statistically significant at the 95% level *** statistically significant at the 99% level		

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Using Financial Variables to Forecast Kentucky Economic Activity

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Abstract

This paper explores the use of financial variables in forecasting growth in Kentucky economic activity. Economic activity is measured by real income and by a coincident index of economic activity. For each activity measure models are developed for one-, four-, and eight-quarter growth rates using only financial variables as predictors. It is found that financial variables are significant predictors in predicting growth in Kentucky economic activity. The predictors vary across activity measures and time horizons. In a rolling ex post forecast evaluation of the models forecasting ability their performance is not especially impressive, particularly in the last half of the evaluation period.

I. Introduction

Financial variables have long been used to predict economic activity in the United States. For example, real M2 and the Standard & Poor's 500 stock price index have long been components of the composite index of leading indicators constructed originally by the Bureau of Economic Analysis and now by the Conference Board. More recently, following the work of Stock and Watson (1989) the yield spread has been included as a component of the composite index of leading indicators. Financial variables, such as interest rates and financial asset prices, have certain advantages over other types of indicators for predicting general economic activity. First, financial variables are thought to contain information that is forward looking. Second, financial variables are usually available with a very short lag time. This means they may be used to make forecasts of general economic activity in a more timely fashion than can other types of indicators. See, for example, Dotsey (1998) and Estrella and Mishkin (1998). The third advantage financial variables hold over other indicators is that they are rarely subject to frequent or large revisions.

One financial variable in particular has attracted a great deal of attention in terms of forecasting general economic activity. Several studies have shown that the yield spread (the difference between a long-term interest rate and a short-term interest rate) is useful in predicting the rate of economic growth. Laurent (1988, 1989), Estrella and Hardouvelis (1991), Haubrich and Dombrowski (1996), Dotsey (1998), and Bonner- Neal and Morley (1997), among others, have found the yield spread to be a useful predictor of real GDP growth in the United States. Davis and Henry (1994), Plosser and Rouwenhorst (1994), Dotsey (1998), and Bonner-Neal and Morley (1997) have also found the yield spread to be a significant predictor of real GDP growth for countries other than the United States. The yield spread has also been found to be a useful predictor of recessions. The yield spread is a significant predictor in a binary choice model where

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the dependent variable indicates whether or not the economy is in a recession at some point in time in the future. See, for example, Estrella and Hardouvikis (1991), Dotsey (1998), and Estrella and Mishkin (1998). However, more recently studies have found that the predictive ability of the yield spread has declined. See, for example, Friedman and Kuttner (2001) and Hamilton and Kim (2002).

State economies are often affected by the same factors that affect the national economy. This may be explained in part by an export base model of a regional economy in which part of a state's output is exported to other regions. To the extent that the demand for a state's exports is related to the level of general economic activity (measured by say real GDP), there is a linkage between the state and national economies. Hence, variables that are useful in predicting growth in the national economy may also be useful in predicting growth in the state's economy.

The yield spread has been used in studies of forecasting economic activity at the state level. Wisley (1999) found that the yield spread was a significant predictor in equations predicting the growth rate of real personal income in most states. Shoesmith (2003) showed that the yield spread was a significant predictor of recessions at the state-level.

Jaditz, Riddick, and Sayers (1998) evaluated several forecasting methods using a broader class of financial variables (such as the growth rate in stock prices and a risk premium variable) to forecast real economic activity. They found, in general, that although the magnitude of the effect was in general small, financial variables did make a significant contribution to predicting the growth rate of industrial production in the United States.

The purpose of this paper is to report some preliminary results of a study of the usefulness of financial variables in predicting the growth of general economic activity in Kentucky. I find that, in the class of models employed here, financial variables by themselves are significant predictors of the growth in real activity in the state; however, the out-of-sample forecasts are not terribly impressive. The remainder of the study is organized as follows. In the next section I outline the general approach taken and discuss the data. The third section presents the results of out-of-sample forecast evaluations. The last section contains some concluding remarks and suggestions for further study.

II. Methodology and Data.

For the purposes of this study I have chosen two measures of general economic activity for the state of Kentucky. First, I use the growth rate of real personal income. Second, I use the growth rate of a composite index of coincident indicators constructed by the Federal Reserve Bank of Philadelphia. Both indicators are broad measures of general economic activity. Both variables were obtained from the Federal Reserve Economic Data (FRED) database at the Federal Reserve Bank of St. Louis (www.stlouisfed.org). The variables to be forecast are defined as follows.

(1) $G(t) = (400/k)*\ln(X(t+k)/X(t))$

X denotes a measure of economic activity (either real personal income or the Kentucky coincident index) and G is its annualized growth rate over the next k quarters.

In this paper I examine whether or not financial variables, by themselves, are significant quantitative predictors of the future growth rates of real personal income and the coincident index. I report results for forecast time horizons of one quarter, four quarters, and eight quarters. I consider a set of five financial predictor variables. All five variables are constructed from data obtained from FRED. First, we considered the yield spread (defined here as the difference between the 10-year constant maturity Treasury yield minus the effective Federal funds rate). An increase in the yield spread is expected to have a positive impact on real growth for two reasons. First, if firms anticipate higher profits in the future and increase investment, the demand for long-term funds will rise, raising the long-term rate relative to the short rate. Second, if the Federal Reserve adopts a more accommodative monetary policy the short rate will fall relative to the long rate.

The second variable I consider is the growth rate of stock prices. This is measured as the annual percentage change in the S&P 500 stock price index. It is assumed that rising stock prices reflect expectations of higher future profits and associated output growth. Faster growth in stock prices may also stimulate output growth through a wealth effect.

The third financial variable is the annual growth rate of the real money supply. For purposes of this study, the real money supply is defined to be nominal M2 deflated by the personal consumption expenditures chain price index. An increase of the growth rate is expected to lower interest rates in general and stimulate future economic activity. It is also possible that growth in economic activity could be stimulated by real balance and/or wealth effects.

The fourth financial variable is the real rate of interest. I have taken the simple view that the real rate is proxied by the Moody's Baa corporate bond rate less the current percentage change (at an annual rate) in the personal consumption expenditures chain price index. An increase in the real rate is expected to reduce the growth rate of economic activity through the usual channels.

The final financial variable considered is the risk premium on corporate bonds. This is defined as the percentage difference between Moody's Baa and Aaa bond rates. It is assumed that an increase in the risk premium indicates an increase in uncertainty. Resources are shifted away from more productive uses to dealing with the increased uncertainty, placing a drag on the growth rate of general economic activity.

For each measure of economic activity I estimate three regression models using the financial measures as predictors. Each regression corresponds to a different time horizon of one quarter, four quarters, or eight quarters. Each model initially contains all five financial variables as predictors. Backward elimination is used to arrive at more parsimonious models. Predictors that are not significant at least the 10% level are dropped from the regression (only the single least significant predictor is dropped at each step of the backward elimination process). The

regressions are estimated using the first two-thirds of the available observations. The remaining observations are used for ex-post forecast analysis. The equations for growth in real personal income are initially estimated over the period 1959Q1 to 1986Q4. The regressions for the growth rate in the coincident index are initially estimated over the period 1980Q1 to 1990Q4. Because the way the dependent variable is defined induces autocorrelated residuals, all regressions were estimated using the Newey-West (1987) correction.

The remaining observations are used to perform ex-post forecast evaluations for each estimated model. A rolling forecast procedure is used for each ex-post forecast analysis. For each regression the initial estimates are used to generate the first forecast. Then an additional quarter of data is added to the estimation period and the regression is re-estimated and another forecast is made. This procedure is repeated until all available observations are exhausted. In the data set used here the last available observation is 2005Q2.

III. Results

The results of the initial estimation of each regression are reported in the top panel of Table 1. All of the estimated coefficients reported have the expected signs and are significant at least the 10% level. It also reveals that not all the variables are significant predictors in all regressions. The yield spread appears in five of the six regressions. Money growth appears in four of the six. It is also interesting to note that the final set of variables included in the regressions vary across time horizons. For example, compare the final specifications across time horizons for income growth. The regression for the four-and eight-quarter time horizons include the yield spread, money growth, and the real rate of interest. The regression for the one-quarter horizon does not include the real rate, but does include the risk premium. Also note that the risk premium is only included in the models for one-quarter horizons; apparently its information content is relatively short term.

Also note that, for a given time horizon, the included financial variables are not the same for the two measures of growth in economic activity. For example, at the one-quarter horizon the income growth regression includes money growth and the risk premium. At the same time horizon the coincident index growth regression includes those two variables plus the growth rate of stock prices.

Comparisons of the actual values and the forecast values are shown in Figures 1 – 6. The reader is reminded in looking at the figures that the growth rates for economic activity are defined to be forward-looking. For example, for the eight-quarter time horizon the last available observation, the growth rate from 2003Q2 to 2005Q2 is entered in 2003Q2 (this is why the time plot lines in Figures 3 and 6 do not extend beyond that date.) For the income growth rates the forecast performance is not particularly remarkable, particularly in the latter half of the evaluation period. One-quarter forecasts track the actual growth rates in a fairly general way. For the four- and eight-quarter horizons the forecasts track fairly well in the first half of the evaluation period, but the performance deteriorates in the last half of the evaluation period. The same general comments can be made for the forecasts of the coincident index growth rates.

That the forecasting ability of the financial variables seems to degrade in the mid-1990s is perhaps not a surprising result. It is during this period that the forecasting performance of the yield spread began to deteriorate [Friedman and Kuttner (2001), Hamilton and Kim (2002)].

The lower panel of Table 1 includes error statistics for the forecasts that reflect what we see in the figures. The root mean squared error ranges from 1.504% to 3.405% for the income growth models and from 2.021% to 2.956% for the coincident index growth rate models. One interesting finding is that for the income growth equations the root mean squared error falls as the time horizon increases.

IV. Concluding Remarks

Regression results indicate that financial variables do provide some useful information in forecasting the growth of economic activity in Kentucky. However, it appears that the effects are small. The ex post forecast performance of the models considered here is not particularly impressive. About all that can be said is that the models predict better with the financial variables than without them.

Where do we go from here? The purpose of this study was to see how useful financial variables by themselves are in forecasting economic growth and activity in Kentucky. The fact that some financial variables are significant predictors of economic activity holds out some promise. In particular, research should proceed in two directions. First, non-financial variables might be included in a regression model in addition to the financial variables. A second possibility is to expand the class of models considered. For example, it might be possible to exploit the stochastic behavior of the series being forecast as well as take advantage of any information contained in financial variables using an ARMAX model. The ARMAX model is essentially a Box-Jenkins model that includes additional regressors [Doan(2004)].

TABLE 1 INITIAL REGRESSION ESTIMATES

	INCOME GROWTH			INDEX GROWTH		
BEGIN	1959Q1			1980Q1		
END	1986Q4			1996Q4		
	HORIZON			HORIZON		
VARIABLE	1	4	8	1	4	8
CONSTANT	6.423	3.958	3.939	6.199	1.421	2.031
	(0.001)	(0.008)	(.000)	(0.007)	(0.055)	(.000)
YIELD SPREAD		.396	.235	1.075	1.261	1.089
		(.040)	(.091)	(.001)	(.000)	(.000)
STOCK PRICE GROWTH				.042	.039	
				(.052)	(.048)	
MONEY GROWTH	.298	.302	.244			.177
	(.008)	(.000)	(.000)			(.000)
REAL RATE		-.338	-.275			
		(.011)	(.001)			
RISK PREMIUM	-.282			-.418		
	(.069)			(.038)		
ADJUSTED R-SQ.	.064	.323	.348	.339	.449	.637
FORECAST STATISTICS						
ME	-.721	-.597	-.483	-.456	-1.219	-2.128
MAE	2.707	1.746	1.181	1.701	2.166	2.536
RMSE	3.405	2.047	1.504	2.021	2.512	2.956

p-values for 2-tailed t-tests are in parentheses under the estimated coefficients.

FIG. 1. ACTUAL AND FORECAST ONE-QUARTER INCOME GROWTH RATES

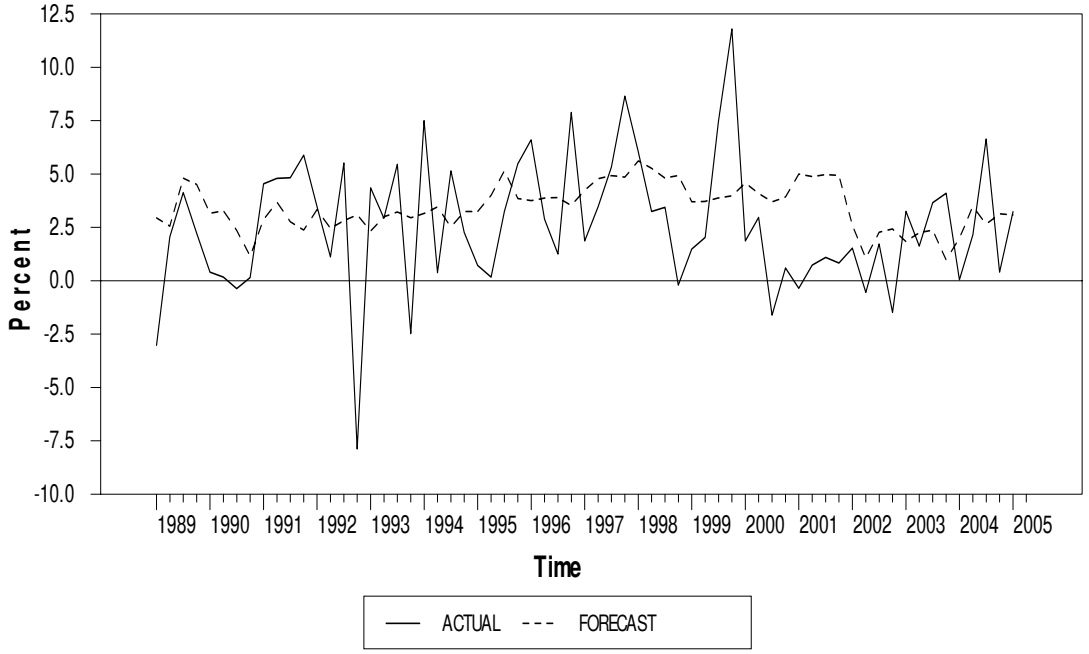


FIG. 2. ACTUAL AND FORECAST FOUR-QUARTER INCOME GROWTH RATES

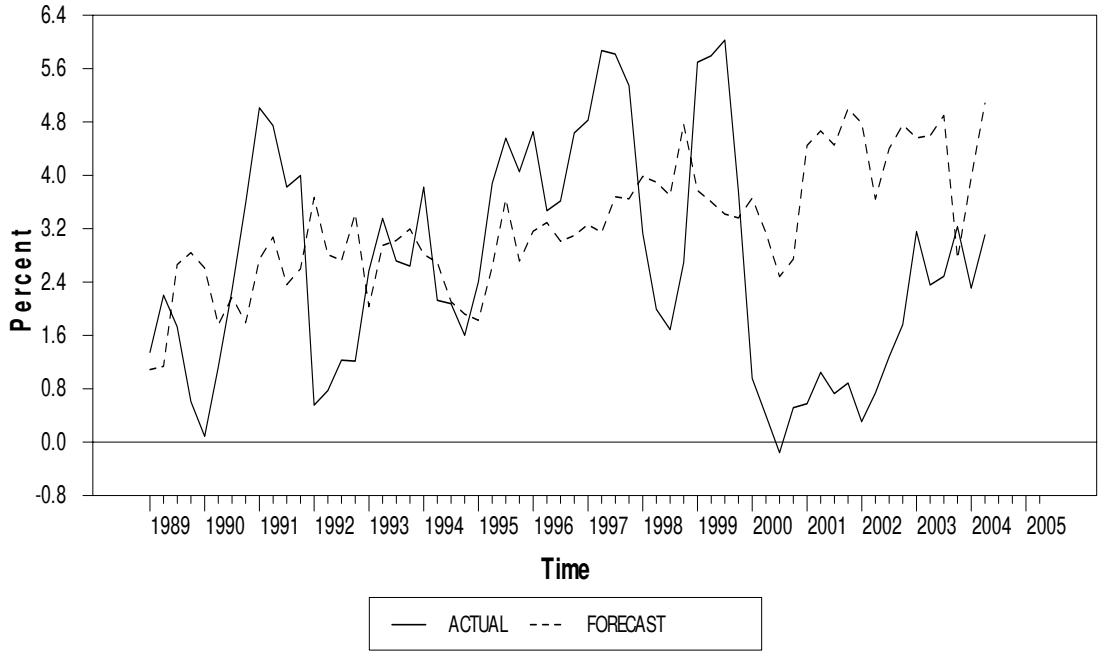


FIG. 3. ACTUAL AND FORECAST EIGHT-QUARTER INCOME GROWTH RATES

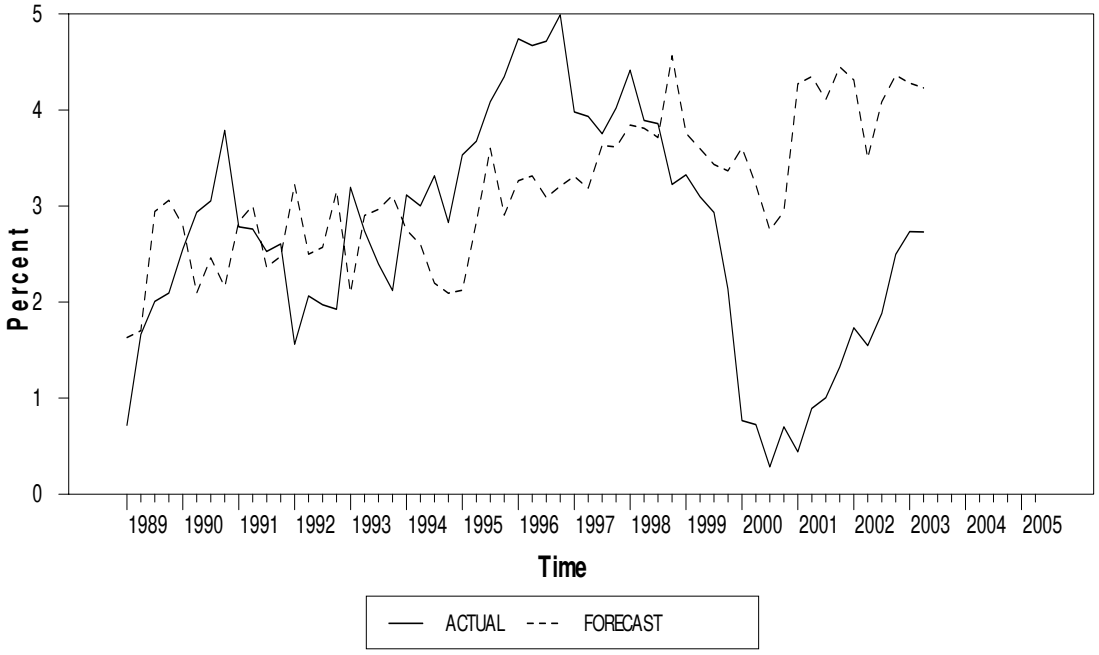


FIG. 4. ACTUAL AND FORECAST ONE-QUARTER INDEX GROWTH RATES

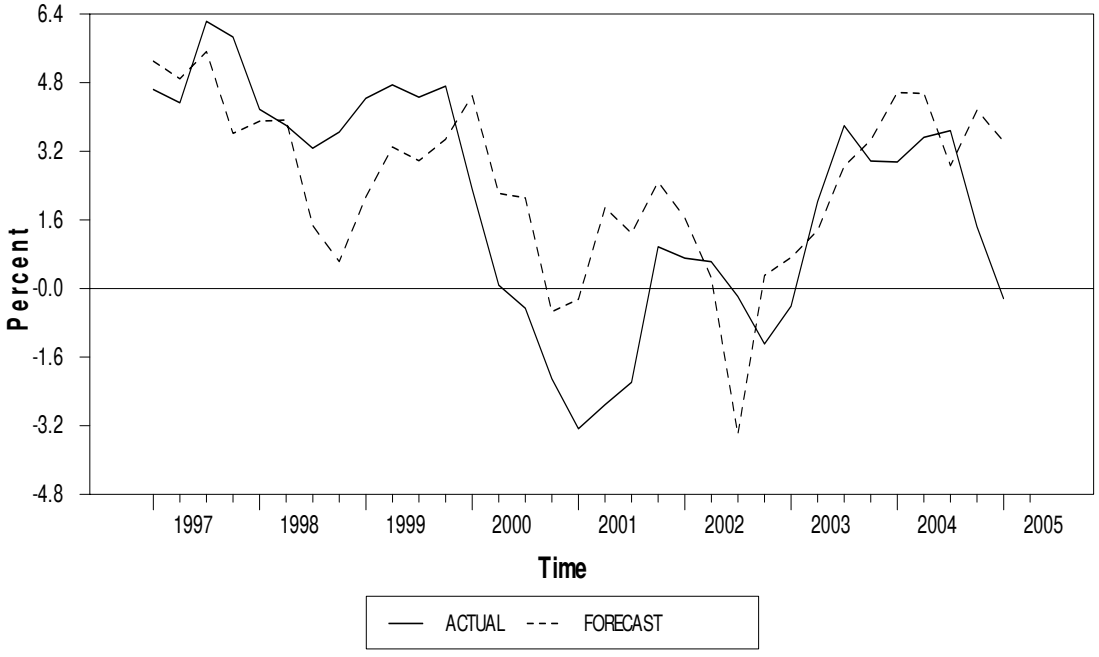


FIG. 5. ACTUAL AND FORECAST FOUR-QUARTER INDEX GROWTH RATES

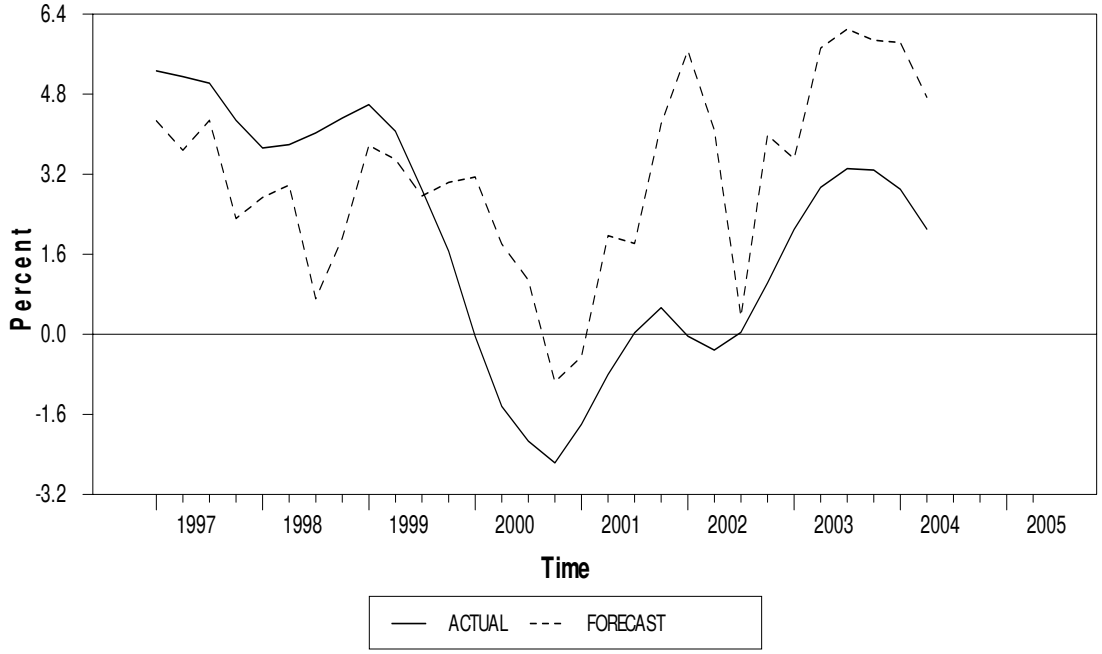
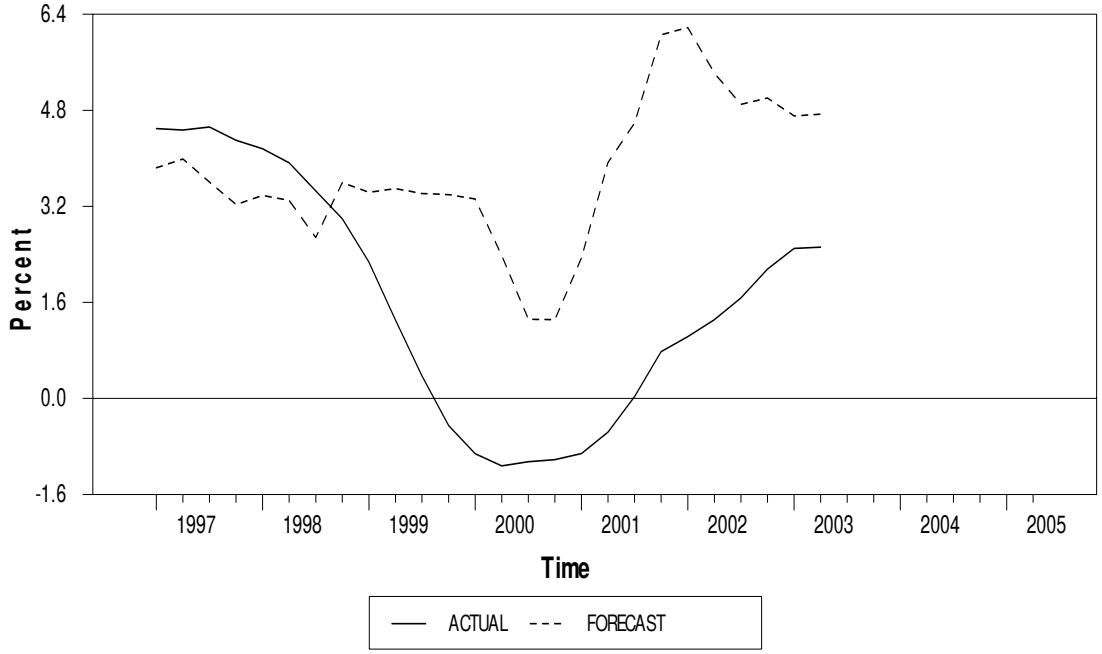


FIG. 6. ACTUAL AND FORECAST EIGHT-QUARTER INDEX GROWTH RATES



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